Clean Cities and Communities Partnership 2023 Activity Report

Mark Singer, Caley Johnson, Alana Wilson, Lauren Reichelt, Muhammad Abdullah, and Neah Downs Dybas

National Renewable Energy Laboratory

NREL is a national laboratory of the U.S. Department of Energy
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Clean Cities and Communities

The authors would like to acknowledge the efforts of thousands of Clean Cities and Communities coalition stakeholders and coalition directors who provided the basis for this analysis by reporting data from their alternative fuel and energy-saving transportation projects.

This publication is part of a series. Past Clean Cities and Communities Coalitions Activity Reports and multiyear data compilations can be found at *www.afdc.energy.gov*.

List of Acronyms

AFV	alternative fuel vehicle
APU	auxiliary power unit
B20	blend containing 6% to 20% biodiesel
BIM	Behavioral Impact Model
CC&C	Clean Cities and Communities
CEJST	Climate and Environmental Justice Screening Tool
CEL	Community Engagement Liaison
CNG	compressed natural gas
CO_2e	carbon dioxide-equivalent
DAC	disadvantaged community
DOE	U.S. Department of Energy
E85	high-level ethanol blend
EEJ	energy and environmental justice
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EUI	energy use impact
EV	electric vehicle
GGE	gasoline gallon equivalent
GHG	greenhouse gas
GREET model	Greenhouse gases, Regulated Emissions, and Energy use in Technologies model
HDV	heavy-duty vehicle
HEV	hybrid electric vehicle
IR	idle reduction
LCFS	Low Carbon Fuel Standard
LDV	light-duty vehicle
LNG	liquefied natural gas
MGGE	million gasoline gallon equivalents
NCFP	National Clean Fleets Partnership
NEVI	National Electric Vehicle Infrastructure
NREL	National Renewable Energy Laboratory
RNG	renewable natural gas
TI	Technology Integration
UC	underserved community
VMT	vehicle miles traveled
VTO	Vehicle Technologies Office

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Introduction

Clean Cities and Communities (CC&C) is a U.S. Department of Energy (DOE) partnership within the Vehicle Technologies Office (VTO) Technology Integration (TI) Program. CC&C advances clean transportation nationwide through collaboration with communities by building partnerships with public and private stakeholders to create equitable deployment of clean transportation solutions that advance the nation's environment, energy security, and economic prosperity. These efforts help businesses and consumers make smarter and more informed transportation energy choices that can save energy, lower costs, provide resilience through fuel diversification, and reduce emissions. This report summarizes the success and impact of partnership activities based on data and information provided in their annual reports.

More than 75 CC&C coalitions work locally in urban, suburban, and rural communities to bring together stakeholders in the public and private sectors to use alternative and renewable fuels, electric vehicles, idle-reduction (IR) measures, fuel economy improvements, and new transportation technologies as they emerge. To ensure success, coalitions leverage a robust set of expert resources and tools provided by DOE and its national laboratories. From technical assistance and handbooks to websites and targeted analyses, these resources contribute to every facet of coalition success. This strong national framework of resources, which facilitates a consistent vision and informed coalitions, is a hallmark of CC&C.

Clean Cities and Communities coalitions use an online tool to report advanced vehicle technology activity, infrastructure development, and relevant energy/fuel use information for their regions.

Each year, CC&C coalition directors submit annual reports of their activities and accomplishments for the previous calendar year. Data and information are submitted via an online reporting tool that is maintained as part of the Alternative Fuels Data Center at the National Renewable Energy Laboratory (NREL). Coalition directors submit a range of data that characterize the membership, funding, projects, and activities of their coalitions. They also submit data about sales of alternative fuels; use of alternative fuel vehicles (AFVs), including electric vehicles (EVs[1]), and hybrid electric vehicles (HEVs); IR initiatives; fuel economy improvement activities; and programs to reduce vehicle miles traveled (VMT).

This report compiles the accomplishments of all coalitions throughout the nation in calendar year 2023. Coalition leaders assembled the data based on voluntary reports from their stakeholders—the private and public entities that are members of the coalitions. As such, each individual coalition report represents a subset of the national partnership's activities. Taken together, they are an important indicator of how data, information, and resources can be effectively leveraged through the CC&C partnership to achieve significant results. Accomplishments from the National Clean Fleets Partnership (NCFP) are also reported directly by the national partners.

NREL analyzes the submitted data to determine how broadly transportation energy use in the United States has shifted as a result of the CC&C partnership. The two main components of energy use tracked by NREL are (1) energy savings from efficiency projects, measured in

[1] EVs include all-electric vehicles and plug-in hybrid electric vehicles, but not hybrid electric vehicles in this report.

gasoline gallon equivalents (GGE), and (2) alternative fuel use. The alternative fuel use numbers in this report have been adjusted to account for any gasoline or diesel content (e.g., with biodiesel or ethanol blends), as well as for any conventional fuels used upstream to produce, distribute, or deliver alternative fuels. Analysis also accounts for the efficiency differences between AFVs and conventional vehicles.[2] Ultimately, these two components are combined and reported as energy use impact (EUI) in GGE. EUI is a metric that measures combined progress in energy savings from efficiency projects and increased fuel diversity through use of alternative fuels. Both components provide consumers and businesses with more energy choices. When achieved at scale, these strategies support DOE's mission to pursue more affordable, efficient, and clean energy choices. This report summarizes the EUI and related greenhouse gas (GHG) emissions reduction impacts of partnership activities.

Effort is made to keep the annual report questions consistent from year to year to facilitate longitudinal comparison. However, this year four new questions were added to the reporting tool to further assess mechanisms for public participation and community engagement with underserved and disadvantaged communities[3]. The results of these questions will be discussed in the "Outreach, Engagement and Training Activities" and "Estimated Benefits to Disadvantaged Communities" sections of this report.

A compilation of data from this report, along with reports from previous years, can be accessed on the Alternative Fuels Data Center's Maps and Data page (https://afdc.energy.gov/data/categories/clean-cities). Reports from previous years can be downloaded in their entirety at *www.afdc.energy.gov*.

Summary of Key Findings

Coalitions achieved an EUI of over 1 billion GGE in 2023.

Clean Cities and Communities partnership activities in 2023 resulted in an EUI of over 1 billion GGE, comprising net alternative fuels used and energy savings from efficiency projects. Table 1 represents the combined results of all strategies to increase fuel diversity and energy efficiency in the nation's fleets. It should be noted that estimated EUI benefits from outreach projects were not included this year. CC&C coalition participation in vehicle and infrastructure development projects remained strong, and the resulting EUI increased in 2023.

[2] Net alternative fuel used and energy savings from efficiency projects are expressed in GGE in this report using the lower heating value ratio of the fuels.

[3] Underserved communities are urban, suburban, and rural communities at the front line of pollution and climate change, communities with high energy expense or fossil dependence, indigenous communities, and those historically overburdened by racial and social inequity. The geospatial analysis used "disadvantaged communities" instead, for reasons explained in that section.

Table 1. Energy Use Impact of Each Portfolio Element

Project Type	Coalition Impact (MGGE [a])	Percent of Total Coalition Impact [b]	Change From Last Year
AFVs (non-electric)	716.5	70%	-4%
EVs	90.1	9%	26%
Idle reduction	58.9	6%	17%
HEVs	48.5	5%	-14%
Fuel economy	40.6	4%	2%
VMT reduction	36.0	4%	13%
Off-road	31.6	3%	-40%
Total EUI [c]	**1,022.1**	**100%**	**-2%**

[a] Million gasoline gallon equivalents
[b] Totals and subtotals may differ from the sums due to rounding.
[c] The *Clean Cities and Communities Coalitions 2023 Activity Report* is focused on the impacts of partnership activities and projects and excludes related DOE-led efforts that were included in this report series prior to 2016.

Clean Cities and Communities partnership activities reduce GHG emissions as they impact energy use. Table 2 shows that coalition-reported activities prevented 9.1 million tons of carbon dioxide-equivalent (CO_2e) emissions. The GHG benefits increased 74% in 2023. This increase was in large part due to a change in methodology detailed below that more accurately accounts for the renewable natural gas (RNG) portion of reported compressed natural gas (CNG).

Coalitions averted 9.1 million tons of GHG emissions—the equivalent of removing 2.5 million conventional cars from the road.

Table 2. GHG Emissions Reduced by CC&C Coalitions in 2023

Project Type	Tons CO_2e of GHG Emissions Averted	Equivalent of Conventional Cars Removed [a]	Percent of Coalition Total
AFVs (non-electric)	5,885,789	1,628,251	64%
EVs	784,986	217,159	9%
Idle reduction	699,863	193,611	8%
HEVs	575,549	159,221	6%
Fuel economy improvements	483,789	133,836	5%
VMT reduction	425,309	117,658	5%
Off-road vehicles	243,931	67,481	3%
Coalition Total	**9,099,215**	**2,517,217**	**100%**

[a] Calculated as total passenger car GHG emissions (Tables 2–13 in the U.S. Environmental Protection Agency's "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021") divided by total short-wheelbase light-duty vehicles (Table VM-1 in the Federal Highway Administration's "Highway Statistics 2021").

Coalitions were successful in securing project grant awards from numerous outside (non-DOE) sources. For other federal, state, and local agencies and private sector foundations, see the Funding section. The 109 project grant awards in 2023 generated $1.12 billion in funds from coalition members and project partners, in addition to $519 million in DOE grant funds. Coalitions also collected $1.6 million in stakeholder dues and $13.8 million in operational funds from host organizations. In macro terms, this non-DOE supplemental funding represents a leveraging of over 3:1 of the $106 million included in the VTO Technology Integration budget in 2023.

Clean Cities and Communities coalition directors spent 134,000 hours pursuing their coalitions' goals in 2023. The average coalition director is quite experienced and has held the director position for over 8 years. Coalition directors logged 5,452 outreach, education, and training activity days in 2023, which reached an estimated 2.2 million people. Activities that reached energy and environmental justice underserved communities were tracked for the third time in 2023 and accounted for 28% of all activity days.

Of all coalition outreach, education, and training activities in 2023, 28% reached energy and environmental justice underserved communities.

Attribution and Fuel Use Factors

To clarify the link between partnership activities and end results, this *Clean Cities and Communities Partnership Activity Report* includes an attribution factor that accounts for the percentage of a project's outcome that is likely to be a result of partnership activities, rather than the activities of other project participants. This attribution factor was used in the estimates of impacts for fuel economy, VMT reduction, IR, alternative fuel use, and outreach projects. Coalition directors estimated the percentage of each project's outcome that the coalition was responsible for, and then the project's overall outcome was multiplied by that percentage to determine the individual coalition's impact. Although subjective, this method attempts to address the issue of attribution where a coalition is one of several partners involved in a project. To reduce the subjectivity of this factor, NREL provides a tool to help a coalition estimate its contribution to a given project.

Coalition-Reported Data

Coalition directors submitted information about their stakeholders' alternative fuel use and energy savings, broken down according to the technologies in the Technology Integration Program portfolio, using an online reporting tool. NREL analyzed the data, converted them into an equivalent net quantity of gasoline for each element of the portfolio, and reported the data in GGE. As shown in Table 1, CC&C coalition efforts impacted 1,022 MGGE of energy in 2023.

Clean Cities and Communities coalitions' work with local fleets led to a substantial reduction in GHG emissions. To estimate the GHG reductions resulting from partnership activities, NREL used a version of the Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET) model.[4] This model accounts for the fuel life cycle, or "well-to-wheels" factor of GHG

[4] Argonne National Laboratory. 2023. The Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET) Model.

emissions for transportation fuels, which includes fuel production, transport, and usage in the vehicle. It does not consider emissions from indirect land use changes or vehicle manufacturing and decommissioning.

Alternative Fuels and Vehicles

As shown in Figure 1, alternative fuels (used in AFVs including EVs, and in biodiesel blends) and fuel savings from HEVs collectively accounted for 855 MGGE, or 84% of the coalition-reported net alternative fuel use and energy savings from efficiency projects (excluding outreach in Table 1).

In 2023, coalitions reported a total inventory of 1.7 million AFVs, split among 10 fuel and technology types. The total number of vehicles reported by coalition directors increased by 9% from 2022.

Among the fuel types with greater than 100,000 vehicles reported, EVs increased by 25% to 595,912. Biodiesel vehicles increased by 23% to 191,454. CNG vehicles increased by 5% to 129,026, and HEVs increased by 2% to 157,582. Vehicles operating on ethanol blends decreased by 6% to 534,976. These vehicles are dominated by a single coalition reporting an estimate of 275,000 vehicles using mid-level ethanol blends.

The EUI due to electric vehicle use grew by 26% in 2023.

Among vehicle technologies with lower vehicle counts, vehicles operating on renewable diesel grew by 23% to 33,597. Vehicles operating on RNG (biomethane) increased by 20% to 13,185. Propane vehicles increased by 1% to 33,909, while liquified natural gas (LNG) vehicles decreased by 7% to 2,673 vehicles. The least common vehicle technology type, hydrogen vehicles, increased by 55% to 429.

The EUI decreased by 2% across all vehicle technologies while it increased for four technologies. Hydrogen vehicles increased by 208%, EVs increased by 26%, renewable diesel vehicles by 23%, and RNG vehicles by 21%. Propane vehicle EUI was flat. EUI decreased for the remaining technologies including from ethanol (as reported as E85, a high-level ethanol blend) by 2%, CNG vehicles by 7%, biodiesel vehicles by 9%, LNG vehicles by 11% and HEVs by 14%.

Figure 1 shows the percentage of EUI according to fuel type. CNG remains at the top of the list, accounting for 47% of the EUI, even though only 8% of the total vehicle population uses CNG. This contrasts with E85, a high-level ethanol blend, which accounts for only 10% of the AFV EUI, although 32% of reported AFVs can use E85.

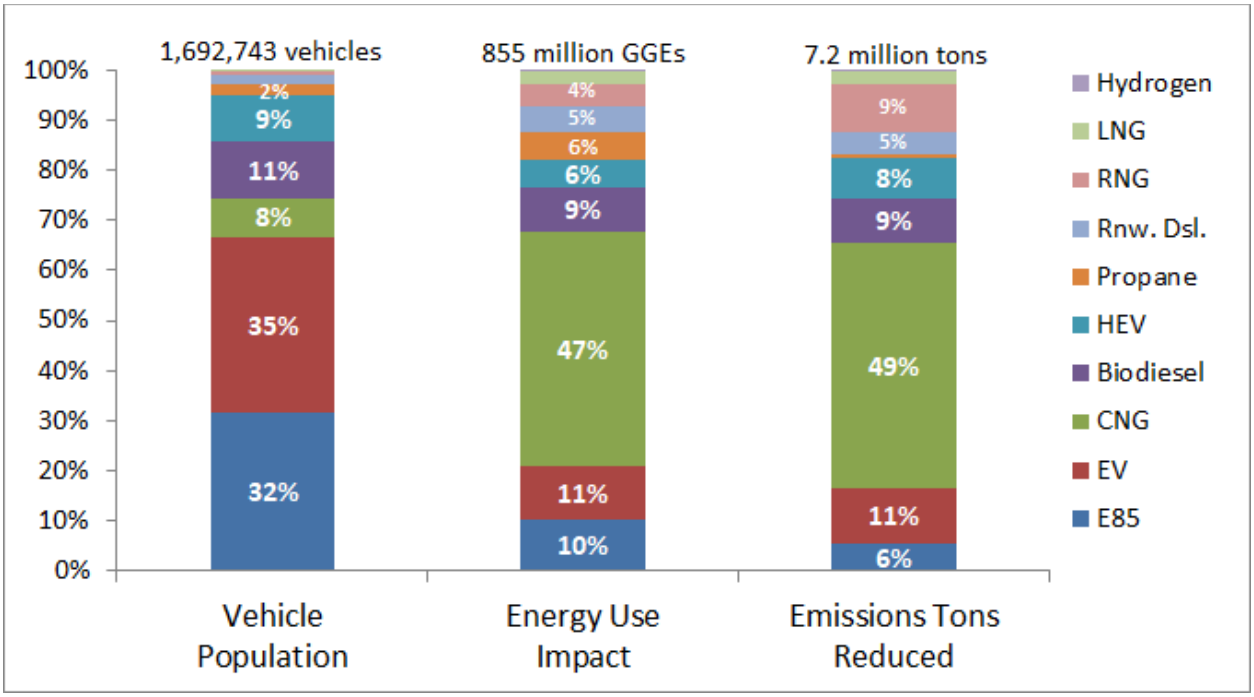

Figure 1. 2023 percentage of AFVs, EUI, and GHG emissions reductions by fuel type

The average EUI per vehicle, shown in Table 3, reveals some interesting trends. For a given vehicle, this number is influenced by five factors:

1. Dedicated AFVs (those that can only operate on alternative fuel) have a higher EUI than flex-fuel, dual-fuel, or bi-fuel vehicles that can switch between fuels. Simply stated, dedicated AFVs use alternative fuel 100% of the time, while those with interchangeable fuel systems may only use alternative fuel some of the time.
2. The number of miles per year that the AFV travels (higher mileage uses more alternative fuel).
3. The AFV's fuel consumption. Large vehicles that are doing more work tend to consume more fuel. Therefore, Table 3 separates light-duty vehicles (LDVs) and heavy-duty vehicles (HDVs) to increase fidelity.
4. The amount of conventional fuel contained in an alternative fuel blend (e.g., B20 still contains 80% conventional diesel, so only a portion of the B20 fuel consumed counts toward the alternative fuel usage).
5. The amount of conventional fuel used to produce or transport the alternative fuel. For example, the diesel used to grow the corn that is turned into ethanol is subtracted from the EUI.

Table 3. Average Annual EUI per Vehicle in 2023

Fuel	GGE per HDV	# of HDVs	GGE per LDV	# of LDVs
LNG	8,790	2,673	NA	NA
Hydrogen	6,511	204	388	225
RNG	5,722	5,783	444	7,402
CNG	4,571	82,972	464	46,054
EV	4,239	4,173	122	591,739
HEV	2,869	6,280	202	151,302
Propane	1,806	18,057	910	15,852
Renewable Diesel	1,363	30,585	543	3,012
Biodiesel	620	114,753	64	76,701
E85	258	4,461	164	530,515

Alternative fuels and AFVs were responsible for greater total GHG emissions reductions than any other coalition-reported activity. These reductions were calculated by subtracting the life cycle GHG emissions resulting from the use of an alternative fuel in a vehicle from the life cycle GHG emissions resulting from the use of gasoline or diesel fuel in an equivalent vehicle. For these calculations, gasoline is considered the baseline fuel for all LDVs, and diesel is considered the baseline fuel for HDVs. An exception is made for school buses, where gasoline is considered the baseline fuel for buses using E85, CNG, LNG, and propane because many baseline buses use gasoline, and these vehicles are equipped with spark-ignition (gasoline-like) engines.

As shown in Figure 1, the emissions reductions are not necessarily proportional to the alternative fuel used because the various alternative fuels result in different levels of life cycle emissions. RNG is a prime example of a fuel that has extremely low life cycle emissions because it has the net effect of reducing methane (a GHG) emissions from landfills, wastewater treatment facilities, and farms. As noted in detail below, reported CNG use has been found to include a much larger RNG portion than previously captured. Including the RNG impacts has significantly increased CNG GHG reductions in comparison to prior year reports. It is also worth noting that VMT reduction, HEVs, IR, and fuel economy improvement projects have a disproportionately high emissions reduction compared to their EUI because these conservation measures "eliminate" 100% of the emissions that would have resulted from the fuel they save. AFVs generally demonstrate a net "reduction" in emissions compared to vehicles that use conventional fuels but usually do not "eliminate" all the GHG emissions.

The average EUI of an HDV in the Technology Integration Program is 14 times as much as an LDV.

High-Impact Fleets and Vehicle Segments: Although HDVs represented only 16% of the reported AFVs, these HDVs are responsible for 72% of the EUI from AFV and HEV projects. The average HDV that operates on alternative fuels impacts 14 times as much fuel use as the average LDV. The use of LNG is confined exclusively to HDVs. Likewise, the overwhelming majority of renewable diesel, CNG, hydrogen, biodiesel, and

RNG is used by HDVs (96%, 95%, 94%, 94%, and 91%, respectively). Technologies with contributions more evenly split between LDVs and HDVs include propane vehicles, HEVs, and EVs, where HDVs accounted for 69%, 37%, and 20%, respectively. The only technology whose contributions were dominated by LDVs was E85 (with only 1% from HDVs).

Idle Reduction

Savings resulting from idle reduction policies accounted for 36% of idle reduction savings in 2023.

The estimated energy savings in 2023 for IR technologies and policies was 58.9 MGGE. The number of IR projects increased 5% in 2023, and the quantity of energy that these projects saved increased 17%. As shown in Figure 2, at 21.1 MGGE, IR policies were responsible for the greatest percentage (36%) of energy savings from IR. Automatic engine shutoff at 15.7 MGGE, auxiliary power units at 11.7 MGGE, the "other" category at 4.5 MGGE, onboard batteries at 2.5 MGGE, direct-fired heater at 1.2 MGGE, and driver training at 1.2 MGGE followed with significant percentages (27%, 20%, 8%, 4%, 2%, and 2% respectively). Thermal storage at 0.5 MGGE and truck-stop electrification at 0.5 MGGE each represented 1% of the IR energy savings. The remaining methods combined to represent less than 1% of the total savings.

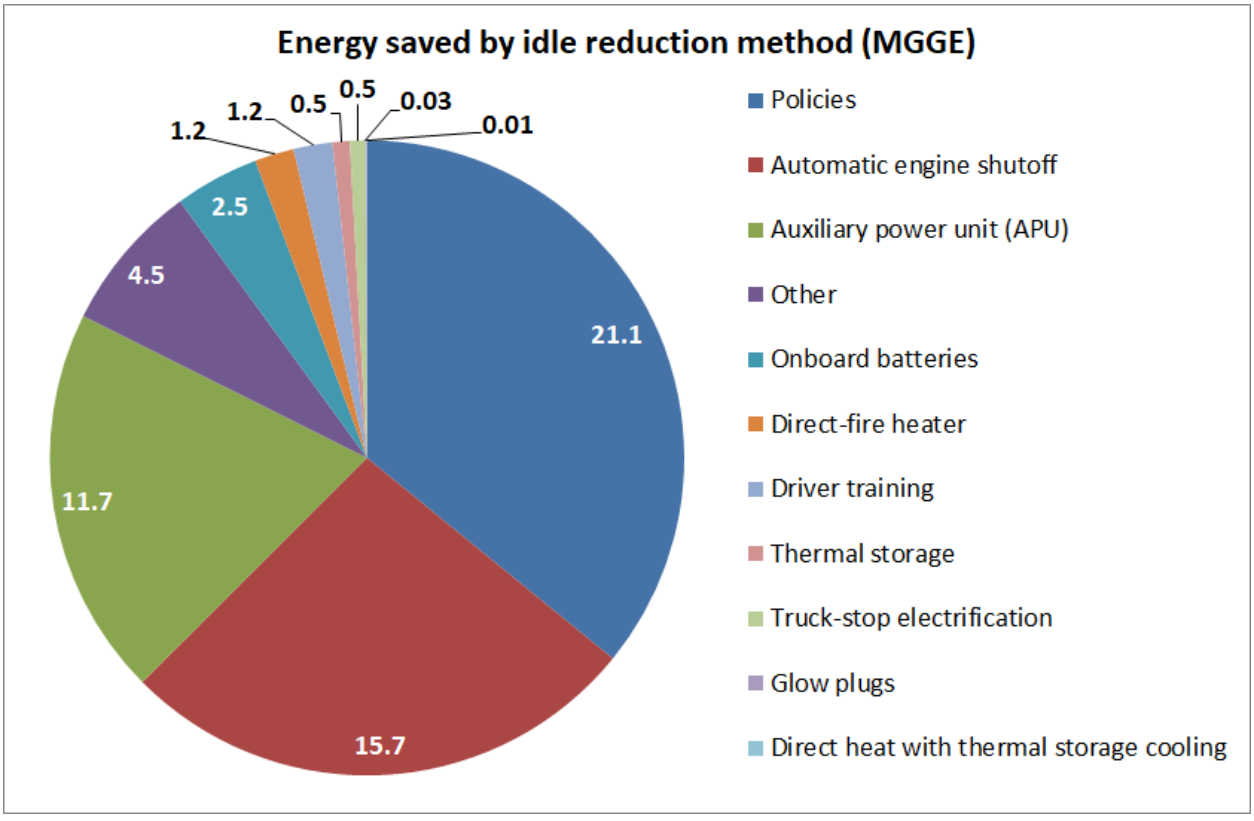

Figure 2. Energy savings measured in MGGE from IR projects, 2023

Fuel Economy

Coalitions completed a range of fuel economy projects aimed at using energy more efficiently. Non-HEV coalition-reported fuel economy projects accounted for a total savings of 40.6 MGGE, which was a 2% increase from the reported 2022 savings. Figure 3 includes the range of fuel

economy technologies advanced by coalitions. There were 98,170 vehicles in the non-HEV fuel economy technology category, equating to an average annual EUI of 413 GGE per vehicle. Figure 3 shows the fuel economy improvement projects with the largest improvements were those from the "other" category and those replacing vehicles with more efficient vehicles (including diesel vehicles). Hydraulic hybrid vehicles, automated tire inflation systems, lightweight materials, driver training, and cylinder deactivation all showed improvements near 400 GGE or more per year per vehicle.

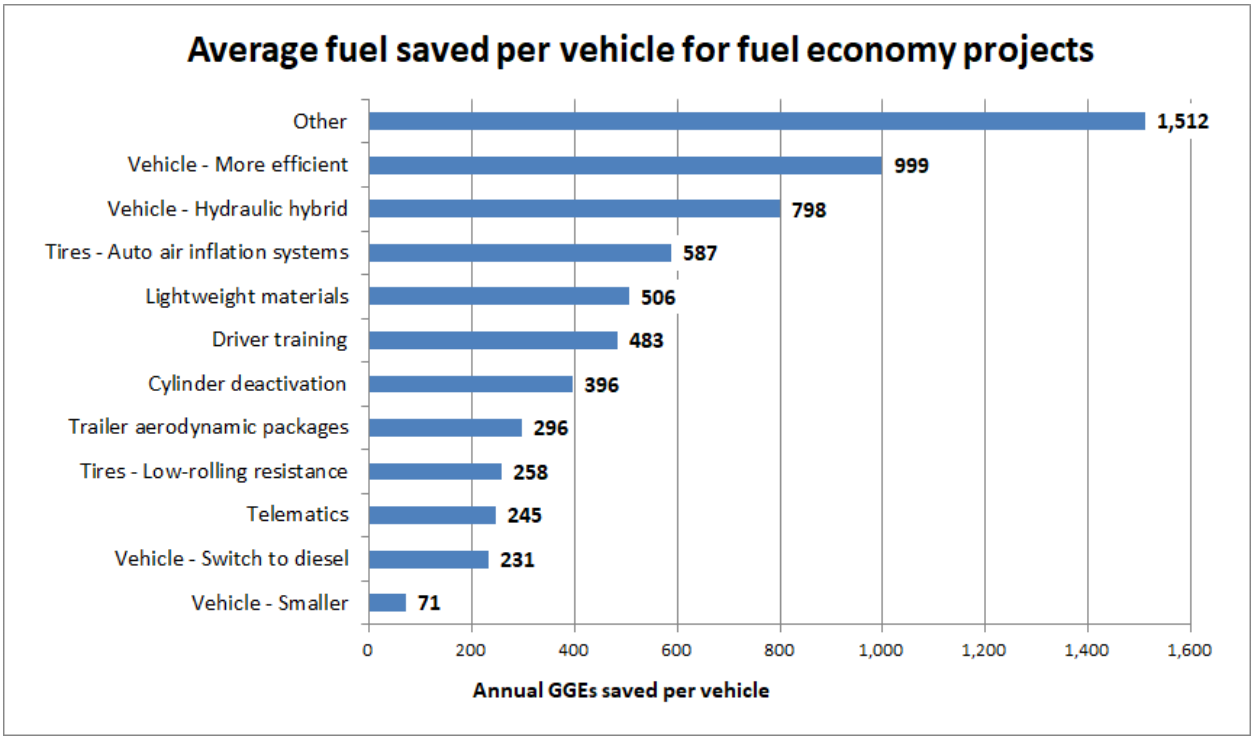

Figure 3. Average energy saved per vehicle for 2023 CC&C coalition fuel economy projects

Vehicle Miles Traveled Reduction

VMT reduction projects save fuel, and therefore money, while simultaneously curbing emissions. These types of projects include strategies such as carpooling, biking, teleworking, and public transportation. Of the 74 reporting coalitions, 60 (81%) reported at least one VMT reduction project in 2023, with a total of 454 projects reported. VMT projects have historically been outside the traditional scope of advanced vehicle, fuel, and systems research addressed by VTO. Since the primary purpose of this report is to analyze and document the impact of CC&C coalition efforts related to VTO technologies, the contribution of VMT projects to this analysis has been limited to 25% of any given coalition's total energy savings. This cap affected five coalitions; however, even with this limit in place, coalitions saved 36.0 MGGE of fuel with VMT activities. The project types, numbers, and sizes of the VMT projects are shown in Table 4.

Table 4. VMT Reduction Project Types, Number, and Energy Savings in 2023

Project Type	Number of Projects	Increase in # of Projects Over 2022 [a]	GGE Saved per Project [b]	DOE-Capped GGE Saved per Project
Route Optimization	114	8	59,725	54,569
Non-motorized locomotion (e.g., bicycles)	68	-1	17,766	17,764
Mass transit	66	9	299,905	190,173
Telecommute	62	16	47,319	47,315
Carpooling	57	8	139,309	130,377
Other	26	3	186,110	173,851
Compressed work week	21	7	11,387	11,382
Car sharing (e.g., Zipcar)	17	1	23,513	18,699
Vanpooling	13	2	54,360	34,064
Electric bikes and scooters	10	NA	9,682	8,939
Grand Total	**454**	**63**	**99,044**	**79,195**

[a] Negative numbers indicate decreases since 2022.
[b] GGE per project calculated before the 25% limit of coalition overall energy savings was implemented.

Off-Road, Rail, Marine, and Aviation

Coalition impact extends beyond the road. Off-road project EUI was nearly 32 MGGE in 2023.

Vehicles used in off-road applications contributed to coalitions' overall accomplishments. These projects support VTO's increasing interest in the potential impacts of off-road vehicles toward reducing transportation energy use. Many of these projects were born out of synergies with on-road projects with existing stakeholders using several of the same alternative fuels, technologies, and strategies. Table 5 shows the number of off-road vehicles (or pieces of equipment) reported by coalitions in 2023. These categories are self-descriptive, except for three. "Construction equipment" includes cranes, earth movers, and similar equipment. The "recreation equipment" application includes jet skis, snowmobiles, and all-terrain vehicles. The "other" category includes vehicle speed limitations and improvements to hydraulic pump efficiency.

Table 5. Number of Off-Road Vehicles or Equipment and EUI in 2023

Application	Number of Vehicles	Energy Use Impact (GGE)	Energy Use Impact per Vehicle
Construction equipment	7,439	1,758,126	236
Other	5,831	1,668,615	286
Forklifts	5,272	2,374,169	450
Landscaping and lawn equipment	1,459	229,327	157
Recreational equipment	1,151	105,099	91
Mining equipment	925	522,598	565
Rail	299	6,095,635	20,387
Farm equipment	263	54,011	205
Marine	188	18,675,439	99,337
Street sweeper	59	67,553	1,145
Aviation	4	3,904	976
Total	**22,890**	**31,554,477**	**1,379**

Overall EUI contributions from off-road vehicles totaled 31.6 MGGE—a 40% reduction from 2022. This decrease was largely caused by a significant drop in estimated electricity consumption for a project providing shore power to ships to reduce ship idling. The reported project used much less electricity than initially estimated. Marine still had the largest EUI, despite having a relatively low number of vehicles. Vehicles using biodiesel accounted for 44% of the AFVs included in this category. Other fuels with large numbers of off-road vehicles in the off-road total include electric vehicles (20%), propane vehicles (14%), and renewable diesel vehicles (11%). Biodiesel was primarily used in marine, construction equipment applications, and mining equipment. All-electric drivetrains had the largest EUI in marine, rail, other equipment, forklifts, and construction equipment categories. Propane vehicles were primarily reported as forklifts and landscaping equipment. Renewable diesel use was primarily reported for construction equipment and marine. Applications varied widely in number of GGE saved per vehicle, as shown in Table 5.

National Clean Fleets Partnership Contributions

In April 2011, DOE began partnering with national fleets that operate in more expansive geographic areas than any one coalition covers. The NCFP currently has 27 partners, who lead by example and are pacesetters for local stakeholder fleets. Three of them reported their fuel use data directly to NREL this year, and previous data from four more was used under a phaseout schedule that aligns with vehicle retirement rates. NREL then allocated NCFP fuel use from these data to 67 individual coalitions based on fleet garage locations, refueling locations, and partner estimates. Coalition directors then verified that they did assist the NCFP fleets operating in their regions and claimed full, partial, or no credit for the partner's alternative fuel use that was attributed to them. Table 6 shows the contributions to total CC&C EUI that were attributed to national partners. Their EUI of 183 MGGE represents a 12% decrease from 2022.

Table 6. Vehicles, EUI, and Emissions Reduction From National Partners

Fuel	Vehicles	Energy Use Impact (GGE)	GHG Reduced (tons)
CNG	21,260	130,251,644	950,308
LNG	1,379	20,840,879	157,214
Propane	2,901	12,921,780	19,822
Fuel economy	19,631	11,470,470	136,823
Biodiesel	644	4,309,078	33,801
RNG	573	2,493,507	26,063
Idle reduction	1,426	176,957	2,111
EV	319	86,868	614
HEV	223	70,611	842
VMT	107	27,088	323
Total	**48,463**	**182,648,883**	**1,327,922**

Outreach, Engagement, and Training Activities

Outreach, engagement, and training activities are an important part of the CC&C partnership's mission regardless of their impact on EUI and emissions benefits. Therefore, this year we have dropped the process of converting outreach events into EUI and have entirely focused on the statistics that best represent the events. These include the number of activities, the activity days that account for how many days each activity lasted, and the total persons reached by the activities.

Outreach events increased 18% in 2023.

Coalitions' outreach, education, and training activities were classified into 10 categories, as shown in Table 7. A total of 5,452 activity days were reported, which were estimated to have reached over 2.2 million people and 407 people per event on average. Media events continued to be the activity that reached the largest audience at 1.3 million people. Social media was estimated to have reached 262,685 people. Estimated persons reached through outreach decreased by 67% from 2022. The decrease was largely due to a decrease in large media events reported in 2022. Overall outreach activity days increased 18% from 2022.

Table 7. Outreach, Education, and Training Activities

Activity Type	Number of Activity Days	Share of Total Activity Days	Activity Days Increase Since 2022	Persons Reached	Share of Total Persons Reached	Persons Increase Since 2022
Meeting - other	1,375	25.2%	-5%	119,323	5.4%	-30%
Meeting - stakeholder	1,344	24.7%	40%	21,072	0.9%	33%
Conference participation	609	11.2%	46%	204,223	9.2%	19%
Social media	565	10.4%	1%	262,685	11.8%	-70%
Workshop held by coalition	494	9.1%	2%	50,627	2.3%	-64%
One-on-one fleet outreach	413	7.6%	73%	3,941	0.2%	84%
Literature distribution	311	5.7%	30%	133,580	6.0%	74%
Media event	242	4.4%	13%	1,308,772	59.0%	-73%
Website	94	1.7%	135%	38,861	1.8%	-81%
Advertisement	5	0.1%	-86%	76,275	3.4%	-23%
Total	**5,452**	**100.0%**	**18%**	**2,219,359**	**100.0%**	**-67%**

Figure 4 shows the range of technologies covered by the 5,452 outreach activity days. Each activity could, and often did, cover multiple technologies; each activity covered nearly four different technologies. Coalition outreach events covered EVs much more than any other technology type. The remaining technologies were included in 17%–35% of outreach activities.

EVs continue to be the most common topic of coalition outreach events.

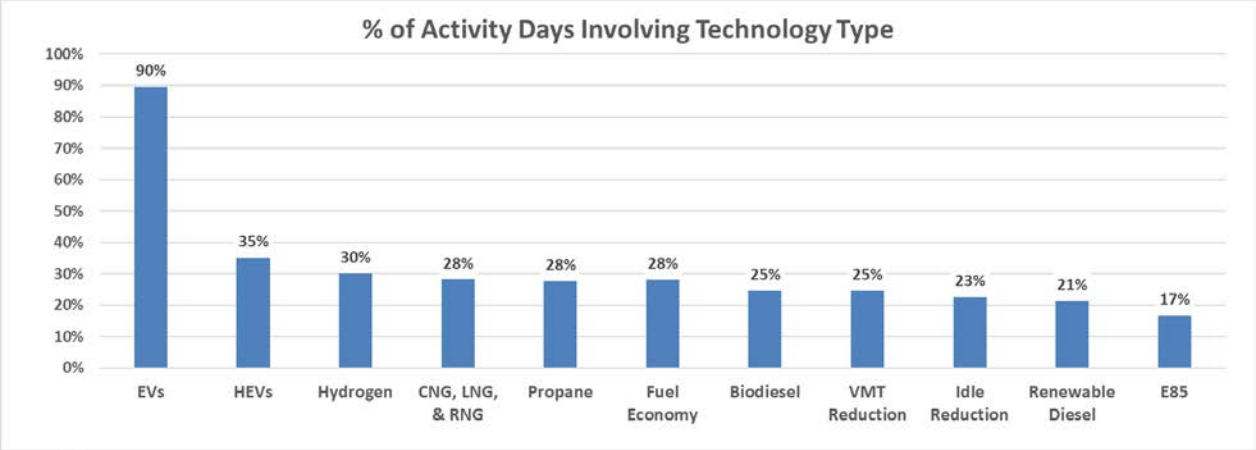

Figure 4. Percentage of outreach activity days by technology type

Figure 5 shows government fleets were the most cited target audience, followed by the general public, and private fleets. The "other" audience group, mass transit fleets, and utility fleets each

were targeted by 37%, 32%, and 30% of activity days, respectively. Fleets with delivery trucks, waste management, and airport applications were identified as audiences in less than 20% of the outreach activity days. Just as with technology types, each activity could be, and often was, aimed at multiple audiences; each activity targeted over three different audiences. This composition of outreach activity audiences was consistent with 2022.

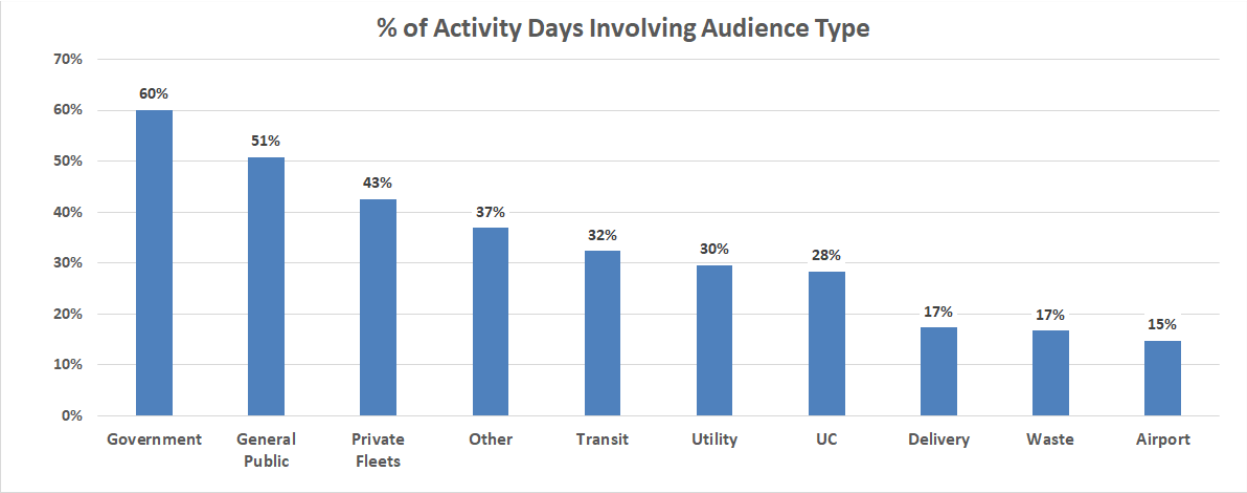

Figure 5. Percentage of outreach activity days reaching each audience type

Figure 5 shows that activities with audiences that included underserved communities (UCs)[5] represented 28% of activity days. The reporting tool does not provide a method to determine the portion of persons reached that were among each audience type. However, the portion of activity days (by activity type) that reached each audience type does allow a measure of how the activities including UCs differed from activities overall.

Outreach, Engagement, and Training Accomplishments with Underserved Communities

Given CC&C's desire to reach UCs, it is worth diving deeper into the activities that reached this audience. Comparing the overall activity days with the activity days that included UCs helps us determine which activity types were more likely to reach UC audiences. Table 8 shows UC audiences were much more likely to be included in social media activities (71%) than activities overall (28%). This is likely attributable to the fact that reaching UC audiences through social media activities has a lower barrier to entry than more engaging activities such as meetings. Indeed, the meetings coalitions held were found less likely to include UC audiences than other forms of outreach. There were no UC audiences reported in the last activity type, advertisements, likely because it was difficult for coalition directors to obtain that information.

[5] Underserved communities (UCs) are urban, suburban, and rural communities at the front line of pollution and climate change, communities with high energy expense or fossil dependence, indigenous communities, and those historically overburdened by racial and social inequity.

Table 8. Inclusion of UCs in CC&C Activities, by Activity Type

Activity Type	Activity Days	Activity Days Including UCs	% of Activity Days Including UCs
Conference participation	609	180	30%
Meeting - other	1,375	214	16%
Meeting - stakeholder	1,344	272	20%
One-on-one fleet outreach	413	83	20%
Workshop held by coalition	494	159	32%
Social media	565	401	71%
Literature distribution	311	170	55%
Media event	242	38	16%
Website	94	27	29%
Advertisement	5	0	0%
Total	5,452	1,544	28%

When investigating the inclusion of UCs, it is helpful to focus on the five outreach activity types that more directly target specific audiences and omit the subset of broader reach such as social media, website activity, social media, and advertisement. Activity types included in this analysis include both types of meetings: "stakeholder" and "other"; workshops held by coalition; one-on-one fleet outreach; and conference participation.

For the five activity types specified above, 21% of activity days were reported to include UC audiences. Coalition outreach activities that had the highest reported UC audiences were workshops held by coalitions (32%) and conference participation (30%). The lowest was "other" meetings (16%).

UC Participation Type

Describing *how* UC audiences are participating in CC&C activities indicates how meaningful the engagement is, best practices of which ensure *direct participation* with the community *early and often* to the level of *consultation*, *collaboration*, and enablement of *community-driven processes and decisions*. (Bryson et al., 2013; Gonzalez & Facilitating Power, 2019; Spurlock et al., 2022; Young, 1990). UC participation in CC&C activities also indicates the opportunity for their needs and goals to impact the work of CC&C. To help track this, we asked coalition directors, for the first time in 2023, to classify activities into one or more of the following participation types:

1. They received information
2. Their input was gathered
3. Their input was integrated in planning
4. They had a collaborative role

5. They had a decision-making role

Figure 6 presents the types of participation for the five activity types ranging from light to dark blue, with the darkness of blue generally increasing with the depth of participation. One or more participation types were reported for 54% of activity days that included UC audiences for the five activity types. Overall, there is a trend of more one-way types of participation (participation types 1 and 2), where UC audiences receive information or provide input. The trend, shown in Figure 7, also results in less two-way types of participation (types 3–5), where UC input is integrated in planning, collaborating, and making decisions. Overall, of the activity days with reported UC audiences and UC participation types for the five activity types, 51% of activity days were two-way.

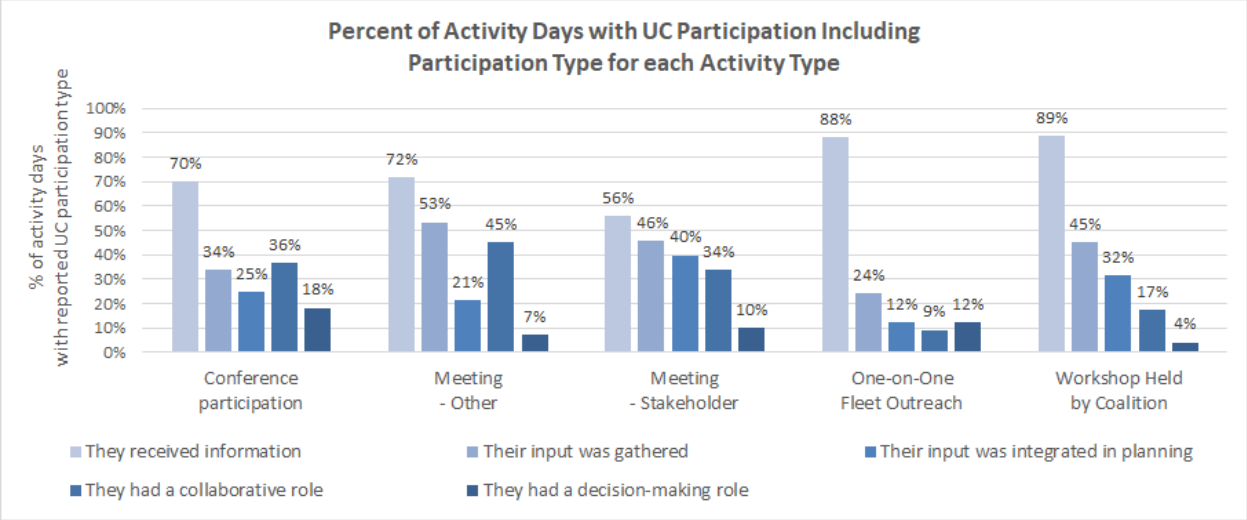

Figure 6. Type of UC Participation in Outreach, Engagement, and Training Activities

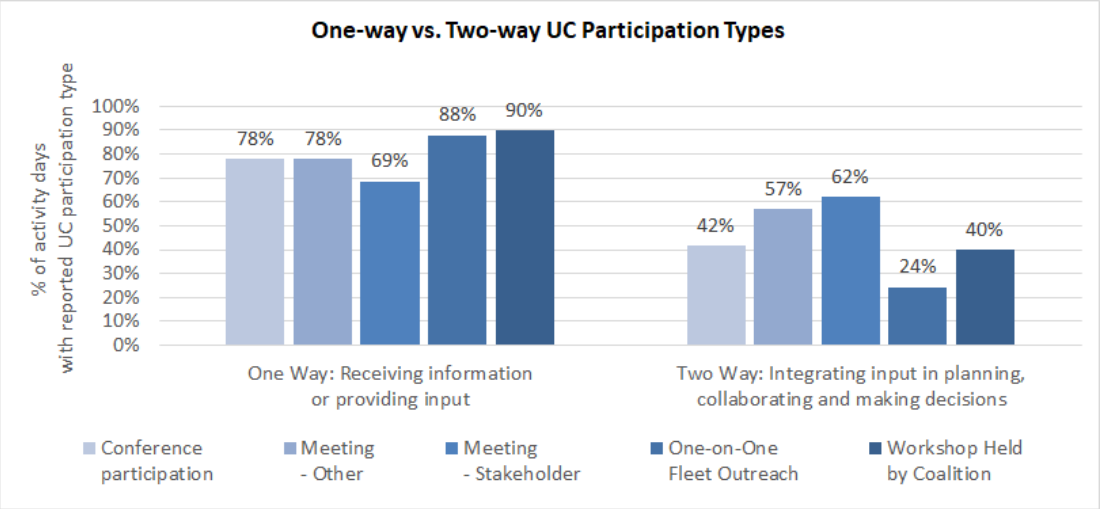

Figure 7. UC Participation in One-way vs. Two-way Participation Types of Outreach, Engagement, and Training Activity

Community Engagement Liaison Pilot Participation

There are 17 CC&C coalitions participating in the CC&C Energy and Environmental Justice Initiative's Community Engagement Liaison (CEL) Cohort pilot. This pilot focuses on meaningful and impactful public participation and community engagement to collaborate with underserved and under-represented communities on clean and just transportation projects. Figure 8 shows that across all activity types, of the activity days with reported UC audiences and UC participation, coalitions participating in the CEL Cohort pilot are engaging UC audiences slightly more with each participation type (particularly with two-way participation types) than coalitions not participating in the CEL Cohort pilot.

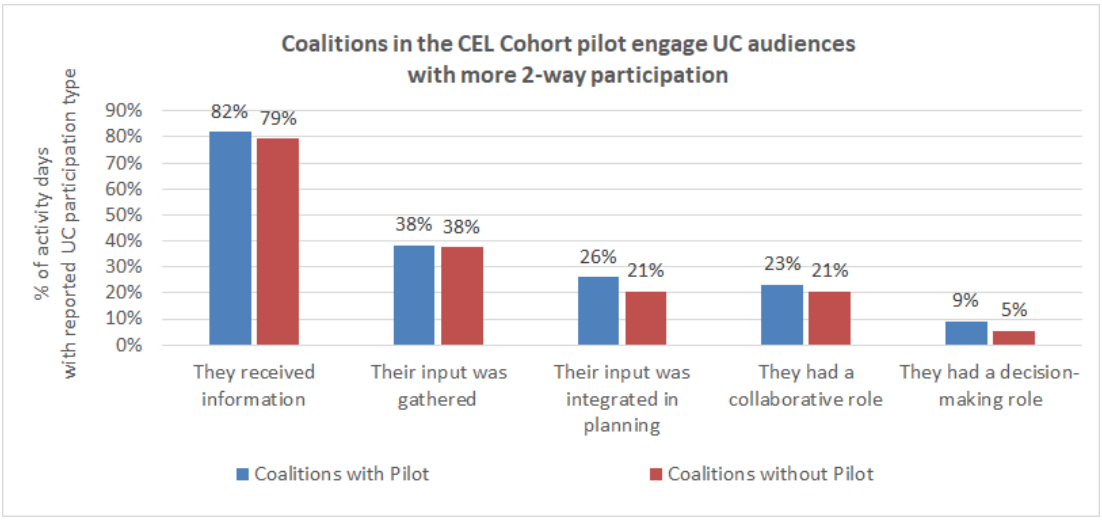

Figure 8. Coalitions in the CEL Cohort Pilot Engage UC Audiences with More 2-way Participation

Broader Coalition Energy and Environmental Justice Efforts

In 2023, an open-ended question was added to "describe any notable successes regarding incorporating energy and environmental justice (EEJ) in coalition activities, and/or how the coalition impacts underserved communities." Of the 53 answers to this question, there were examples of job training, air quality, fleet electrification, grant support, and community representation:

- We provide training and upskilling to underemployed people from disadvantaged neighborhoods, so they can obtain good jobs in the energy sector.
- We are working on a mapping tool for siting medium- and heavy-duty zero emission vehicle chargers with a priority on disadvantaged and low-income communities to help improve their air quality.
- We are providing education to our city school district and rural communities as they plan for state mandated fleet electrification.
- We provided letters of support and assisted in planning processes for grant applications for our city and numerous rural and environmental justice communities.
- We established a community-supported steering committee that empowers local residents and promotes ownership, and ensures initiatives align with community priorities.

Further representation of these responses is provided by the word cloud in Figure 9.

Figure 9. Word frequency for reported notable coalition EEJ success and impact

Note: Figure 9 only includes words used between 12 and 286 times by the 53 coalitions that answered this question, size increases by frequency of word use.

Cumulative Energy Use Impact

Clean Cities and Communities coalitions have steadily increased their annual EUI as projects have been expanded and built upon each year. Figure 10 shows coalition annual EUI remained near its highest level in 2023. In the last 8 years of tracking (2016–2023), annual coalition EUI has been near or above 1 billion GGE. The 2023 reporting year showed the coalitions continued the trend and achieved an annual EUI of 1.02 billion GGE, with a slight decrease from 2022.

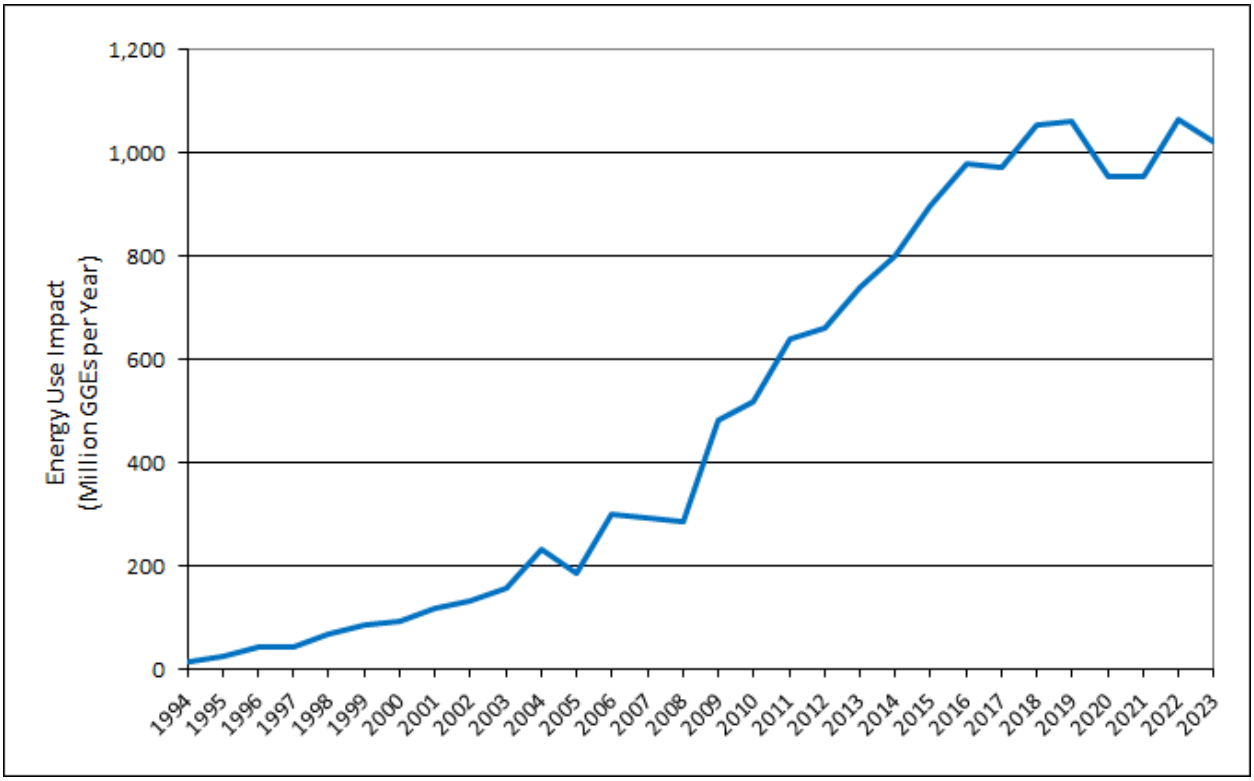

Figure 10. Increasing EUI from coalitions

The impacts of CC&C coalition efforts have added up considerably over the years. The full extent of the program's effect can be seen when the annual EUIs shown in Figure 10 are aggregated to a cumulative EUI. This cumulative measure, shown in Figure 11, is now nearly 15 billion GGE.

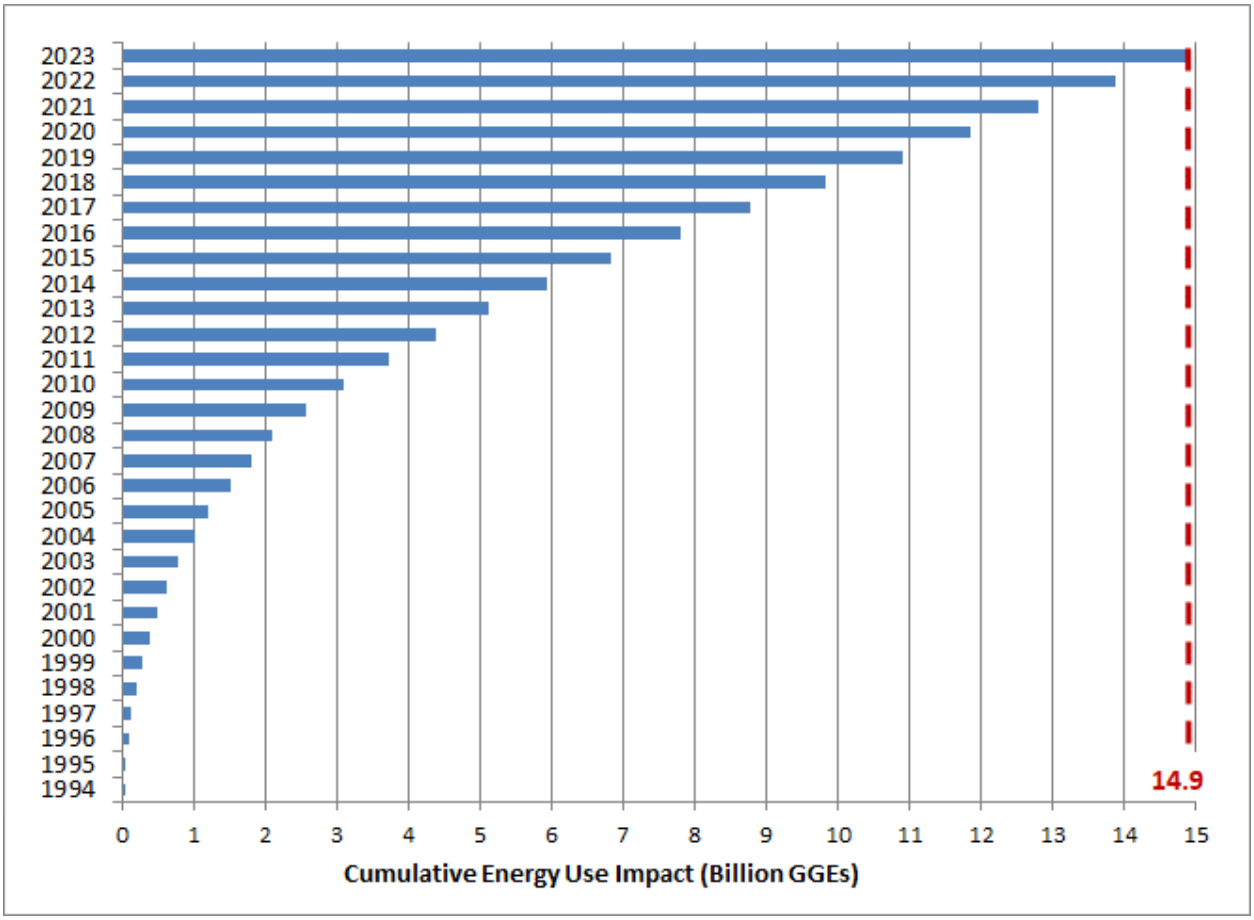

Figure 11. Cumulative accomplishments of all CC&C partnership activities

GHG and Criteria Pollutant Emissions

Clean Cities and Communities activities reduced 9.1 million tons of GHG emissions in 2023. The GHG emissions reduction grew by 70% from 2022 in large part due to the change in accounting for RNG inclusion in CNG projects, as described below.

Renewable Natural Gas in CNG and LNG Projects: Updated Assumptions and Emissions Factors

In past years, this report has assumed that all CNG and LNG projects reported by coalitions are 100% conventional natural gas and that all RNG has been specifically reported as RNG. However, analysis shows that RNG consumption has been under-reported and the national RNG mix is higher than the reported mix from coalitions and communities. This is likely because many coalition directors, or even fleet managers, do not know that their vehicles are refueling with RNG that has been provided through trading mechanisms described below. As a result, coalition directors typically reported RNG use only if the fleet or station was explicitly identified as an RNG project. This shortfall in reporting required its own investigation to determine what portion of reported CNG and LNG was actually RNG and to adjust the GHG emissions factors accordingly.

Four data sources were key to estimate the portion of CNG and LNG used in CC&C projects that was actually RNG:

- Environmental Protection Agency's (EPA) Renewable Fuel Standard (RFS) and Renewable Identification Numbers (RINs). The RFS sets up a trading mechanism that incentivizes and enables RNG to use the national pipeline system and be sold to vehicle uses. This RNG is tracked based upon RINS, as posted on the RIN Transaction Website[6].
- California Low Carbon Fuel Standard (LCFS). Similar to the RFS, the LCFS has a trading mechanism that further incentivizes and enables the lowest-GHG forms of RNG to be sold to fleets in California. Transactions done through this trading mechanism, including conventional natural gas sold to vehicles, can be tracked on the LCFS Data Dashboard[7].
- Energy Information Administration's (EIA) Annual Energy Outlook 2023[8] estimates the total amount of natural gas (including RNG) consumed by road vehicles.
- Clean Cities and Communities coalitions reported RNG projects.

To calculate the total U.S. natural gas and RNG consumption, we used EIA data and EPA's RINs data, respectively. Since EPA's RFS specifies that all the renewable fuels are to be used solely by domestic transportation, and miniscule amounts are used by rail and shipping, we attributed the total RNG calculated from RINs towards vehicle fuel. Using the equation 1, we identified that approximately 81% of the U.S. natural gas consumption in the transportation sector is a mixture of RNG from various sources (landfill, animal waste, wastewater).

$$RNG\_Mix = \frac{Total\ US\ RNG\ (from\ RINs)}{Total\ US\ NG\ (from\ EIA)}$$

For a more granular geographical attribution, we then used fuel consumption reports from California's LCFS to identify the RNG mixture in California and non-CA 49 states to be ~97% and 72% respectively. Equation 2 explains how we calculated the non-CA 49 states RNG mix.

$$RNG_{Mix}\ Non\ CA\ 49\ States = \frac{Total\ US\ RNG\ (RINs) - Total\ CA\ RNG(from\ LCFS)}{Total\ US\ NG(from\ EIA) - Total\ CA\ NG\ (from\ LCFS)}$$

Additionally, before using this updated RNG mix to calculate the updated GHG emissions factor, we accounted for the CC&C coalition-reported RNG consumption to avoid double counting of the credits. We subtracted the California and non-CA 49 states-based CC&C reported RNG numbers from the respective RNG numbers and re-calculated the RNG mix for the two geographical sectors using eq. 3.

$$Final\ RNG\_Mix\ California = \frac{RNG\ (from\ LCFS) - RNG_{CA}(from\ CC\&C)}{Total\ CA\ NG\ (from\ LCFS)}$$

[6] https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rins-generated-transactions
[7] https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard
[8] https://www.eia.gov/outlooks/aeo/

All equations above were also done based on the source-specific RNG, which have different GHG emissions factors in GREET (as shown in Table 9). Note that the lifecycle GHG emissions factors are lower for RNG coming from animal and wastewater sources than RNG coming from landfills. As a matter of fact, lifecycle emissions from animal and wastewater sources are actually negative because the reduction in methane, a potent GHG, outweighs the emissions from capturing, transporting, and combusting the RNG.

70% of the natural gas reported as CNG or LNG projects in non-CA states in 2023 was actually RNG, made available through the Renewable Fuel Standard's trading mechanism.

The updated natural gas mix shown in Table 9 warranted an updated, and significantly reduced, weighted GHG emissions factors for both CA and non-CA vehicles. The emissions factors from GREET, in the right column of Table 9, were weighted by the % natural gas consumption (from the equations above) in the left three columns to determine the weighted average GHG emissions listed as the CNG and LNG emissions factors in the second-to-bottom row. These emissions factors (-5.1 kg CO2e/GGE for CA and 3.4 for non-CA states) are applied to all natural gas projects that have not been specified by coalition directors as RNG and simply entered as CNG or LNG projects. CA based coalitions have the highest reduction in GHG emission factor due to 1) 97% RNG mix and 2) higher mix of animal waste RNG. For the non-CA states, landfill RNG is the dominant source of RNG.

Table 9: RNG Content (%) of CC&C-Reported CNG and LNG Projects, and Related Emissions Factors

Fuel Category	CA (GGEs)	Non-CA 49 States (GGEs)	GHG Emissions Factors (kg CO2e/GGE)
Fossil Natural Gas	3%	30%	8.83
Landfill RNG	46%	69%	1.38
Animal RNG	47%	0%	-11.89
Wastewater RNG	4%	1%	-11.89
Total RNG	97%	70%	N/A
CNG and LNG Emissions Factor	-5.14	3.40	N/A
Previous natural gas Emissions Factor	8.83	8.83	N/A

Notable GHG and Criteria Emissions Trends

Using the updated GHG emissions factors shows that CC&C efforts have led to a cumulative emissions reduction of 81 million tons over the years, as shown in Figure 10. The relationship between the two has not always been consistent, since some technologies can be more effective at increasing EUI or reducing emissions than others (see Figure 3), and the TI Program portfolio evolves over time to stay relevant. Therefore, Figure 11 and Figure 12 do not reflect one another exactly. An additional update in the reporting tool to be consistent with periodic updates of the GREET model resulted in a shift in the emissions calculations in 2020.

The average CC&C HDV reduced nearly 17 times as many GHGs as the average LDV. This is largely for the same reasons that HDVs have a larger EUI per vehicle ratio relative to LDVs. Other notable trends in GHG emissions that have been mentioned in other sections have been called out in boxes in this section.

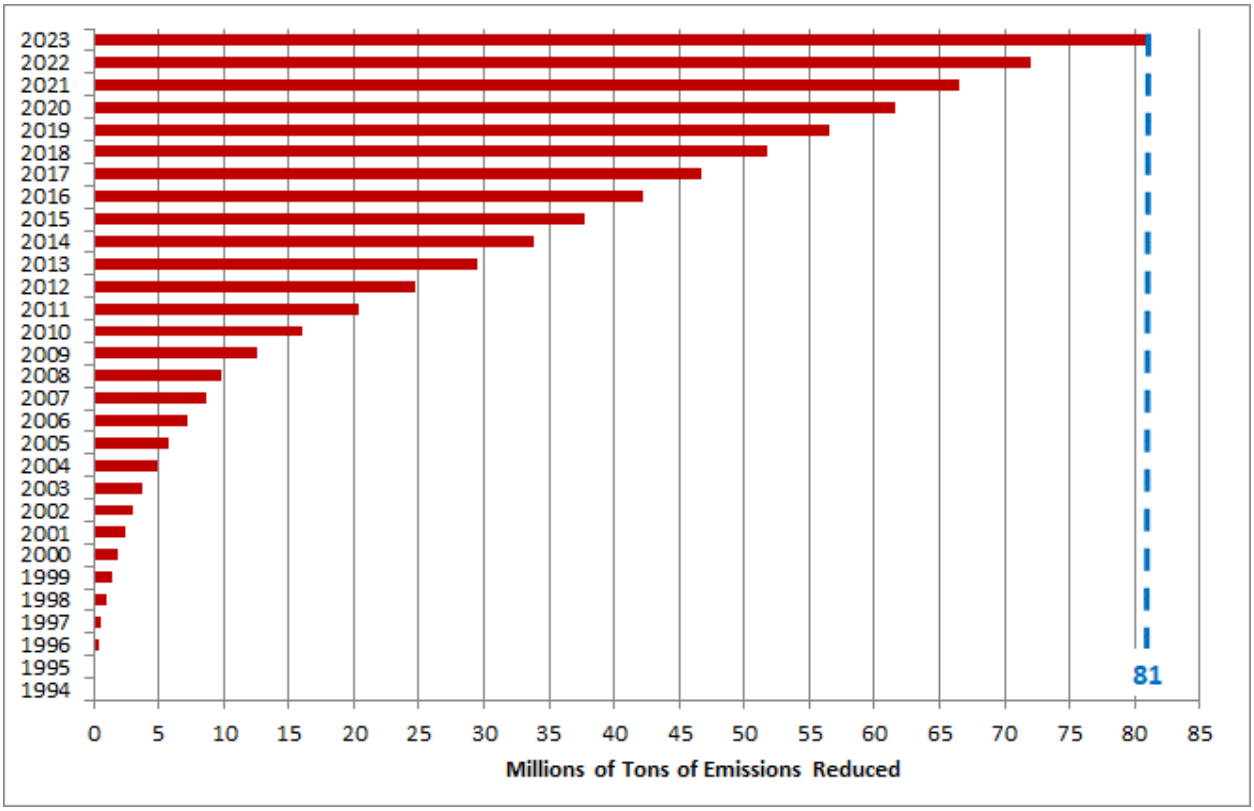

Figure 12. Cumulative emissions reductions from all CC&C partnership activities

Note: Emissions reductions accelerated in 2023 largely due to the inclusion of RNG blended into CNG and LNG (per the preceding section)

Conservation measures "eliminate" 100% of the emissions that would have resulted from the fuel they save.

In addition to reducing GHG emissions, CC&C activities improve air quality by reducing nitrogen oxides and volatile organic compounds. These are two categories of emissions that react to form tropospheric (ground-level) ozone or smog and are frequently linked to health impacts and respiratory issues. Clean Cities and Communities reduced over 769 tons of nitrogen oxide emissions in 2023, with CNG, EVs, and HEVs being the dominant reduction technologies. The coalitions also reduced 2,892 tons of volatile organic compounds, with EVs, HEVs, CNG, and VMT reduction being the leading technologies achieving these reductions. Furthermore, they reduced over 30,133 tons of carbon monoxide, 175 tons of 10-micron particulate matter (PM_{10}), and 29 tons of $PM_{2.5}$.

Clean Cities and Communities' Energy and Emissions Benefits to Disadvantaged Communities

Communities benefit from AFVs and vehicles with advanced technologies that are driven in them, regardless of who owns the vehicles, due to reductions of harmful air pollutants and fuel expenditures. Therefore, we attempted to track which communities the AFVs were driven in and where vehicles with other technology types are operating in order to allocate the emissions and energy benefits to those locations, including an estimate of what proportion of the benefits occur in disadvantaged communities (DACs) as defined by the Climate and Environmental Justice Screening Tool (CEJST). To do this, coalitions first provided location-related information about their projects across the VTO technologies including AFVs, EVs, fuel efficiency, idle reduction, and VMT reduction. This reporting of operation areas began in 2021 and continued in 2022 and 2023 with the same five categories of primary locations for vehicle operations:

- Cities: Project vehicles operated mainly within a set of cities or towns.
- Counties: Project vehicles operated mainly within a set of counties.
- Coalition boundaries: Project vehicles operated mainly within a coalition's boundaries.
- Statewide: Project vehicles operated in a range of locations across one or more states.
- Unknown.

Out of a total of 7,656 records submitted in 2023, 7,111 (92.9%) were submitted with an operation area type assigned by coalition respondents and 545 had "unknown" locations. Respondents could list multiple cities, counties, and states if applicable, however those with multiple states were removed. This included coalition boundaries that cover multiple states where the report location was "my coalition boundaries." For some other records, an operation area was assigned based on the project name. This was only done in cases where the operation area was clear, such as a specific city, county, or transit agency.

For the original analysis with 2021 data, all projects with a statewide operating area were excluded from the analysis, regardless of the size of the state. For the 2022 and 2023 analyses, a more nuanced approach was taken to account for the fact that the area of many states is smaller than the area of coalitions that don't cover their entire state. Stated another way, there are coalitions that cover areas that are larger than some U.S. states. The exclusion of very large areas was done because the methodology distributes the impact of projects evenly across the reported operational area. The larger the area of operation, the more uncertainty is introduced into the analysis. Therefore, the analysis of the 2023 data was limited to areas of operation (including states) that were smaller than the coalition area of Valley of the Sun in Phoenix, Arizona. Valley of the Sun is the Clean Cities and Communities coalition with the largest area that is not an entire state, covering 53,986 square miles. Records for projects within coalition boundaries or statewide projects that were reported by coalitions with an area smaller than that of Valley of the Sun were retained for further analysis, as were all coalitions with sub-state areas, including Valley of the Sun.

Projects that operated in multiple cities, counties, or states (a total of 299 projects) were also excluded because of the additional resources that would be required to clean the data and

conduct additional geospatial analyses for this relatively small proportion of records (3.9% of total).

Therefore 6,304 records were used in the full analysis (82.3% of the total reported). This compares to 72% of the records in the 2021 report and 81.9% in 2022 that were included in the full analysis, attributable to improved reporting processes and the higher threshold for exclusion of large-area projects. Based on these locations, an estimate of the benefits to DACs using federal definitions was generated.

In this report, we differentiate between UCs and DACs. We use the term UCs for coalition outreach, engagement, and training activities, while the term DAC is used for geospatial analysis of estimating benefits from coalition projects. Essentially, the term UC is broad enough that it allows coalitions to use their local understanding of communities to identify UCs when reporting, offering a bottom up approach to tracking impacts in the Outreach, Engagement, and Training section of the report. For the geospatial analysis of impacts from alternative fuel vehicles and fuel use reduction, reported on in the Estimated Benefits to Disadvantaged Communities section, we are using the White House Council on Environmental Quality's CEJST geographic designation of DACs by census tract, as Federal agencies have been directed by the White House to use CEJST to identify DACs that can be geospatially mapped.[9] This direction to use CEJST for mapping DACs is part of the implementation guidance for Justice40, the executive order that directs 40% of the benefits of certain federal investments, including clean transit, to DACs.[10]

The analysis of 2021 reporting data used the interim definitions of DAC that were in use in 2022, including a DOE interim definition and an interim definition in use by the Joint Office of Energy and Transportation for the National Electric Vehicle Infrastructure (NEVI) Formula Program. DOE shifted in 2023 to use of the Climate and Environmental Justice Screening Tool (CEJST), developed by the Council on Environmental Quality. So, both the NEVI and CEJST definitions of DAC were used for analysis of the 2022 and 2023 data on the operating area of vehicles. Using the NEVI definition of DAC resulted in a higher % of benefits both years due it its relatively larger area of DACs.

Approximately ¼ of the benefits from coalition reported vehicles occur in in disadvantaged communities.

The total impact of benefits that may be accrued to DACs was estimated by multiplying the percent DAC for each geographic area (tabulated in GIS) by the reported percent of each project in that area attributable to a coalition's contribution. Results for the 6,304 projects analyzed based on the CEJST definition of DAC are shown in Table 10. The table includes general estimates based on the geospatial analysis that assumed impacts are evenly distributed across the population of each geographic area of operation. While the estimates have some uncertainty, the method is still an early effort at a replicable, national-scale analysis of this nature that can inform efforts to comply with the Justice40 Initiative[11]. A main source of variability in the values from year to year are coalitions that report especially high

[9] https://static-data-screeningtool.geoplatform.gov/data-versions/1.0/data/score/downloadable/CEQ-CEJST-Instructions.pdf
[10] https://www.whitehouse.gov/environmentaljustice/justice40/
[11] https://www.energy.gov/justice/justice40-initiative

impact in terms of the emissions and air quality outcomes of their projects. If the coalitions reporting very high numbers have a lower rate of DACs in their project areas, then that influences the overall totals presented in Table 10. For example, in the 2023 data, the coalitions in Virginia (~24% DAC using CEJST) and East Bay (~23% DAC using CEJST) were two of the largest reporters. In comparison, in the 2022 data, Valley of the Sun coalition in Arizona reported almost double the emissions impacts (GHG and GGE) of any other coalition and it has ~29% DAC population using CEJST.

Table 10. Estimated Percent of Total Benefit Accrued to DACs from Coalition Projects That Were Attributed to a Specific Operating Area

All Coalitions	2023 DAC Impact Based on CEJST Definition	2023 DAC Impact Based on NEVI Definition	2022 DAC Impact Based on CEJST Definition	2022 DAC Impact Based on NEVI Definition	2021 DAC Impact Based on NEVI Definition
GGE reduced	25.1%	29.5%	27.2%	31.8%	39.6%
GHG reduced	27.4%	33.3%	25.7%	30.0%	39.7%
CO reduced	25.9%	30.7%	26.4%	30.4%	43.4%
NOx reduced	25.3%	29.9%	26.9%	31.0%	43.7%
PM_{10} reduced	24.5%	28.7%	27.1%	31.2%	44.7%
$PM_{2.5}$ reduced	23.9%	27.9%	27.0%	31.1%	44.2%
VOC reduced	24.6%	28.7%	24.1%	27.7%	40.8%

The GGE reduced in Table 14 are related to fuel expenditures, and therefore can be used as a rough proxy for cost savings to DACs. The five air pollutants listed in Table 10 (carbon monoxide [CO], nitrogen oxides [NOx], 10-micron particulate matter [PM10], 2.5-micron particulate matter [PM2,5], and volatile organic compounds [VOCs]) have health impacts. Therefore, Table 10 percentages can be broadly interpreted as the percentage of health benefits that CC&C projects provided to DACs. The differences between pollutant types within one column are largely due to the differing impacts that various technology types have on specific pollutants and the relative frequency of those technology types in each coalition's projects.

Alternative Fuel Vehicle Types and Applications

The online reporting tool allows coalition directors to categorize their AFVs into key vehicle types and fleet applications. Figure 13 shows that the largest portion (32%) of AFVs were cars, and 68% of reported cars were EVs. Unknown LDVs—which are usually vehicles reported in conjunction with a Clean Cities and Communities coalition-supported fueling station—represented 28% of vehicles. Light trucks, vans, and SUVs represented 23% of vehicles. These

were dominated by a coalition reporting an estimate of registered vehicles using high-level ethanol blends. Unknown HDVs—typically reported in conjunction with public biodiesel fueling stations—accounted for 7% of vehicles, while heavy-duty trucks without trailers, or delivery trucks, accounted for 4%. All remaining categories individually accounted for less than 2% of the vehicle population.

EVs in the car segment were the most frequently reported fuel/vehicle combination at 374,934. E85 vehicles in the light truck segment followed at 311,525. EVs in the unknown LDV segment were the next largest group, with 181,844 vehicles. E85-capable vehicles were the second largest portion (123,055 vehicles) of the unknown light-duty segment. EVs were the most common fuel type reported across all vehicle types (595,912 vehicles).

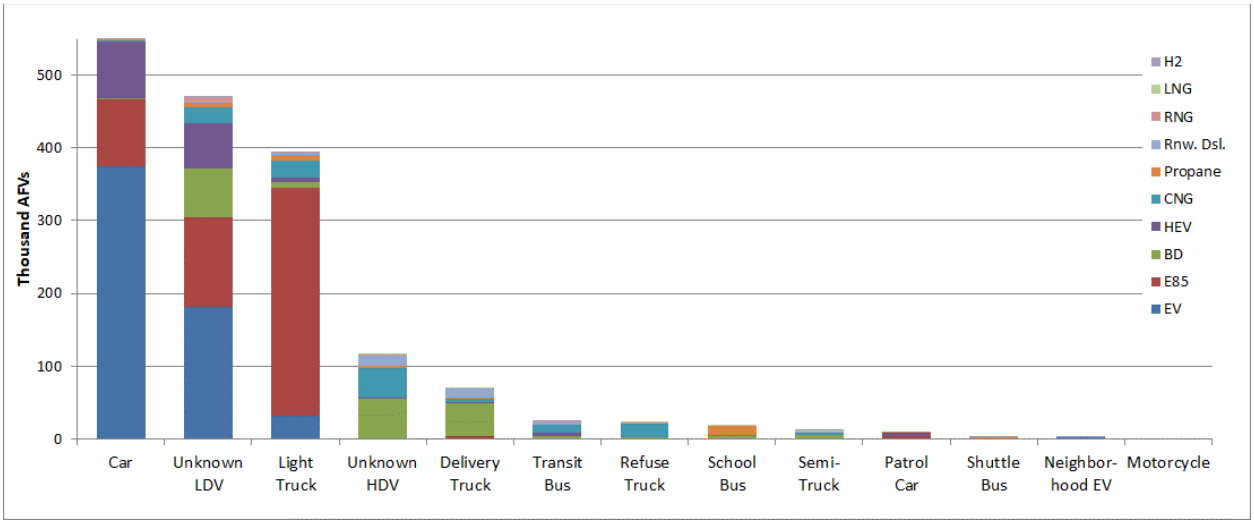

Figure 13. AFVs by vehicle and fuel type

Note: Neighborhood EVs are small EVs only allowed on low-speed roads.

In addition to reporting vehicle types, coalition directors also provided information about vehicle ownership and vehicle end use applications. As shown in Figure 14, more than half of the reported vehicles (62%) were owned by the general public or an unknown entity. Many of these vehicles were reported by fuel retailers to the coalition director, often back-calculated from fuel sales and an assumption for how much fuel the average car uses per year. The next largest ownership groups of AFVs were commuters, local government fleets, state government fleets, and corporate fleets at 17%, 9%, 4%, and 4% of the total vehicles, respectively. If commuters are combined with the general public category, 79% of vehicles are owned by the general public.

Of the fleet application types composing more than 4% of reported vehicles, local government fleets increased by 16% to 155,406, state government fleets increased by 3% to 73,894, and corporate fleets decreased by 8% to 60,613.

62% of coalition-reported vehicles are owned by the general public and have benefited from CC&C coalition projects.

Flex-fuel vehicles and biodiesel vehicles were most often reported as being used by the general public. EVs and HEVs comprised 90% of commuter vehicles (80% and 10%, respectively). CNG and propane vehicles made up the largest portion of corporate vehicles at 63% combined (48% and 15%, respectively).

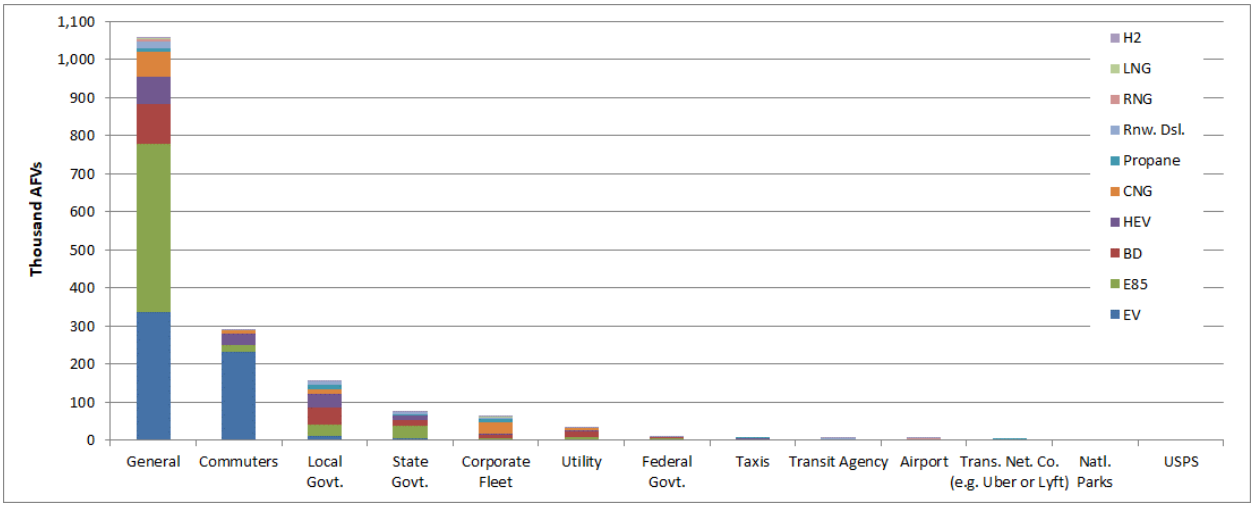

Figure 14. AFVs by application and fuel type

Emerging Technologies—Experimental, Prototype, and Demonstration Vehicle Projects

A small number of CC&C coalitions have worked with fleets and stakeholders who have an interest in field-testing advanced vehicle technologies such as hydrogen and fuel cell electric vehicles. This subset of vehicles represents less than 0.1% of the total number of alternative fuel or advanced technology vehicles reported by coalitions. Some of these projects involve limited-production, experimental, or prototype/demonstration models that vehicle manufacturers make available under special lease arrangements. This is a way for the manufacturers to gather in-use performance data, evaluate durability, and refine engineering designs for future vehicle models that may be under development. In 2023, 429 hydrogen vehicles were reported, and the largest portion were for general public owners as reported for fueling stations. Data reported to CC&C coalitions for some of these vehicles show the noteworthy potential of these technologies for both energy and environmental benefits, but no significant market trends could be drawn from this limited dataset.

Coalition Directors and Coalition Types

The average CC&C coalition director has over 8 years of experience.

Collectively, coalition directors and staff reported spending a total of 5,583 hours per week on CC&C coalition tasks, which is equivalent to more than 279,150 total hours during the year.[12] This translates into over 139 full-time, experienced technical professionals working to increase the use of alternative fuels and electric vehicles and reduce transportation energy use. For an individual coalition, the average amount of time spent completing CC&C coalition business per week was 74.3 hours. The average increased from 65.6 hours in 2022, while the median increased to 53 hours from 50 hours in 2022. The reporting tool also gathered information on coalition director experience. Coalition directors have been on the job for an average of over 8 years; 50%

[12] Assuming 50 work weeks per year.

have held their position for 6 years or less, and 39%, or 29 coalition directors, have 10 years or more of experience as a coalition director.

Table 11. Coalition Metrics by Coalition Type

Coalition Type [a]	Total # of Coalitions	Average # of Stakeholders	Average Funds Raised	Average Program Impact (GGE)	Average Persons Reached
Nonprofit - standalone	31	289	$46,543,114	13,942,829	47,215
Regional governing coalition	16	177	$1,546,968	14,743,886	24,674
Government - state	10	246	$4,571,813	7,530,083	2,508
Nonprofit - hosted	9	103	$307,721	15,561,726	29,566
University	4	129	$384,250	13,228,108	3,651
Government - city or county	4	71	$34,301,484	9,037,696	13,784
Total/overall weighted average	**74**	**216**	**$22,362,413**	**13,142,560**	**29,991**

[a] Coalition types are defined in Appendix B.

Coalition types were tracked, and the relationships between coalition type and general metrics were analyzed. The coalition types correspond to their host organizations (which generally pay the coalition director's salary) and are listed in the first column in Table 11 and defined in Appendix B. Stand-alone nonprofits are coalition types that are self-sustaining and do not operate as part of a larger host organization.

The number of coalitions in each grouping is listed in Table 11, followed by the average number of stakeholders, average funds (including grants and dues) received in 2023, average GGE of energy impacted, and average number of people reached through outreach events. The range of all metrics overlaps heavily between groups, and the low sample size precludes statistical significance. Furthermore, many variables affecting the metrics in this table were not controlled for, so no cause/effect relationships can be inferred between coalition type and specific metrics.

The most common coalition type was the stand-alone nonprofit. Coalitions in standalone nonprofits had the highest average number of stakeholders, the highest average funding levels, and reached the most people in outreach events. Coalitions in hosted nonprofits had the highest average EUI. Coalitions hosted by city and county governments or hosted by universities were the least common coalition types.

Coalitions based in standalone nonprofits had the highest average number of stakeholders and reached the most people in outreach, engagement, and training.

Funding

In 2023, 33 coalitions reported receiving 109 new project awards (project-specific grants) worth a total of $869 million. These coalitions also reported garnering $770 million in leveraged or matching funds for a combined total of $1.64 billion in new grant and matching contributions. Thirty-five of the 109 awards were at or above $1 million. Table 12 presents a breakdown of the number and value of awards reported by the coalitions without the matching funds.

Table 12. Breakdown of 2023 Project Awards by Number and Value

Grant Range	Number of Grants	Share of Total Number	Total Value	Share of Grand Total Value
<$50,000	26	24%	$551,446	0.06%
$50,000–$99,999	11	10%	$640,197	0.07%
$100,000–$499,999	31	28%	$6,416,411	0.74%
$500,000–$999,999	6	6%	$3,741,328	0.43%
$1,000,000+	35	32%	$857,687,834	98.7%
Total	**109**	**100%**	**$869,037,217**	**100%**

Of the $869 million in primary grant dollars received, $519 million (60%) was reported as coming from DOE. Of those DOE funds, 3.4% were awarded to coalitions by VTO through competitive funding opportunities intended for high impact projects. In addition to these reported grants, VTO invests in CC&C coalition success through a variety of other mechanisms:

- The CC&C **coalition cooperative agreement** is the core mechanism for VTO to provide funding to designated CC&C coalitions. With this funding mechanism, coalitions lead various technical assistance and outreach efforts within their regions, participate in program meetings, and track and report critical program and performance metrics. CC&C coalitions are expected to engage in activities that support the goals and objectives of the DOE VTO and the CC&C partnership.

- DOE VTO provides paid internships for students and early-career professionals through **CC&C Accelerate**[13], a workforce development initiative. Interns support coalition projects and receive hands-on experience with alternative fuels and vehicles, public infrastructure, community outreach, and technology integration, positioning them for success in a variety of career paths. Accelerate provided 150 semester-long intern placements (spring, summer, and fall semesters) at 44 CC&C coalitions in 2023, with an average of 50 interns per semester.

- **Jumpstart funding** is an additional source of competitive funding for CC&C coalitions intended to enable coalitions to build a successful trial project, execute a high-risk project on a small scale, educate peers about how to replicate a project, and/or respond to unanticipated opportunities or challenges. Jumpstart projects must demonstrate novel, added value to the coalition, including stakeholders, and the national network.

- CC&C coalitions are collaborating with DOE and its national laboratories to help ensure the benefits of federal investments in clean transportation reach underserved and overburdened communities. The **CC&C Energy and Environmental Justice Initiative** provides training and resources to CC&C coalitions on how to take a community-first approach to developing transportation projects. As part of this effort, VTO funds CC&C coalitions to hire a Community Engagement Liaison (CEL) to lead these efforts with

[13] https://cleancities.energy.gov/internship-opportunities/

communities in their coalition territory. The first cohort of 17 CELs were hired by their CC&C coalitions in 2023.

- **Clean Energy to Communities** (C2C) is a new place-based technical assistance program that helps utilities, local governments, and community-based organizations meet their clean energy goals using technical experts, the latest set of advanced capabilities at the national laboratory complex, and deep stakeholder engagement. CC&C coalitions are funded to provide technical assistance to C2C participants from their regions, bringing a unique local lens and transportation expertise to the experience.

The largest nongovernment funding source was from the Volkswagen Clean Air Act Civil Settlement which was involved with $1.2 million in grant funding. The second largest federal contributor was the U.S. Department of Transportation's Federal Transit Administration which contributed $200 million or 22% of the total. State governments awarded 6% of the funding. Other federal contributors included the U.S. Department of Transportation's Congestion Mitigation and Air Quality Improvement Program, the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, and a grouping of other federal agencies.

89% of new funds brought in by coalitions included collaboration with underserved communities.

For each grant-related project, coalition directors were asked *"Does this project include collaboration with EEJ [underserved] communities or representative organizations in the planning or implementation phase?"* Coalition directors answered this question in the affirmative for 45% of grants. However, this group of grants represent 89% of all new funds brought in 2023, indicating that the larger grants were more likely to collaborate with UCs. This means that CC&C coalitions collaborated with UCs at a fundamental level in their grant planning or implementation, providing opportunity for their influence or potentially funding going to UCs. Of the total spend in 2023 from all grants and matching funds, $404.35 million (84%) was spent on projects that collaborated with UCs.

In addition to new 2023 awards, coalition directors reported the portions of previous multiyear awards spent during the calendar year. If a coalition failed to report the amount spent during 2023, the total amount of the award divided by the number of years of award duration was assumed. Coalitions reported spending $481 million, or 55% of the funds they were awarded in 2023, suggesting that projects start quickly after being awarded. In 2023, coalitions used a total of $556 million in project funds that were awarded and matched between 2018 and 2022.

Coalitions leveraged $3 of project funding for every $1 in the VTO Technology Integration Budget.

In addition to project-related funds, coalitions reported collecting $1.6 million in stakeholder dues and receiving $13.8 million in operational funds, primarily from their host organizations. Combining these funds with non-DOE grant and matching funds totaled $1.7 billion in supplemental non-DOE funds. This total represents 3:1 leveraging of the $106 million VTO Technology Integration budget for 2023.

About the Stakeholders

In 2023, 74 coalitions reported a total of 15,980 stakeholders, for an average of 216 stakeholders per coalition, below the average of 263 stakeholders in 2022. This reduction was largely caused by the significant reduction of reported stakeholders in just two coalitions. Coalitions drew local stakeholders from the public, private, and nonprofit sectors. Stakeholders included local, state, and federal government agencies; large and small businesses; auto manufacturers; vehicle dealers (of light-, medium-, and heavy-duty vehicles); fuel suppliers; public utilities; nonprofits; and professional associations. Coalitions reported that 47% of stakeholders were from the private sector. This composition is more than the 37% reported in 2022 and shows a balance between public and private stakeholders.

Coalitions included nearly 16,000 stakeholders in 2023, with 47% of them from the private sector.

Data Sources and Quality

Gathering data is often challenging for coalitions because they rely on voluntary reporting from numerous stakeholders. To share best practices for data collection, the annual reporting tool asks coalitions how they obtained their data. They could choose one or more of the following: online questionnaires (e.g., SurveyMonkey), written questions (paper, electronic, or spreadsheet based) to stakeholders, phone interviews with stakeholders, coalition records (e.g., from project participation earlier in the year), or coalition estimates. Figure 15 displays the percentage of coalitions that rely on each method and implies that each coalition uses a mix of methods to collect project data across diverse projects.

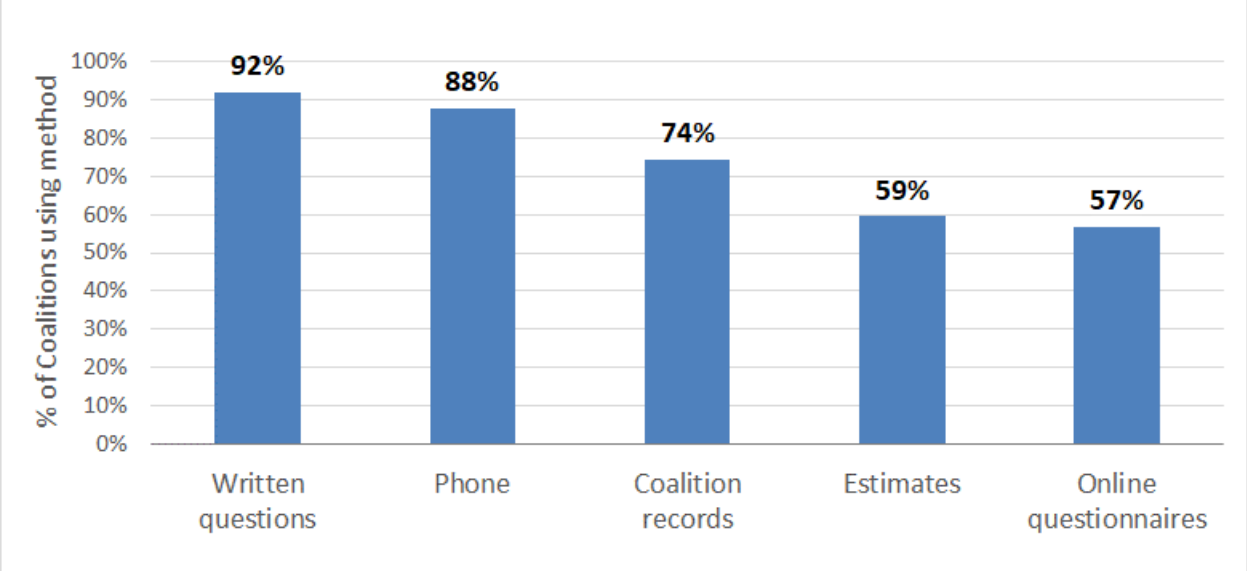

Figure 15. Project data sources

Conclusion

The *Clean Cities and Communities Partnership 2023 Activity Report* helps quantify accomplishments and the impact of the partnership. The report shows that CC&C coalitions had a year of many successful projects. The data indicate that the EUI remained over 1 billion GGE

for activities reported by coalitions in 2023. While the EUI remained similar to 2022, GHG emissions benefits increased by 70% from 2022 in large part due to the change in accounting for RNG inclusion in CNG projects.

Overall, CC&C coalitions maintained a high level of accomplishments. Coalition efforts continued to increase the number and diversity of AFVs and advanced vehicles on U.S. roads in 2023. The combined efforts of local CC&C coalitions, DOE, and DOE national laboratories bring together otherwise disparate groups to leverage people, funding, and resources to accelerate the nation's progress in increasing, and equitably distributing, affordable, efficient, and clean transportation options.

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Appendix A: Clean Cities and Communities Coalitions That Completed 2023 Annual Reports

State	Coalition
AL	Alabama Clean Fuels Coalition
AR	Arkansas Clean Cities
AZ	Valley of the Sun Clean Cities Coalition (Phoenix)
CA	Central Coast Clean Cities Coalition
CA	East Bay Clean Cities Coalition (Oakland)
CA	Long Beach Clean Cities
CA	Los Angeles Clean Cities Coalition
CA	Sacramento Clean Cities Coalition
CA	San Diego Regional Clean Cities Coalition
CA	San Francisco Clean Cities Coalition
CA	San Joaquin Valley CC&C
CA	Silicon Valley Clean Cities (San Jose)
CA	Southern California Clean Cities Coalition
CA	Western Riverside County Clean Cities Coalition
CO	Drive Clean Colorado
CT	Capitol Clean Cities of Connecticut
CT	Clean Transportation Coalition – Western Connecticut
CT	Clean Transportation Communities of Southern CT
DC VA	Greater Washington Region Clean Cities Coalition
DE	Delaware Clean Cities Coalition
FL	Central Florida Clean Cities Coalition
FL	North Florida Clean Fuels Coalition
FL	Southeast Florida Clean Cities Coalition
FL	Tampa Bay Clean Cities Coalition
GA	Clean Cities-Georgia
HI	Sustainable Transportation Coalition of Hawaii
IA	Iowa Clean Cities Coalition
ID	Treasure Valley Clean Cities
ID MT WY	Yellowstone-Teton Clean Cities
IL	Illinois Alliance for Clean Transportation
IN	Drive Clean Indiana
KS	Central Kansas Clean Cities
KS MO	Kansas City Regional Clean Cities Coalition

LA	Louisiana Clean Fuels
LA	Southeast Louisiana Clean Fuel Partnership
MA	Massachusetts Clean Cities
MD	Maryland CC&C Coalition
ME	Maine Clean Communities
MI	Michigan Clean Cities
MN	Minnesota Clean Cities Coalition
MO	St. Louis Regional Clean Cities
NC	Centralina Clean Fuels Coalition
NC	Land of Sky Clean Vehicles Coalition (Western North Carolina)
NC	Triangle Clean Cities (Raleigh, Durham, Chapel Hill)
ND	North Dakota Clean Cities
NH	Granite State Clean Cities Coalition
NJ	New Jersey Clean Cities Coalition
NM	Land of Enchantment Clean Cities (New Mexico)
NY	Capital District Clean Communities Coalition (Albany)
NY	Clean Communities of Central New York (Syracuse)
NY	Clean Communities of Western New York (Buffalo)
NY	Empire Clean Cities
NY	Greater Long Island Clean Cities
NY	Greater Rochester Clean Cities
OH	Clean Fuels Ohio
OK	Central Oklahoma Clean Cities Coalition (Oklahoma City)
OK	Tulsa Area Clean Cities
OR WA	Columbia-Willamette Clean Cities
PA	Eastern Pennsylvania Alliance for Clean Transportation
PA	Pittsburgh Region Clean Cities
RI	Ocean State Clean Cities
SC	Palmetto Clean Fuels Coalition
TN	East Tennessee Clean Fuels
TN	Middle-West Tennessee Clean Fuels
TX	Alamo Area Clean Cities (San Antonio)
TX	Dallas-Fort Worth Clean Cities
TX	Houston-Galveston Clean Cities Coalition
TX	Lone Star Clean Fuels Alliance (Central Texas)
UT	Utah Clean Cities
VA	Virginia Clean Cities

VT	Vermont Clean Cities
WA	Western Washington Clean Cities
WI	Wisconsin Clean Cities
WV	West Virginia Clean Cities Coalition

Appendix B: Definition of CC&C Coalition Types

Coalitions have categorized themselves into six different types, depending on their organizational structures and relationship to hosts.[14] Some coalitions fit within multiple types. These types are:

1. "Government—City or County" coalitions are hosted by a city or county government such as a city department of transportation or municipally owned utility.
2. "Government—State" coalitions are hosted by a state government. This is generally in the state department of energy or department of environment. Coalitions hosted by a state university are not included in this category.
3. "Hosted in a Nonprofit" coalitions are hosted within a larger nonprofit or community service organization with 501(c)(3) status. The host organization's activities are broader in scope than the CC&C coalition, such as the American Lung Association.
4. "Stand-Alone Nonprofit" coalitions are nonprofits typically with 501(c)(3) status and operate with no or minimal oversight and management of a host organization.
5. "Regional Governing Coalition" coalitions are hosted in a multigovernmental body such as a council of governments, municipal planning organization, or regional planning commission.
6. "Hosted in a University" coalitions are hosted by a university (public or private).

[14] The relationship between a host organization and the coalition varies across the country. Typically, the director of the coalition is an employee of the host organization, and the coalition benefits from the resources available at the host organization.