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Clean Cities 2011 Annual Metrics Report

Caley Johnson
National Renewable Energy Laboratory

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Technical Report
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December 2012

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Introduction

The U.S. Department of Energy's (DOE) Clean Cities program advances the nation's economic, environmental, and energy security by supporting local actions to reduce petroleum use in transportation. A national network of nearly 100 Clean Cities coalitions brings together stakeholders in the public and private sectors to deploy alternative and renewable fuels, idle-reduction measures, fuel economy improvements, and new transportation technologies, as they emerge.

Each year DOE asks Clean Cities coordinators to submit annual reports of their activities and accomplishments for the previous calendar year. Data and information are submitted via an online database that is maintained as part of the Alternative Fuels Data Center (AFDC) at the National Renewable Energy Laboratory (NREL). Coordinators submit a range of data that characterizes the membership, funding, projects, and activities of their coalitions. They also submit data about sales of alternative fuels, deployment of alternative fuel vehicles (AFVs) and hybrid electric vehicles (HEVs), idle-reduction initiatives, fuel economy activities, and programs to reduce vehicle miles traveled (VMT). NREL analyzes the data and translates them into petroleum-use reduction impacts, which are summarized in this report.

Eighty-five of the 87 coalitions that were active throughout 2011 completed their reports, resulting in a response rate of 98%. The coalitions that submitted their 2011 annual reports are listed in the appendix to this report. Coalition coordinators assembled the data based on voluntary reports from their stakeholders—the private and public entities that are members of the coalitions. As such, these reports represent just a subset of the Clean Cities activities throughout the nation, but taken together, they are an important indicator of the impact coalitions have.

In addition to collecting data through the coordinator reports, NREL compiles metrics about activities funded by the Clean Cities program at NREL and Oak Ridge National Laboratory (ORNL). NREL provides a range of technical data, tools, and resources to support coalitions in their efforts to accelerate the use of alternative fuels, advanced vehicles, and other technologies. ORNL produces the Fuel Economy Guide, the FuelEconomy.gov website, and other public information related to fuel economy. Metrics pertaining to the use and impact of these resources are presented in this report.

A detailed breakdown of the data used to produce this and previous reports can be accessed at www.eere.energy.gov/afdc/data/cleancities.html.

Summary of Key Findings

Clean Cities activities saved[1] approximately 805 million gallons of gasoline in 2011. Table 1 shows the combined results of three categories of petroleum savings:

- "Reported Savings" resulting from activities reported by coalitions, as analyzed by NREL

[1] The petroleum saved includes both gasoline and diesel. Petroleum savings in this report are expressed in gasoline-gallon equivalents (GGE), using the lower heating value ratio of the fuels.

- "Estimated Lab Savings" resulting from the Alternative Fuels and Advanced Vehicles Data Center (AFDC) and the Fuel Economy Guide, as estimated by NREL and ORNL
- "Estimated Outreach Savings" resulting from coalition outreach, education, and training events, as estimated by NREL and ORNL.

As shown below in Table 1, Reported Savings increased 38% from 2010, while Estimated Lab Savings increased 31%, and Estimated Outreach Savings decreased 4%. Total 2011 petroleum savings increased 25% compared to 2010, keeping the Clean Cities program ahead of schedule to meet its goal of 2.5 billion gallons per year by 2020.

Table 1. Petroleum Savings of Each Portfolio Element

	Technology	Million GGEs Saved	Percent of Total Reported Savings	Percent of Grand Total Savings	Increase from Last Year
Reported Savings	Alt. Fuels and Vehicles	348.5	75%	43.3%	35%
	VMT Reduction	34.5	7%	4.3%	49%
	HEVs	33.3	7%	4.1%	95%
	Idle Reduction	32.3	7%	4.0%	28%
	Fuel Economy	10.4	2%	1%	136%
	Off-Road	5.8	1%	0.7%	-28%
	Total* Reported Savings	***464.8***	***100%***	***57.7%***	***38%***
Estimated Lab Savings	ORNL Fuel Economy	102.6	–	12.7%	43%
	AFDC	61.3	–	7.6%	15%
	Total Estimated Lab Savings	***163.9***	***–***	***20.4%***	***31%***
Estimated Outeach Savings	Total Estimated Outreach Savings	176.2	–	21.9%	-4%
Grand Total		**804.9**	**–**	**100.0%**	**25%**

* Totals may differ from the sums of subcategories due to rounding.

Coalition-reported projects prevented more than 2.6 million tons of carbon dioxide equivalent (CO_2e) from being emitted to the atmosphere. Outreach events, FuelEconomy.gov, and the AFDC kept another 3.2 million tons of CO_2e out of the atmosphere, for a total of 5.8 million tons CO_2e. This greenhouse gas (GHG) emissions reduction is the equivalent of completely removing 1.3 million cars from U.S. roads.

In addition to petroleum savings and GHG emissions reductions, a remarkable achievement of the coalitions in 2011 was their success in leveraging DOE's investment in the program. In 2011, the coalitions won 173 new project awards (project-specific grants) worth a total of $55 million

and another $29 million in leveraged funds from coalition members. This funding represents a 3:1 leveraging of the $26.8 million program budget in fiscal year (FY) 2011.

Clean Cities coordinators spent more than 130,000 hours pursuing Clean Cities' goals in 2011, which is like having a national network of 66 full-time technical and sales professionals working in the field to reduce U.S. dependence on petroleum. Coordinators logged 2,262 outreach, education, and training activities in 2011, which reached an estimated 100 million people and saved an estimated 176 million GGEs of petroleum. The general public was the most common audience at these events, followed by government fleets.

Changes to 2011 Annual Metrics Report

In an effort to assure continuity of data from one year to the next, we made very few changes to the Clean Cities Annual Metrics Report and reporting process in 2011. Most changes were small and were implemented to increase the accuracy and thoroughness of the reporting process. These changes include the following:

- The data review process was more stringent this year, with a focus on ensuring that B5 projects were only reported if B5 was not mandated or already commonplace in the region. We also worked to ensure that a coalition didn't claim more than 75% attribution if participating given fleet was mandated by EPAct to use alternative fuels.
- We added fuel economy and VMT reduction as ways to reduce petroleum use from off-road applications.
- We changed the guidance for "percent contribution" claimed for VMT-reduction projects undertaken by mass transit agencies. We now recommend that coalitions focus on activities that increase or maintain ridership rather than simply claiming full contribution for VMT reduced by mass transit stakeholders.
- We added car-share programs as a way to reduce vehicle miles traveled (VMT).
- We added social media as an outreach event.

Attribution and Fuel Use Factors

To clarify the link between coalition activities and end results, the coalition annual report includes an attribution factor that accounts for the percentage of a project's outcome that may be due to coalition activities rather than to those of other participants in a project. This attribution factor was used in the estimates of impacts for fuel economy, VMT reduction, idle reduction, alternative fuel use, and outreach projects. Coordinators entered the percentage of the project's outcome they estimated their coalition was responsible for, and the project's overall outcome was multiplied by that percentage to determine the 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 added a tool that helps a coalition estimate its contribution to a given project.

Reported Petroleum Savings

Coordinators submitted information on their petroleum use reductions, broken down according to the technologies in the Clean Cities portfolio. NREL analyzed the data, converted it into a quantity of gasoline saved by each element of the portfolio, and reported in units of gasoline-gallon equivalents (GGEs)—the amount of energy contained in a gallon of gasoline. As shown in Table 1, about 465 million GGEs (MGGEs) were saved through primary Clean Cities coalition efforts in 2011—an average of 5.5 MGGEs per coalition. This is 38% higher than the total 2010 reported petroleum savings of 337 MGGEs.

Alternative Fuels and Vehicles

As shown in Table 1, alternative fuels (used in alternative fuel vehicles and in biodiesel blends) accounted for 348 MGGE, or 75% of the coalitions' reported petroleum savings. This represents an increase of 35% relative to the petroleum saved by alternative fuels in 2010.

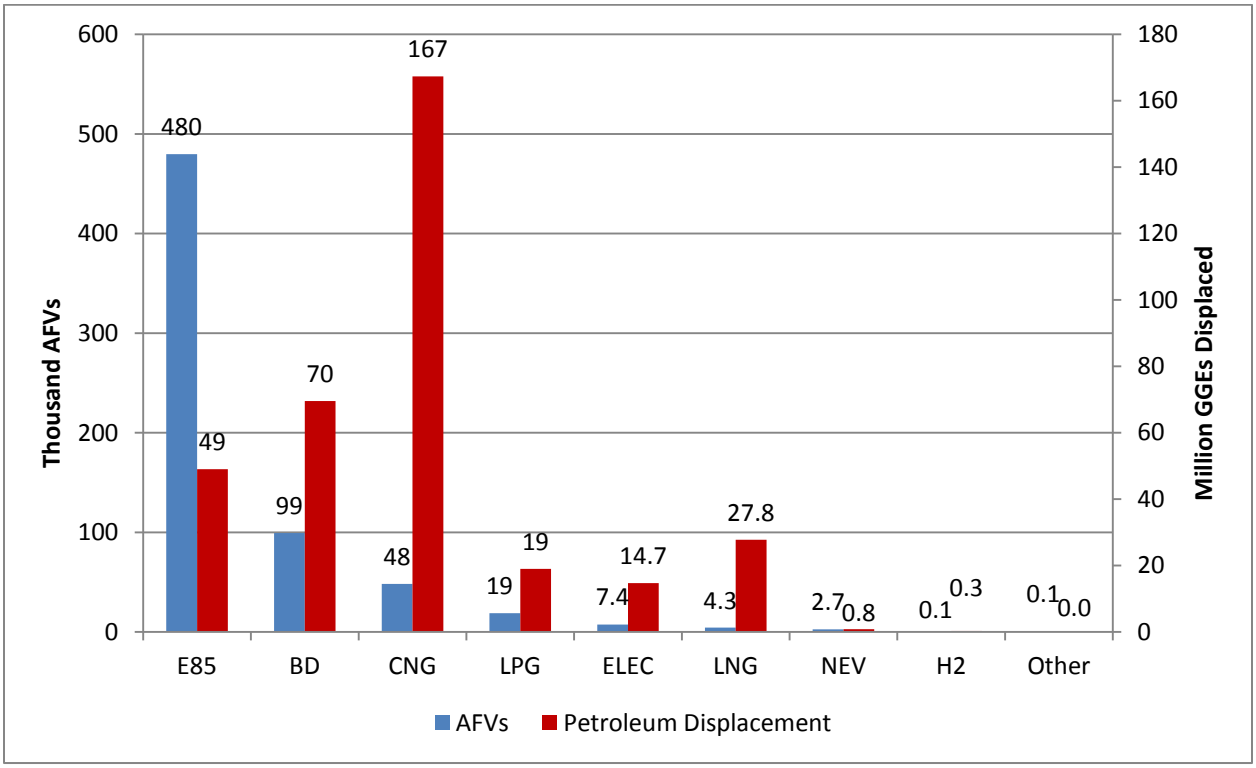

Figure 1. Number of AFVs and petroleum savings from fuel type

In 2011, coalitions reported a total inventory of more than 660,000 alternative fuel vehicles (AFVs), split among nine fuel types (Figure 1). This represents a 17% increase from last year, with the percentages of hydrogen, propane, and electric vehicles increasing the most (90%, 42%, and 35%, respectively). The large increase in hydrogen vehicles was likely due to some new projects in Honolulu and California's East Bay. The increase in electric vehicles was primarily enabled by mass production of the Nissan Leaf. The only categories in which we saw a decrease in number of vehicles in 2011 were the "other" category (96% decrease) and the neighborhood electric vehicle (NEV) category (19% decrease). The "other" category experienced the drop because of a data screen we employed to ensure that coalitions did not enter HEVs into this

category, as many did in 2010. The number of vehicles in the NEV category continues to decrease at nearly the same pace as noted in 2010.

Figure 1 shows the total GGEs displaced by AFVs according to fuel type. Compressed natural gas (CNG) remains at the top of the list, accounting for 48% of the total AFV petroleum displacement, despite that only 7% of the total AFVs used CNG. This is in stark contrast to E85, which accounts for only 14% of the AFV petroleum savings even though 73% of reported AFVs can use E85.

Some interesting trends and insights can be revealed by looking at the average number of GGEs displaced per vehicle, as shown in Table 2. For a given vehicle, this number is influenced by four factors:

- The frequency with which the AFV uses alternative fuel (dedicated AFVs tend to displace more petroleum than vehicles that can use petroleum-based fuels in addition to alternative fuels)
- The number of miles per year the AFV travels (higher mileage displaces more petroleum)
- The AFVs' fuel economy (vehicles with lower fuel economy consume more fuel, and therefore displace more petroleum)
- The amount of petroleum contained in the alternative fuel (ethanol and biodiesel blends contain significant quantities).

For example, liquefied natural gas (LNG) vehicles captured in the data displace much more petroleum per vehicle on average than do any other AFVs—nearly twice as much as CNG vehicles and more than six times as much as flexible fuel vehicles. This is unsurprising, given that LNG vehicles are primarily used in heavy-duty applications and travel relatively long distances. The average AFV in 2011 displaced 528 GGEs of petroleum. This is a 15% increase over last year, indicating a better utilization of AFVs for the purpose of reducing petroleum use.

Table 2. Average Annual Petroleum Displacement Per Vehicle

Fuel	GGEs Reduced per vehicle
LNG	6,432
CNG	3,475
Hydrogen	2,441
Electricity (excluding PHEV and NEV)	1,978
LPG	1,012
Biodiesel	700
Electricity (NEV only)	303
Other	143
E85	102
Average (Weighted)	528

Eighteen percent of the reported AFVs were heavy-duty vehicles (HDVs)—an increase of 4 percentage points from 2010. This 18% of the AFVs is responsible for 78% of the petroleum savings. The average HDV displaces 16.5 times as much petroleum as the average light-duty vehicle (LDV). The use of LNG is confined almost exclusively to HDVs. Ninety-four percent of the petroleum savings from biodiesel and hydrogen, about 88% of the savings from CNG and electricity, and 76% of the savings from propane (LPG) occurred in HDVs. The only fuel whose use was dominated by LDVs was E85 (with only 5% used by HDVs).

Hybrid Electric Vehicles

The number of hybrid electric vehicles (HEVs) resulting from Clean Cities efforts surpassed 50,000 in 2011, representing about 7% of the total vehicles (AFVs plus HEVs) reported. This represents an increase of more than 65% from those reported in 2010. This increase is partially due to coordinators erroneously reporting HEVs in the AFVs "other vehicle" category in 2010, a mistake we discouraged in 2011. The use of these vehicles in place of conventional vehicles saved 33 million GGEs in 2011, for an average of 655 GGEs per HEV.

Plug-in HEVs (PHEVs) increased from 397 to 428 vehicles from 2010 to 2011, reflecting the increased availability of this technology since the Chevrolet Volt went into production. According to data reported by coalitions, the average PHEV displaced 508 GGEs of petroleum, which is somewhat lower than we would expect. This is due in part to a reporting error where many coordinators mistakenly input EPA's fuel economy rating for the Volt into the field designated for the fuel economy of the vehicle the Volt replaced. In the future, we will ensure that the reporting tool alerts coordinators not to make this mistake.

Fuel Economy

Petroleum savings from fuel economy projects by coalitions increased 58% in 2011, to 10.4 MGGEs. This savings resulted from over 1 million vehicles, for an average displacement of 10 GGEs per vehicle. Both of these numbers were heavily skewed by a traffic-signal coordination project in North Dakota that affected many vehicles but had a relatively low GGE per vehicle impact. This project is given its own category in Figure 2, which shows that some fuel economy improvement projects were much more effective at reducing petroleum than others were.

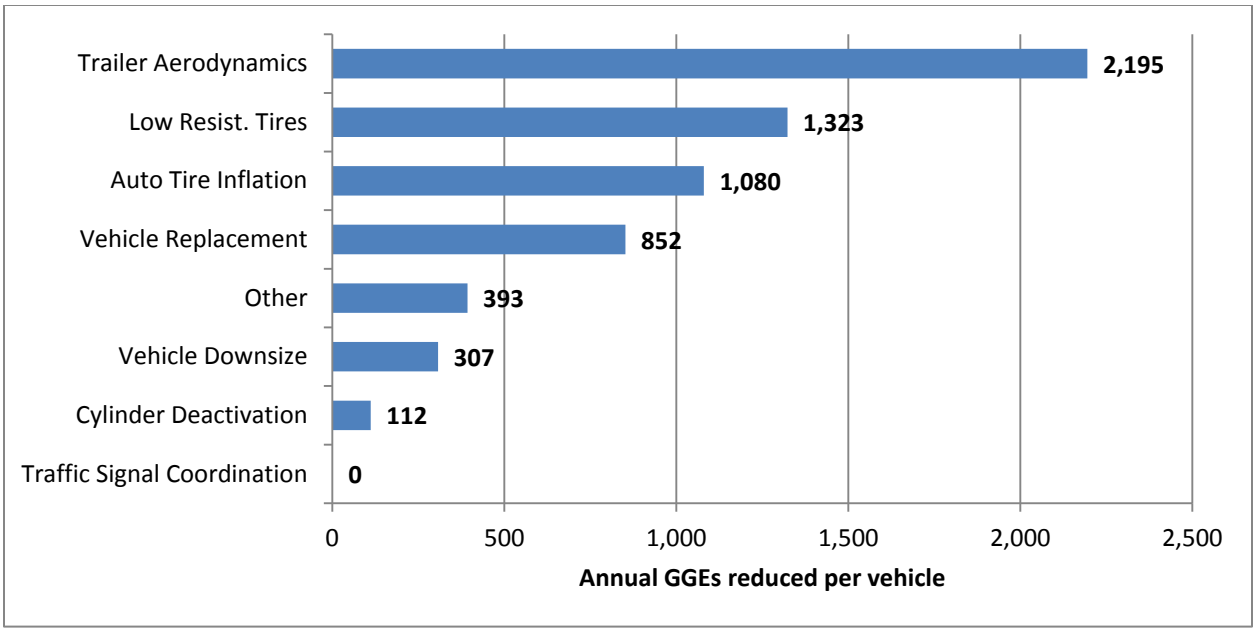

Figure 2. Average fuel-use reduction per vehicle for 2011 fuel economy projects

VMT Reduction

VMT reduction projects save fuel by reducing the miles that vehicles travel. They include strategies such as carpooling, biking, telework, and public transportation. Fifty-five percent of the coalitions reported at least one VMT reduction project in 2010—up from less than half in 2010. Furthermore, the petroleum savings from an average project increased 15% in 2011. These two factors of growth led to a 50% increase in petroleum saved through VMT reduction, from 23.2 MGGE in 2010 to 34.5 MGGE in 2011. This is the second-highest rate of growth among all portfolio categories.

Idle Reduction

Idle reduction (IR) strategies include truck-stop electrification (TSE), onboard idle reduction, and idle reduction policies. Estimated fuel savings for idle reduction technologies and policies was 32.3 MGGEs in 2011. As shown in Figure 3, onboard idle reduction technologies accounted for 51% of the savings estimated for the three approaches; idle reduction policies accounted for 41%; and truck-stop electrification accounted for 7%. This breakdown is remarkably similar to last year.

The total fuel displaced by idle reduction (32.3 MGGEs) was up 28% from 25.1 MGGEs in 2010, with all three categories growing at about the same rate.

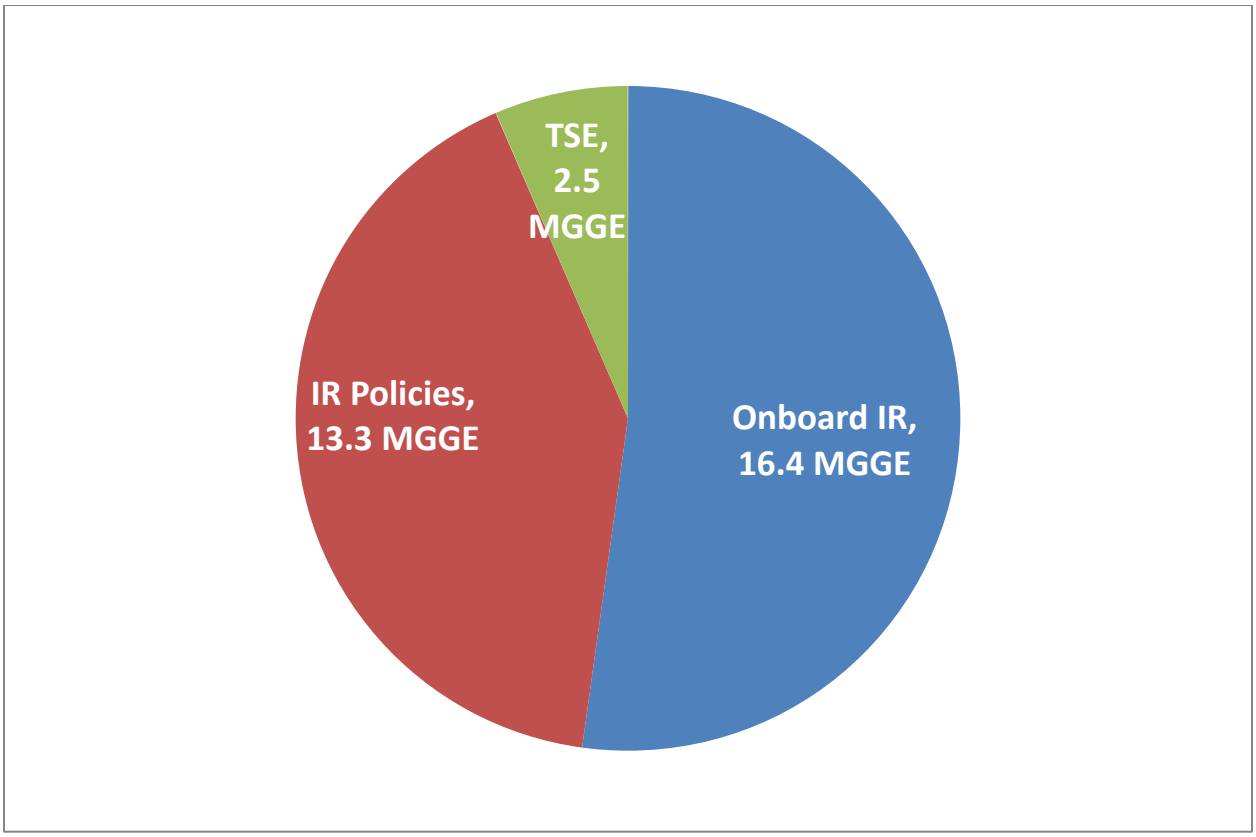

Figure 3. Fuel savings from idle reduction projects

Estimated Petroleum Savings

Estimated petroleum savings comprise two categories: Estimated Lab Savings, which includes national lab activities, such as the Fuel Economy Guide and the AFDC website; and Estimated Outreach Savings, which includes coalition outreach activities. Both these categories impact behaviors such as vehicle purchases, fuel choice, driving habits, vehicle maintenance, and transportation patterns. Calculating these petroleum savings involves a fair degree of uncertainty, but it is nevertheless important to quantify the impacts of educational and outreach activities as best we can. This section outlines our approach and provides the results.

Methods Used to Estimate Petroleum Use Reduction by Websites and Outreach Activities

2011 is the third year for which petroleum use reduction was attributed to the program's online information resources and to outreach events held by Clean Cities coalitions. To quantify these estimated savings, NREL and ORNL developed the Petroleum Impact Model (PIM), and NREL added related functionality to the Clean Cities annual report website.

Clean Cities coordinators input the type of outreach event, the number of people reached by each event, the technologies presented, and the coalition's percent attribution. To determine the number of people reached by a given event, the annual report website multiplied the audience number by the percent attributed to the coalition. When multiple technologies were presented in

a given event, the annual report website assumed the people reached to be divided evenly among the technologies. This data is then entered into the PIM as the "persons reached by the coalition about a given technology."

The PIM multiplies this persons-reached number by the probability they will take action (defined as purchasing an AFV or more efficient vehicle, or changing driving or fueling behavior). This probability is derived by comparing the outreach event and technology to comparable marketing media and products. Eleven of these media-product combinations have a "Customer Conversion Ratio" that is recorded by various marketing firms, as shown in Table 3. The customer conversion ratio is the ratio of purchases made (desired action) over the total number of people contacted through the outreach activity. The code in Table 3 is provided for continuity through the calculation process.

Table 3. Benchmark Customer Conversion Rates and Their Sources.

Code	Benchmark Conversion Rate	Reference
1	0.6% for electronics (expensive, complicated) websites	Fireclick.com. Accessed June 16, 2011
2	1.3% for environmentally related, incremental cost purchase	Bird, Lori. 2004. Utility Green Pricing Programs: Design, Implementation, and Consumer Response
3	2% for common websites	Fireclick.com. Accessed June 16, 2011
4	2.5% for industry-specific mail	Direct Marketing Association (DMA). 2011
5	3.2% for email	Fireclick.com. Accessed June 16, 2011
6	7% for affiliates	Fireclick.com. Accessed June 16, 2011
7	(Rate not listed here due to copyright restrictions) AdMeasure product: LDVs	GfK Mediamark Research & Intelligence, LLC. 2011
8	(Rate not listed here due to copyright restrictions) AdMeasure product: Gasoline	GfK Mediamark Research & Intelligence, LLC. 2011
9	(Rate not listed here due to copyright restrictions) AdMeasure smoking cessation	GfK Mediamark Research & Intelligence, LLC. 2011
10	2% for direct mail to current customers	Eisenberg, B. "The Average Conversion Rate: Is it a Myth?" ClickZ. February 1, 2008.

For activity-type–audience-action combinations that weren't directly addressed by research, NREL adjusted the customer conversion ratios based on the Ostrow Model of Effective Frequency, Krugman's Three Exposure Theory, and the author's assumptions. Table 4 lists a set of relationships that increase or decrease the impact of advertisements.

Table 4. Relationships for Media Effectiveness and Their Sources.

Code	Relationships	Source
A	Degree of media interactivity increases impact	Ostrow Model of Effective Frequency
B	Brand recognition increases impact	Ostrow Model of Effective Frequency
C	Long purchase cycle increases impact	Ostrow Model of Effective Frequency
D	Less frequent usage of item increases impact	Ostrow Model of Effective Frequency
E	Affordability of item increases impact	Ostrow Model of Effective Frequency
F	Simple message increases impact	Ostrow Model of Effective Frequency
G	Media clarity (not cluttered) increases impact	Ostrow Model of Effective Frequency
H	Message in relevant environment increases impact	Ostrow Model of Effective Frequency
I	Audience attentiveness increases impact	Ostrow Model of Effective Frequency
J	More steps in processing the media increases impact	Krugman's Three Exposure Theory
K	Availability of item increases impact	Author's assumption
L	Length of vigilance required decreases impact	Author's assumption

We adjusted the benchmark conversion rates shown in Table 3 by the relationships for media effectiveness shown in Table 4. The direct application of these rates and relationships is shown in Table 5, where the number relates to the code in Table 3, and the letters relate to the code in Table 4. The final customer conversion ratios used are displayed in Table 6.

Table 5. Combination of Benchmarks and Relationships.

Activity Type	Purchase new AFV	Use alt fuel in existing vehicle	Use biodiesel blends in diesel vehicle	Purchase more efficient car	Operate vehicle more efficiently	Purchase HEV	Reduce idling	Idle reduction HDV (equip purchase)	Reduce vehicle miles travelled
Advancing the Choice	6+H+I+J-E	6+H+I+J	6+H+I+J	6+H+I+J	6+H+I+J	6+H+I+J-E	6+H+I+J	6+H+I+J-E	6+H+I+J
Advertisement	7-K	8-K-L	8-K-L	7+E	9-G-L	7-K	9-L	7+E	9-L
Conference	6+H+J-E	6+H+J	6+H+J	6+H+J	6+H+J	6+H+J-E	6+H+J	6+H+J-E	6+H+J
Literature Distribution	4+B+H-E	4+B+H	4+B+H	4+B+H	4+B+H	4+B+H-E	4+B+H	4+B+H-E	4+B+H
Media Event	7-E-G-H-K	8-G-H-K	8-G-H-K	7-G-H+E-K	9-G-H-K	7-E-G-H+B-K	9-G-H-K	7-E-G-H-K	9-G-H-K
Meeting	6+A+B+I-E	6+A+B+I	6+A+B+I	6+A+B+I	6+A+B+I	6+A+B+I-E	6+A+B+I	6+A+B+I-E	6+A+B+I
Website	1+B+J	3+B+J	3+B+J	3+B+J	3+B+J	1+B+J	3+B+J	1+B+J	3+B+J

In 2011 we lowered slightly the assumed effectiveness of media events in as a way to account for media covering technologies that are not yet available to the public. Last year, this problem was countered by eliminating these specific media events—a technique that was deemed less reliable and thorough than the new approach.

Table 6. Customer Conversion Ratios Used in the PIM

Activity Type	Purchase new AFV	Use alt fuel in existing vehicle	Use biodiesel blends in diesel vehicle	Purchase more efficient car	Operate vehicle more efficiently	Purchase HEV	Reduce idling	Idle reduction HDV (equip purchase)	Reduce vehicle miles travelled
Advancing the Choice	2.0%	6.0%	6.0%	5.0%	7.0%	2.0%	5.0%	4.0%	8.0%
Advertisement	0.6%	5.5%	5.5%	2.0%	10.0%	2.0%	10.0%	3.0%	4.0%
Conference	2.0%	6.0%	6.0%	5.0%	7.0%	2.0%	5.0%	4.0%	8.0%
Literature Distribution	2.0%	3.0%	3.0%	2.5%	3.0%	2.5%	3.0%	2.5%	5.0%
Media Event	0.3%	2.0%	2.5%	1.0%	3.0%	1.0%	4.0%	1.5%	1.5%
Meeting - Other	2.0%	7.0%	6.0%	5.0%	7.0%	2.0%	5.0%	4.0%	8.0%
Website	2.0%	4.0%	3.0%	3.0%	4.0%	3.0%	3.0%	3.0%	3.0%

The persons-reached multiplied by the appropriate customer conversion ratio (from Table 6) results in the number of people assumed to take the intended action. At this point, the PIM is similar to the Clean Cities annual reporting tool, as it converts the estimated number of vehicles purchased or number of people changing their driving habits into reduced petroleum use. We make downward adjustments to the estimates to account for probable overlaps between audiences attending outreach events and entities reporting their own petroleum savings via a Clean Cities coalition. We only apply the estimated petroleum savings to the reporting year in question, even though many of the vehicle purchases and behavioral changes will likely last beyond that year.

We also used the PIM to estimate petroleum savings resulting from the AFDC. NREL gathers Web statistics on the AFDC that allow us to estimate the number and characteristics of individual users. The PIM then uses inputs, defaults, and methodologies similar to those it employs in calculating the savings from coalition websites (including the website row of Table 3) to estimate the total petroleum savings attributable to the AFDC.

Estimated Lab Savings

Both NREL and ORNL use a variety of means to track the use of the information and resources they provide on behalf of the Clean Cities program. ORNL produces the Fuel Economy Guide, based on fuel economy data from the Environmental Protection Agency. It also produces and maintains the FuelEconomy.gov website, along with other print products and educational activities related to fuel economy. By tracking the number of new car buyers, used car buyers, and car drivers exposed to fuel economy products through their educational materials, and assuming a 1% – 3.3% improvement in fuel economy per customer, ORNL estimated that the fuel economy materials resulted in a savings of 103 MGGE in 2011.

Online resources managed by NREL reached a large audience in 2011: The Clean Cities and AFDC websites received a combined 4.8 million page views. The sites provide a range of resources to support coordinators, fleets, businesses, policymakers, and other transportation decision-makers in their efforts to implement the technologies and strategies in the Clean Cities portfolio. The sites' content includes technical data, case studies, publications, and industry contacts, along with databases of federal and state incentives and laws, fueling station locations, available vehicles, and other information and tools.

NREL estimates that the 4.4 million page views through 1.0 million visits by 806,000 users of the AFDC resulted in a petroleum savings of 77 MGGEs in 2011. It captivated the average visitor for nearly four minutes. The Clean Cities website received 406,000 page views through 106,000 visits from 53,800 visitors, and held the average visitor for 4.5 minutes. We did not make petroleum use reduction estimates for the Clean Cities website, because the majority of visits to the Clean Cities website are assumed to be related to Clean Cities activities taking place through coalitions, and those activities are already reported by the coalitions. For the same reason, we did not make petroleum use reduction estimates for other Clean Cities activities performed by NREL, such as webinars, technical advice, presenting and exhibiting at conferences, and publications.

Estimated Outreach Savings

We classified coalitions' outreach, education, and training activities into nine categories, as shown in Table 7. A total of 2,262 activities were reported, and these activities were estimated to reach over 100 million people. Compared to 2010, the number of events increased 34%, while the number of persons reached decreased 24%. This is due to a decrease in the number of persons reached by media events, Advancing the Choice events, websites, and meetings, despite that the number of events held increased for all activity types. The majority of people (82%) were reached through media events in 2011, even though only 10% of the outreach activities were media events. Meetings were the most common type of outreach event (30%) but reached less than 0.5% of the outreach audience.

Table 7. Outreach, Education, and Training Activities

Activity type	Persons reached	Share of total persons reached	Number of activities	Share of total activities
Media Event	82,547,848	82.1%	232	10.3%
Advertisement	13,286,049	13.2%	55	2.4%
Literature Distribution	1,244,186	1.2%	206	9.1%
Conference	1,141,369	1.1%	308	13.6%
Advancing the Choice	1,103,497	1.1%	406	17.9%
Website	693,856	0.7%	32	1.4%
Meeting - Other	435,215	0.4%	685	30.3%
Meeting - Stakeholder	104,030	0.1%	326	14.4%
Social Media	6,293	0.0%	12	0.5%
TOTAL	100,562,343	100.0%	2,262	100.0%

Figure 4 illustrates the types of audiences of the 2,262 outreach activities. Any one activity could be aimed at more than one audience; in fact, each activity targeted an average of 3.25 different

audiences. The general public was the most-cited target audience, followed by private fleets, then government fleets. Entities with specialized applications—delivery trucks, mass transit, airports, waste management, and utility trucks—were identified as audiences in nearly 36% of the outreach activities.

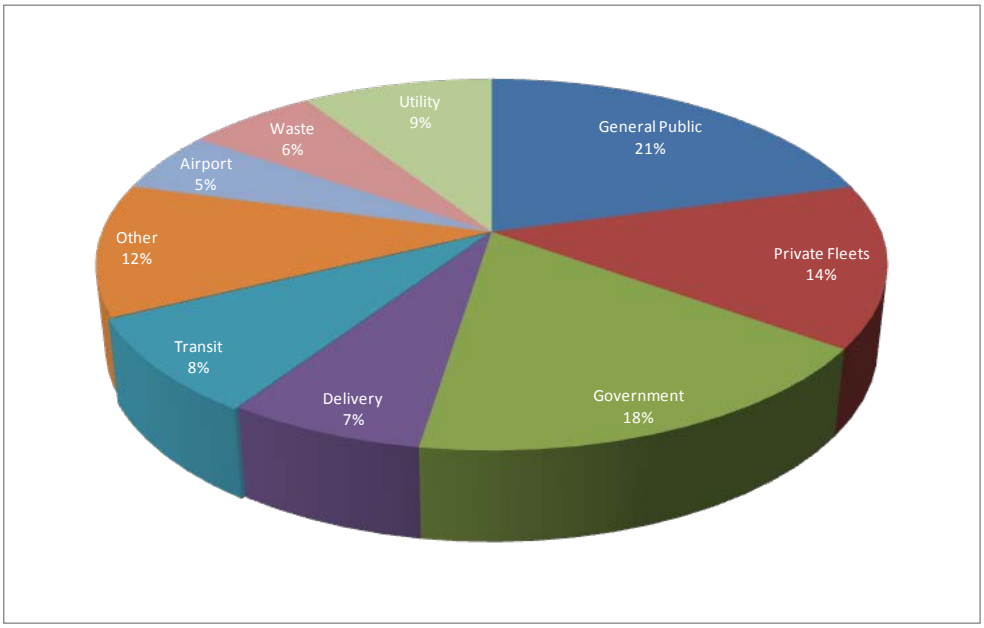

Figure 4. Percent of outreach activities split among audience types

The coalitions' outreach events featured a relatively even mix of technologies, as illustrated in Figure 5. No single technology dominated, but AFVs were covered more often than any of the other technology types. The number of activities has increased this year for all technologies, with each increasing between 12% and 31% (for blends and fuel economy, respectively). Just as with audience types, any one activity could be centered on more than one technology; in fact, each activity featured an average of three different technologies.

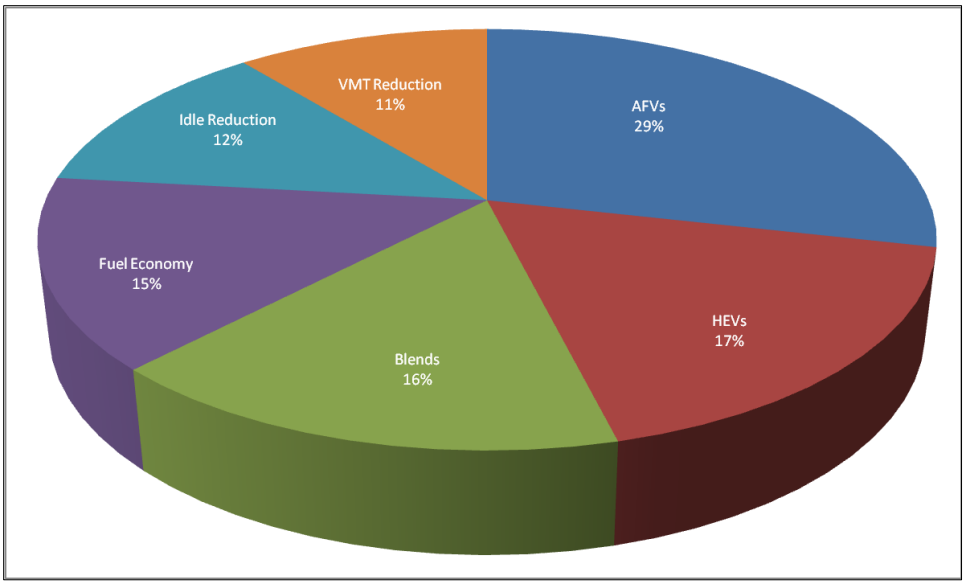

Figure 5. Percent of outreach activities by technology type

Using the PIM, NREL estimates that Clean Cities coalition outreach events prompted and enabled actions that saved 176 MGGEs of petroleum in 2011. PIM and the estimation methods are explained above in more detail at the beginning of this section.

Goal Tracking

In 2005, Clean Cities set a goal of displacing 2.5 billion GGEs per year by 2020. The data presented in this report show that Clean Cities is ahead of schedule to meet this goal. Clean Cities' progress toward its petroleum use reduction goal is shown in Figure 6, where the path toward achieving the 2020 goal is represented by the blue dashed line, and actual petroleum savings are tracked by the black solid line. When the goal was originally set in 2005, meeting it required a compounded annual growth rate of 16.6%. However, because of higher-than-projected petroleum savings in subsequent years, the average growth rate required henceforth to meet the 2020 goal is 13.4%.

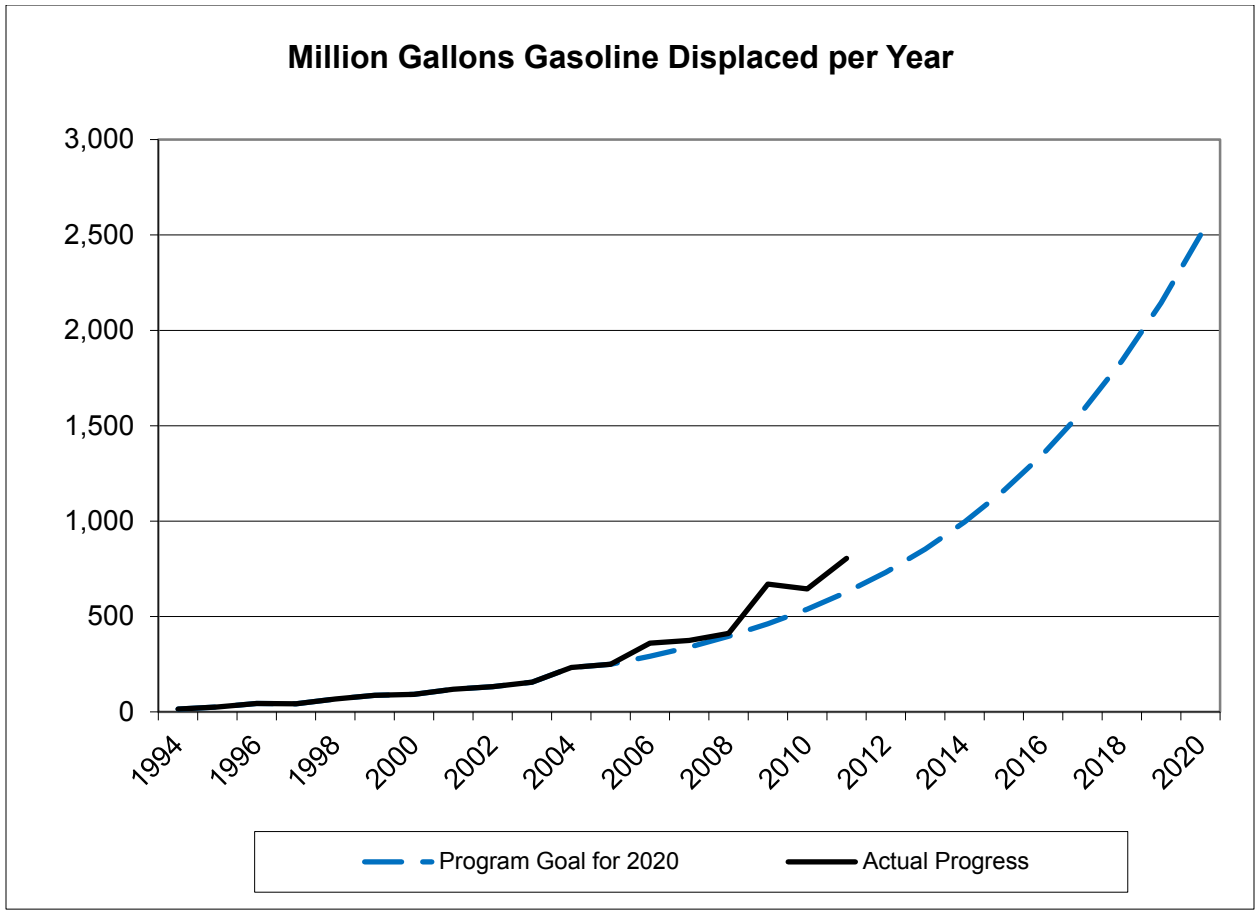

Figure 6. Annual petroleum savings trajectory to meet 2020 goal and actual progress

Greenhouse Gas Emissions Reduction

Clean Cities' petroleum use reduction leads to a substantial reduction in GHG emissions, the pollutants responsible for global climate change. To estimate the GHG reductions resulting from Clean Cities activities, we used a variation of Argonne National Laboratory's Greenhouse Gas, Regulated Emissions, and Energy Use in Transportation (GREET) model. This model takes into account the fuel life cycle, or "well to wheels," GHG emissions for transportation fuels, which include fuel production, transport, and use in the vehicle. It does not take into account the emissions from indirect land use changes or vehicle manufacturing. Table 8 contains Clean Cities 2011 GHG emissions reductions by technology type. The table also indicates the number of passenger cars that would need to be removed from the road to achieve an equivalent reduction in GHG emissions.

Table 8. GHG Emissions Reduced by Clean Cities in 2011

Technology	Tons of GHG emissions averted	Equivalent cars removed*	Percent of coalition total
Alt Fuels & Vehicles	1,195,518	262,751	46%
VMT Reduction	425,410	93,497	16%
HEVs and PHEVs	410,314	90,179	16%
Idle Reduction	394,328	86,665	15%
FE Improvements	128,520	28,246	5%
Off-Road Vehicles	38,869	8,543	1%
Coalition Reported Total	2,592,958	569,881	100%
Outreach Events	1,788,905	393,166	na
ORNL Fuel Economy	1,264,571	277,928	na
AFDC	171,460	37,683	na
Grand Total	5,817,893	1,278,658	na

* Calculated as total passenger car GHG emissions (Table 2–15 in the EPA's Inventory of GHG Emissions and Sinks) divided by total short wheelbase LDVs (Table VM-1 in the Federal Highway Administration's Highway Statistics 2010)

Alternative fuels and vehicles were responsible for more GHG emissions reductions than any other coalition-reported activity. We calculated these reductions 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 the purposes of these calculations, gasoline is considered the baseline fuel for all LDVs, except in the case of biodiesel, for which conventional diesel fuel is used as the baseline. Gasoline is considered the baseline fuel for HDVs using E85, CNG, LNG, and LPG, because these vehicles are equipped with spark-ignition (gasoline-like) engines. For all other alternative fuel HDVs, we used conventional diesel fuel as the baseline. Figure 7 shows which fuels were used to achieve these reductions and how many AFVs were required for a given reduction. Notably, the GHG emissions reductions are not necessarily proportional to the petroleum displacement shown in Figure 6. This discrepancy occurs because the various alternative fuels emit different levels of life cycle GHGs. It is also worth noting that the outreach events and ORNL fuel economy activities have a disproportionately high reduction of GHGs relative to their petroleum displacement. This is because they are more heavily focused on idle reduction, fuel economy improvements, and VMT reduction than other coalition activities are. These three technologies eliminate 100% of the GHG emissions per gallon of petroleum saved, while alternative fuels reduce GHG emissions by a lesser amount per gallon of petroleum saved.

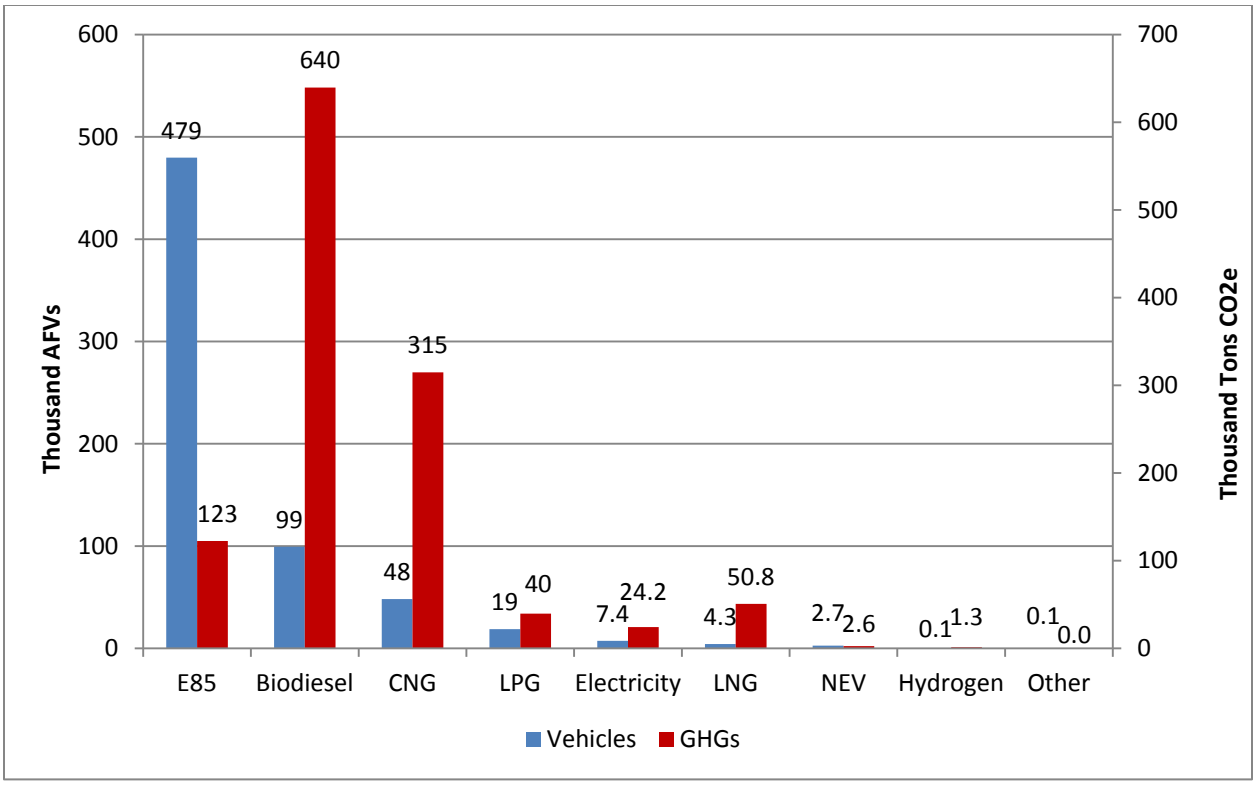

Figure 7. Number of AFVs and amount of GHG reduction by fuel type

Off-Road Vehicles

Alternative fuels are used in off-road applications as well as on-road applications. Table 9 shows the number of AFVs (or pieces of equipment) reported by coalitions in 2011. These categories are self-descriptive, with the exceptions of Construction Equipment, which includes cranes, earth movers, and similar equipment, and Recreation Equipment, which includes jet skis, snowmobiles, and all-terrain vehicles. The number of alternative fuel off-road vehicles increased 34% from 2010 to 2011, yet their overall petroleum displacement decreased 28%. This was likely because the number of vehicles declined in applications that use large quantities of fuel (e.g., construction, farm equipment, planes, and railroad) while the number of vehicles increased in applications that use smaller quantities of fuel (e.g., forklifts, landscaping equipment, and recreational equipment). Biodiesel use accounted for 53% of the AFVs included in this category. Other fuels used in off-road applications included electricity (27% of equipment) and LPG (18%). The other eight fuels and technologies together accounted for less than 2% of the total, and no E85 was used in off-road equipment in 2011.

Coordinators reported alternative fuel consumption in these vehicles, which the reporting website converted into petroleum savings. Overall savings from off-road vehicles totaled 5.8 MGGE. The most commonly reported fuel-application combinations included biodiesel construction equipment, biodiesel mining equipment, LPG forklifts, and electric forklifts. The various applications varied widely in the number of GGEs displaced per vehicle, as shown in Table 9.

Table 9. Number of Non-Road Vehicles or Equipment and Petroleum Saved

Application	Number of vehicles	GGEs saved	GGEs per vehicle
Other	4,334	461,557	106
Forklifts	4,008	1,186,592	296
Construction equipment	4,005	586,300	146
Mining equipment	1,825	2,733,497	1,498
Landscaping equipment	1,151	118,829	103
Recreational equipment	159	43,795	275
Farm equipment	87	163,993	1,885
Ships	26	472,112	18,158
Planes	20	3,252	163
Total	15,615	5,769,927	Average: 370

AFV Types and Markets

The online reporting tool asked coordinators to categorize their AFVs into key vehicle types and niche market fleets. Table 10 shows that the majority (56%) of AFVs are "unknown" or "other" vehicle types. Many of these were likely vehicles that didn't fit into any of the listed categories or vehicle estimates from E85 or biodiesel fueling stations in which multiple vehicle types were grouped together. Cars are the second-largest category comprising 20% of the AFVs. Light trucks/vans/SUVs were the third most numerous AFV (at 14% of total), and were also the category that decreased in size the most this year, likely because coordinators lumped them into the "other" category more than previous years. Delivery trucks accounted for 4% of the vehicles, and none of the remaining categories surpassed 3% of the vehicle population. Please note that we do not currently track vehicle type or market for HEVs.

Table 10. Number and Type of AFVs by Fuel Type

Vehicle Type	E85	Biodsl	CNG	LPG	Elec	LNG	NEV	H2	Other	Total
Unknown/ Other	290,508	55,600	7,193	10,501	1,968	512	1,693	10	4	367,989
Car	108,993	1,097	13,712	674	4,550	0	936	10	52	130,024
Pickup/SUV/ Van	73,497	5,746	9,200	3,807	204	0	17	58	0	92,529
Truck: No Trailer	62	20,049	5,080	1,508	82	139	0	0	0	26,920
Bus: Transit	0	3,311	8,535	260	553	963	0	25	0	13,647
Bus: School	0	6,709	1,249	1,211	2	770	0	0	0	9,941
Truck: Refuse	1	6,119	1,590	25	23	1,086	0	0	0	8,844
Patrol Car	6,644	1	54	481	31	0	2	0	0	7,213
Bus: Shuttle	1	132	1,423	183	4	0	0	15	0	1,758
Truck: Semi-trailer	0	583	121	135	0	845	0	0	0	1,684
Motorcycle	0	0	0	8	24	0	24	0	0	56
TOTAL	479,706	99,347	48,157	18,793	7,441	4,315	2,672	118	56	660,605

In addition asking coordinators to report vehicle types, we also asked them to provide information about vehicle ownership and the markets served by reported vehicles. As shown in Figure 8, two-thirds of the reported vehicles were owned by the general public or an unknown entity. Many of these vehicles were reported through fuel retailers. The next two largest ownership groups of AFVs are local governments and state governments, at 12% and 11%, respectively. These three groups grew at a rate similar to the total number of AFVs from 2010 to 2011, while vehicle numbers in corporate, airport, and taxi fleets grew approximately 50%, and vehicle numbers in utility, national park, and U.S. Postal Service fleets decreased in size between 20% and 74%.

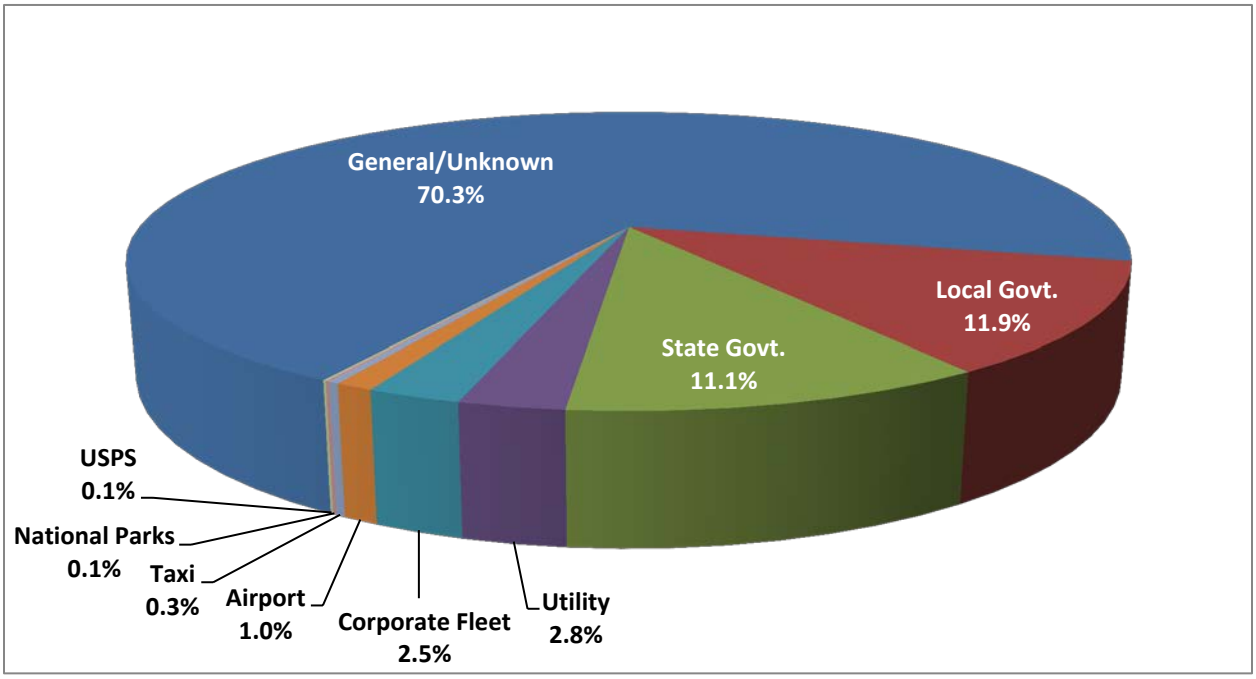

Figure 8. Percentage of total AFVs by market/owner

About the Coordinators

Coordinators reported spending a total of 2,657 hours per week on Clean Cities tasks, or more than 130,000 total hours over the course of the year. This translates to more than 66 full-time, experienced technical professionals working to reduce U.S. dependence on petroleum. For an individual coalition, the average amount of time spent coordinating Clean Cities business per week was 31 hours, and the median was 30. Both values stayed relatively consistent from 2010 to 2011.

The reporting website also gathered information on coordinator experience. On average, coordinators have been on the job for 5.6 years. Half the coordinators have had more than four years of experience as of 2011, and half have had four or fewer years of experience. Sixteen coordinators have been with Clean Cities for at least 10 years.

Project Funding

In 2011, 61 coalitions reported receiving 173 new project awards (project-specific grants) worth a total of $55 million. These coalitions also reported garnering $29 million in leveraged, or matching, funds, for a combined total of $83 million. This funding represents a 3:1 leveraging of the $26.8 million program budget in FY 2011. Of the 173 awards, the value of six each exceeded $1 million. Table 11 presents a breakdown of the number and value of awards reported by the coalitions.

Table 11. Breakdown of 2010 Project Awards by Number and Value

Size Category	Number	Share of total number	Total value	Share of grand total value
< $50,000	86	50%	$1,439,601	3%
$50,000–$99,999	18	10%	$1,215,616	2%
$100,000–$499,999	47	27%	$11,923,705	22%
$500,000–$999,999	16	9%	$9,835,088	18%
$1M–$15M	6	3%	$30,109,773	55%
Grand Total	173	100%	$54,523,783	100%

In addition to new 2011 awards, coordinators reported the portions of previous multi-year awards spent during the calendar year. If a coordinator failed to report the amount spent during 2011, we assumed it to be the total amount of the award divided by the number of years of award duration. Coalitions reported already spending 33% of the multi-year funds they were awarded in 2011, suggesting that projects started quickly. In 2011, coalitions helped utilize a total of $266 million in project funds that were awarded and matched from 2006 to 2011.

The American Recovery and Reinvestment Act (ARRA) was signed into law on Feb. 17, 2009, for the purpose of creating jobs in all areas of the country and spurring future economic development in key areas such as clean energy. Clean Cities proved to be a highly effective avenue through which to identify effective projects across the nation and quickly fund them. In 2009, more than $190 million of the award funding reported by Clean Cities coalitions came from ARRA, and that money attracted $176 million in leveraged funds. In 2010, 48 more ARRA awards were distributed through 33 coalitions. In 2011, the final nine awards came in with $4.3 million and leveraging an additional $2 million in matching funds. ARRA funds distributed during all three years are still being utilized, accounting for $35 million in Clean Cities project funding in 2011.

Of the $83 million in project awards and leveraged funds issued in 2011, $10 million (12%) was listed as coming from DOE independent of ARRA. DOE funds distributed in 2011 and previous years totaled $48 million of the $266 million (18%) utilized for projects in 2011. Funding from Clean Cities coalition support contracts was not included among the project awards, since those funds are intended to support coalition operations rather than specific projects.

About the Stakeholders

In 2011, 85 coalitions reported a total of nearly 13,000 stakeholders for an average of 152 stakeholders per coalition. These data indicate Clean Cities coalitions are continuing to grow: The average coalition grew 28% from 119 stakeholders in 2010.

Participation in Clean Cities is voluntary, and coalitions draw local stakeholders from the public and private sectors. Stakeholders include local, state, and federal government agencies, large and small businesses, auto manufacturers, car dealers, fuel suppliers, public utilities, and professional associations. Coalitions reported that 48% of the total stakeholders were from the private sector. This composition represents a slight shift (2%) from private to public stakeholders in 2011.

Data Sources and Quality

Gathering data is always challenging for the coordinators, because they rely on voluntary reporting from their stakeholders. Therefore, the annual report website contains some questions relating to coordinator sources and data quality. In these questions, coordinators were asked to rate the quality of their data as excellent, good, fair, or poor. The "cumulative" bar in Figure 9 presents the response breakdown for the 85 coordinators who answered the question. Twenty-six percent of the respondents classified their data as excellent, 67% as good, and 7% as fair. For the first time, no coalition rated their data as poor. Relative to 2010, the poor category decreased 2 percentage points, the fair category stayed the same, the good category decreased by 4 percentage points, and the percentage of coordinators that felt their data was excellent increased 6 points.

We also asked coordinators how they obtained their data. They could choose one or more of the following: written (paper or electronic) questions to stakeholders, phone interviews with stakeholders, coalition records, or coalition estimates. Written questions were the most used method of data gathering, accounting for 32%. The next most used method was phone interviews (29%), then coalition records (24%), and finally estimates (15%). When compared to 2010, this breakdown represents a slight shift from estimates toward coalition records and phone interviews. Figure 9 shows that estimates resulted in slightly lower levels of reliability than the other three collection methods. This is likely due to coordinators' confidence in numbers that come from stakeholder fleets as opposed to the numbers they track or estimate themselves. The quality of the data collected via the other three methods was rated very similarly, from one method to the next.

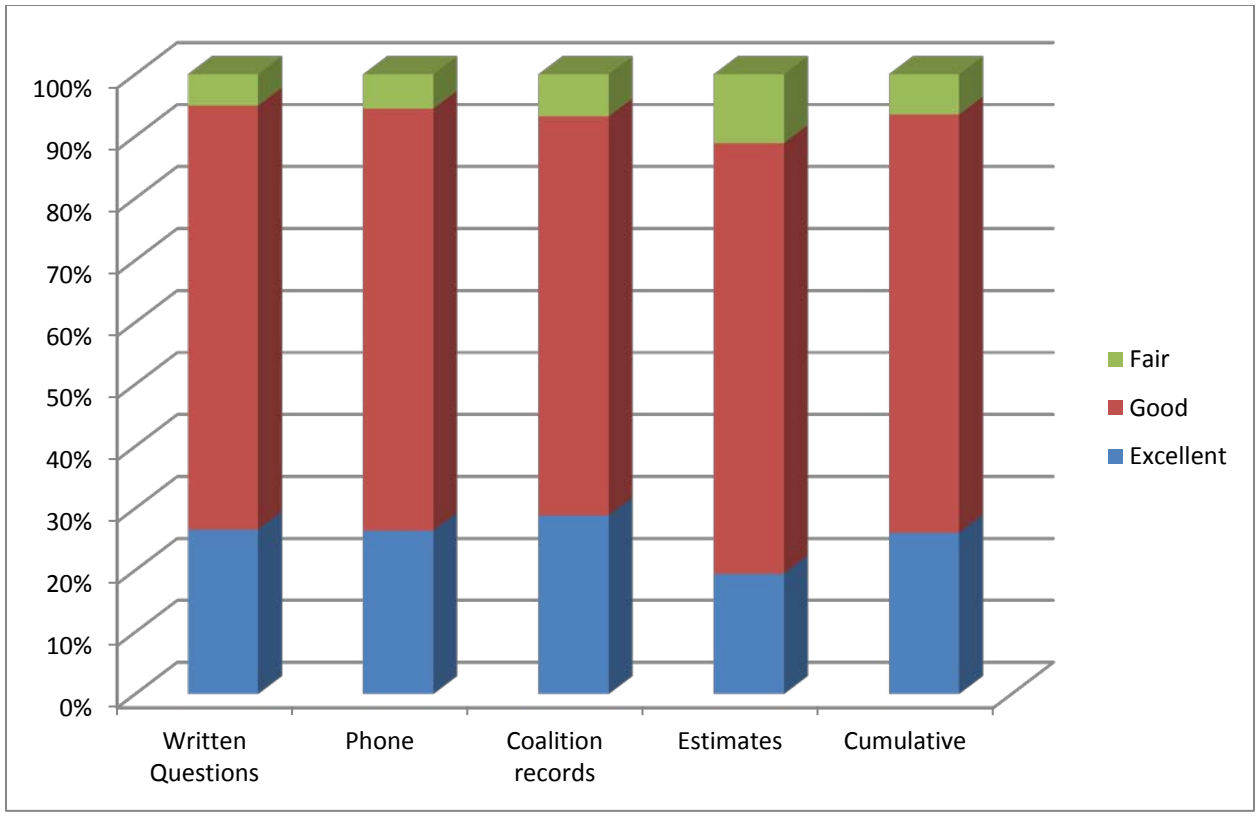

Figure 9. Data quality responses by data source

Conclusion

The Clean Cities 2011 Annual Metrics Report helps quantify the impact of the program as a whole and of the activities of individual coalitions. It shows that the Clean Cities program had a very successful year on all accounts. It outpaced its petroleum-saving goal by improving that metric 25% this year. It increased the number and diversity of AFVs and advanced vehicles on U.S. roads. The program also substantially increased its greenhouse gas savings, people reached through outreach events, stakeholder involvement, and reported data quality. The combined efforts of DOE, its national laboratories, and local Clean Cities coalitions bring together otherwise disparate groups and funding sources to accelerate the nation's progress toward petroleum savings, and thereby, toward improved energy independence, economic security, and environmental protection.

Appendix A: Clean Cities Coalitions that Completed 2011 Annual Reports

State	Coalition
AL	Alabama Clean Fuels Coalition
AR	Arkansas Clean Cities
AZ	Tucson Clean Cities
AZ	Valley of the Sun Clean Cities (Phoenix)
CA	Antelope Valley Clean Cities
CA	Central Coast Clean Cities
CA	Coachella Valley Region Clean Cities
CA	East Bay Clean Cities (Oakland)
CA	Long Beach Clean Cities
CA	Los Angeles Clean Cities
CA	Sacramento Clean Cities
CA	San Diego Regional Clean Cities Coalition
CA	San Francisco Clean Cities
CA	San Joaquin Valley Clean Cities
CA	Silicon Valley Clean Cities (San Jose)
CA	Southern California Clean Cities
CA	Western Riverside County Clean Cities
CO	Denver Clean Cities
CO	Northern Colorado Clean Cities
CO	Southern Colorado Clean Cities
CT	Capitol Clean Cities of Connecticut
CT	Connecticut Southwestern Area Clean Cities
CT	New Haven Clean Cities
CT	Norwich Clean Cities
DC	Greater Washington Region Clean Cities
DE	State of Delaware Clean Cities
FL	Central Florida Clean Cities Coalition
FL	Florida Gold Coast Clean Cities (Miami-Dade/Broward/Palm Beach/Monroe)
GA	Clean Cities-Atlanta
GA	Middle Georgia Clean Cities
HI	Honolulu Clean Cities
IA	Iowa Clean Cities Coalition
ID	Treasure Valley Clean Cities
IL	Chicago Area Clean Cities Coalition
IN	Greater Indiana Clean Cities
IN	South Shore Clean Cities
KS	Kansas City Regional Clean Cities

State	Coalition
KY	Kentucky Clean Cities Partnership
LA	Greater Baton Rouge Clean Cities
LA	Southeast Louisiana Clean Fuels Partnership
MA	Massachusetts Clean Cities
MD	State of Maryland Clean Cities
ME	Maine Clean Communities
MI	Ann Arbor Clean Cities
MI	Detroit Clean Cities
MI	Greater Lansing Clean Cities
MN	Twin Cities Clean Cities
MO	St. Louis Clean Cities
NC	Centralina Clean Fuels Coalition
NC	Land of Sky Clean Vehicles Coalition
NC	Triangle Clean Cities (Raleigh, Durham, Chapel Hill)
ND	North Dakota Clean Cities
NH	Granite State Clean Cities
NJ	New Jersey Clean Cities
NM	Land of Enchantment Clean Cities (New Mexico)
NV	Eastern Sierra Regional Clean Cities
NY	Capital District Clean Communities (Albany)
NY	Central New York Clean Cities (Syracuse)
NY	Clean Communities of Western New York (Buffalo)
NY	Genesee Region Clean Communities (Rochester)
NY	Greater Long Island Clean Cities
NY	New York City and Lower Hudson Valley Clean Communities
OH	Clean Fuels Ohio
OH	Northeast Ohio Clean Transportation (Cleveland)
OK	Central Oklahoma Clean Cities (Oklahoma City)
OK	Tulsa Clean Cities
OR	Columbia-Willamette Clean Cities
OR	Rogue Valley Clean Cities
PA	Philadelphia Clean Cities
PA	Pittsburgh Clean Cities
RI	Ocean State Clean Cities
SC	Palmetto State Clean Cities
TN	East Tennessee Clean Fuels Coalition
TN	Middle Tennessee Clean Cities
TX	Alamo Area Clean Cities (San Antonio)
TX	Central Texas Clean Cities (Austin)
TX	Dallas-Fort Worth Clean Cities

State	Coalition
TX	Houston-Galveston Clean Cities
UT	Utah Clean Cities
VA	Virginia Clean Cities
VT	State of Vermont Clean Cities
WA	Western Washington Clean Cities (Seattle)
WI	Wisconsin Southeast Area Clean Cities
WV	State of West Virginia Clean Cities
WY	Yellowstone-Teton Clean Energy Coalition