EVS26
Los Angeles, California, May 6-9, 2012

Expanding the Availability of Public Charging

Andrew P. Hudgins[1], Witt Sparks[1]
[1]*National Renewable Energy Laboratory, 1617 Cole Blvd. Golden, CO 80401, andrew.hudgins@nrel.gov*

Abstract

Plug-in electric vehicles (PEVs) have exploded into the public consciousness during the past 18 months. As manufacturers roll out the first mass-produced, widely available PEVs, other industry stakeholders are working to create the public charging infrastructure that will provide PEV drivers with the peace of mind to use their vehicles to the fullest potential. Electric vehicle supply equipment (EVSE) manufacturers, vehicle manufacturers, utilities, Clean Cities coalitions, and government officials are working together to reinvent today's vast network of fueling stations by using an energy source that is domestically produced, cleaner, and in abundant supply.

Until EVSE becomes as ubiquitous as conventional fueling stations, it is important to provide drivers with an easy way to locate stations. Automakers recognize this fact and are including EVSE locations in their in-vehicle navigation systems. Today, there are nearly 20 EVSE manufacturers and several different data networks linking EVSE stations together. A comprehensive database is required in order to provide the driver with a seamless experience and the ability to locate any available station without worrying about network divisions.

The Alternative Fuels and Advanced Vehicles Data Center (AFDC), sponsored by the U.S. Department of Energy's Clean Cities program, hosts a publicly accessible online database of alternative fueling stations, and has been available for over 20 years. The database includes all EPAct defined alternative fuels, but the focus during 2010 and 2011 was to establish relationships with PEV and EVSE stakeholders to develop robust and accurate charging station information.

To support EVSE data quality and collection efforts, the National Renewable Energy Laboratory (NREL) established the GeoEVSE Forum. Members of the GeoEVSE Forum include original equipment manufacturers (OEM), EVSE manufacturers, EVSE installers and distributers, utilities and data providers. The members of the GeoEVSE Forum are instrumental in keeping the AFDC database up to date and accurate.

1 Introduction

Plug-in electric vehicles (PEVs) have vaulted into the public consciousness and onto U.S. roadways at unprecedented levels during the past 18 months. As manufacturers roll out the first mass-produced, widely available PEVs, other industry stakeholders are working to create the public charging infrastructure that will provide PEV drivers with the peace of mind to use their vehicles to the fullest potential. Electric vehicle supply equipment (EVSE) manufacturers, vehicle manufacturers, utilities, Clean Cities coalitions, and government officials are working together to re-imagine vehicle fueling by looking beyond today's vast network of gasoline stations to an energy source that is domestically produced, cleaner, and in abundant supply.

To date, much progress has been made, with a five-fold increase in the number of installed EVSE units between June 2010 and July 2011 (Fig. 1). Nevertheless, challenges remain. For comparison, there are more than 160,000 gasoline filling stations in the United States [1] and 6,300 publicly available EVSE units, as of March 2012 [2]. And even though most charging will take place at home, availability of public charging stations gives drivers the confidence to utilize their vehicles' full ranges.

Until EVSE becomes as ubiquitous as conventional fueling stations, it is important to provide PEV drivers with an easy way to locate charging equipment. Automakers recognize this, and their in-vehicle navigation systems assist drivers in identifying charging locations. Today, there are nearly 20 EVSE manufacturers and several different data networks, making communication across networks difficult.

A comprehensive database, spanning all manufacturers, networks, and types of equipment, is necessary in order to seamlessly provide the driver with the maximum number of charging options, and therefore the greatest convenience, efficiency, and flexibility. The Alternative Fuels and Advanced Vehicles Data Center (AFDC), managed by the National Renewable Energy Laboratory (NREL) for the U.S. Department of Energy's Clean Cities initiative, houses just such an EVSE database.

2 Alternative Fuels and Advanced Vehicles Data Center

The AFDC is a comprehensive clearinghouse of information related to advanced transportation technologies. Provided by the U.S. Department of Energy's Clean Cities initiative and managed by NREL, the AFDC offers transportation decision-makers a collection of unbiased alternative fuel

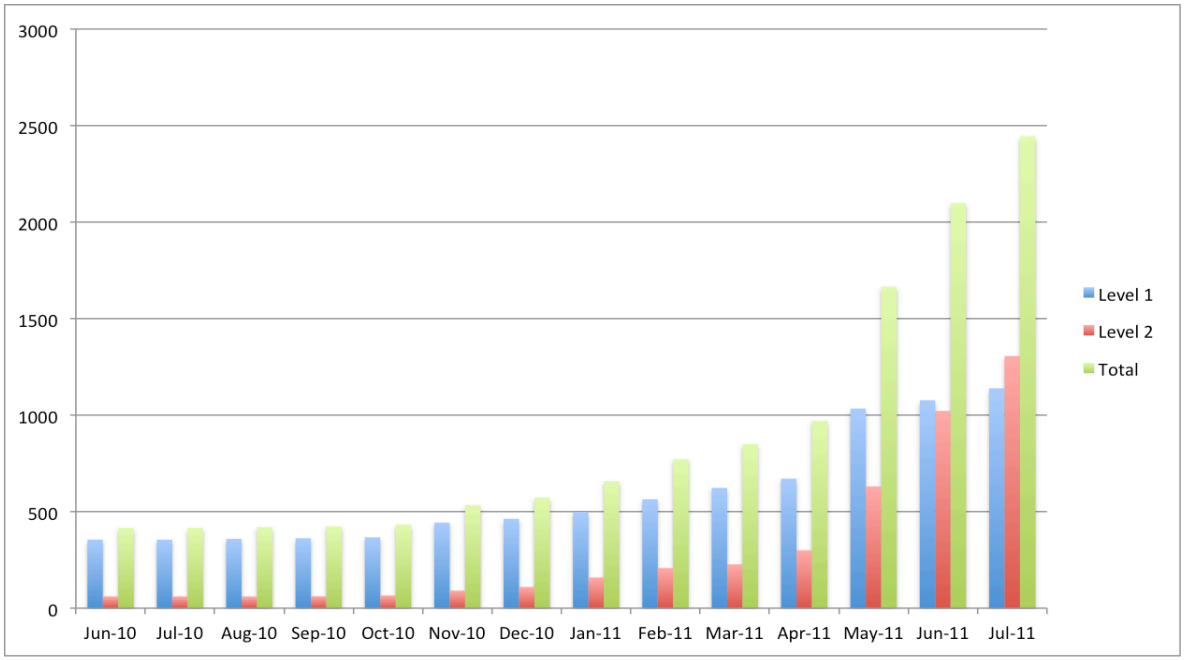

Figure 1: Number of installed, publicly available EVSE units in the United States from June 2010 to July 2011. EVSE units are counted once for each outlet available, even when multiple outlets are available at a single site.

information, publications, data, and tools. These resources help AFDC visitors understand the benefits, challenges, and opportunities involved in reducing petroleum consumption through the use of alternative and renewable fuels, advanced vehicles and other energy efficiency measures. Clean Cities stakeholders, private fleets, and federal, state, and local fleets covered under the Energy Policy Act of 1992 and subsequent federal regulations and mandates, share this goal and regularly use the information offered in the AFDC. All data, information, and tools featured on the AFDC are freely available to the general public as well.

Among the AFDC's datasets is a list of locations of alternative fueling stations throughout the United States. The database contains geographical location information for public fueling stations that provide natural gas, propane, E85 (85% ethanol, 15% gasoline), biodiesel, hydrogen, and EVSE. This data is presented in several formats on the AFDC, including through its Alternative Fueling Station Locator tool, which maps station locations in user-specified geographic areas.

With proximity to research and development activities in the laboratory community, and regular interactions with vehicle and technology manufacturers and fuel producers, NREL is uniquely positioned to develop and maintain technical data and information that characterize industry progress and support the deployment of alternative fuels and advanced vehicles.

3 The GeoEVSE Forum

NREL and the U.S. Department of Energy's Clean Cities program have teamed up with more than 200 other key players to make sure drivers of plug-in electric vehicles (PEVs) can easily find charging stations across the United States. These leaders in PEV deployment form the GeoEVSE Forum — a government-industry collaboration designed to ensure that the AFDC's database of stations keeps up with the expanding EV charging network.

The database provides an accurate, comprehensive source of locations for electric vehicle supply equipment (EVSE)—better known as charging stations—from all manufacturers and installers. Although most initial charging is expected to take place at drivers' homes, public charging stations extend the range of PEVs, providing opportunities to power up while on trips or running errands.

Consumers can quickly find nearby charging stations online through the AFDC's Alternative Fueling Station Locator using a computer or a smartphone. The database, which includes information on more than 4,000 publicly accessible EVSE locations, maps detailed directions, types and number of charging units, phone numbers, payment methods, URLs, and business hours.

NREL updates EVSE data on a bi-weekly basis, and station information is supplemented by GeoEVSE partners. Information is then made available free of charge to leading aggregators of data for vehicle systems, such as TomTom, Google, MapQuest, and Navteq. Eventually, navigation systems using this data are installed by GeoEVSE automotive partners, including Chrysler, Fisker Automotive, Ford, Toyota, Tesla, Nissan, and General Motors.

Computer programmers can subscribe to NREL's Developer Network website (www.developer.nrel.gov) and receive automated EVSE data feeds for use in their own mobile and Web applications. This provides developers with comprehensive, validated and current EVSE data, while expanding the reach and impact of the Forum partnership.

As EVSE networks grow and drivers become more comfortable using PEVs for long-distance trips, the AFDC Station Locator and the Forum's efforts to provide accurate navigation coordinates will play a vital role in getting drivers to their destinations and support PEV deployment activities across the United States.

4 EVSE Counts

The total number of alternative fueling stations (across all alternative fuels) in the AFDC database continues to grow. The increase in the total number of stations during 2011 resulted primarily from new EVSE locations added to the database. Figure 2 illustrates the total number of stations in the database, including existing and planned stations, between January 2009 and December 2011.

The overall increase in the number of stations in the database can be attributed to the growth of the

alternative fuels industry, as well as enhanced collaboration and coordination with industry to collect and verify station data.

5 Conclusion

NREL's continued data collection efforts and enhanced collaboration with PEV-deployment stakeholders has yielded considerable success in the establishment of a centralized, comprehensive, accurate repository of EVSE location data: The number of EVSE locations in the AFDC's station database has quintupled during the past year.

The GeoEVSE partnership will help ensure new EVSE locations are added to the system, providing one go-to source for location data and ultimately encouraging wider PEV adoption and deployment.

This robust dataset better enables drivers to pinpoint charging stations, thereby alleviating range anxiety. Access to comprehensive information on public charging stations can extend the range of PEV trips, spurring greater use of PEVs already on the road and encouraging wider adoption and deployment.

References

[1] National Association of Convenience Stores. *2011 annual fuels report*, nacsonline.com/gasprices

[2] *Alternative Fueling Station Total Counts By State and Fuel Type*, afdc.energy.gov/afdc/fuels/stations_counts.html, accessed on 2012-03-18.

Author

Andrew P. Hudgins is a Project Leader at the National Renewable Energy Laboratory where he supports the Department of Energy's Clean Cities, Federal Fleets, and EPAct programs. Mr. Hudgins received his MAS in Environmental Policy from the University of Denver in 2007 and a BA in Environmental Science from Capital University in 1998.

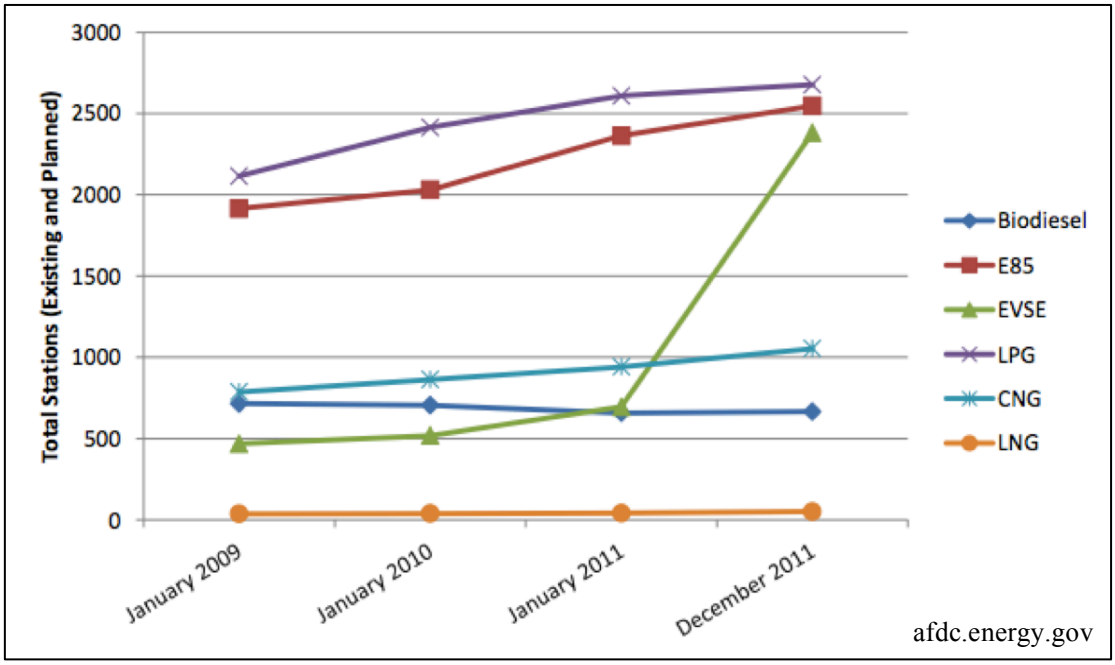

Figure 2: Total Stations by Fuel Type (2009-2011)