

Fuel Cell Electric Vehicle Performance Composite Data Products: Spring 2018

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May 2018

Analysis Categories



CDP-FCEV-175: Summary of Key FCEV Metrics

Summary of Key FCEV Metrics

	Vehicle Performance Metrics	DOE Target (Year 2020) ^a	LD3 ^b	LD2+ ^c	LD2 ^c	LD1 ^c
Durability	Max Fuel Cell Durability Projections (hours)	5,000	4,130	--	2,521	1,807
	Average Fuel Cell Durability Projection (hours)		2,442	1,748	1,062	821
	Max Fuel Cell Operation (hours)		5,648	1,582	1,261	2,375
Efficiency	Adjusted Dyno (Window Sticker) Range (miles)		200 - 320	--	196 - 254	103 - 190
	Median On-Road Distance Between Fuelings (miles)		124	98	81	56
	Fuel Economy (Window Sticker) (mi/kg)		53 (median)	--	43 - 58	42 - 57
	Fuel Cell System Efficiency at 1/4 Power	65	57% (average)	--	53% - 59%	51% - 58%
	Fuel Cell System Efficiency at Full Power		43% (average)	--	42% - 53%	30% - 54%
Specs	Specific Power (W/kg)	650	240 - 563		306 - 406	183 - 323
	Power Density (W/L)	650	278 - 619		300 - 400	300 - 400
Storage	System Gravimetric Capacity (kg H2/kg system)	5.5%	2.5% - 3.7%		2.5% - 4.4%	
	System Volumetric Capacity (kg H2/L system)	0.04	0.018 - 0.054		0.018 - 0.025	

a. Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan
(<https://energy.gov/eere/fuelcells/downloads/fuel-cell-technologies-office-multi-year-research-development-and-22>)

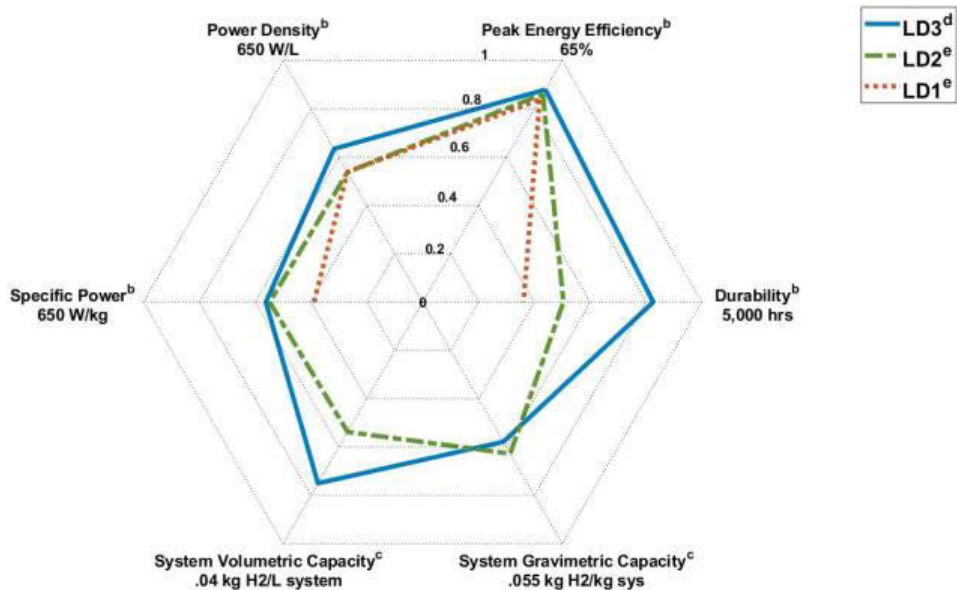
b. Current results are available at http://www.nrel.gov/hydrogen/proj_fc_vehicle_evaluation.html (Updated 5/2017)

c. National Fuel Cell Vehicle Learning Demonstration Final Report (<http://www.nrel.gov/hydrogen/pdfs/54860.pdf>)



CDP-FCEV-174: FCEV Summary of Key Metrics vs. DOE Targets

Summary of Key FCEV Metrics vs DOE Targets^a



a. Results are a fraction of the 2020 targets in the Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration (MYRDD) Plan (<https://energy.gov/eere/fuelcells/downloads/fuel-cell-technologies-office-multi-year-research-development-and-22>)

b. MYRDD Fuel Cell section 3.4 (last updated May 2017), table 3.4.3.

c. MYRDD Hydrogen Storage section 3.3 (last updated May 2015), table 3.3.3.

d. Current results are available at http://www.nrel.gov/hydrogen/proj_fc_vehicle_evaluation.html (Updated 4/2018)

e. National Fuel Cell Vehicle Learning Demonstration Final Report (<http://www.nrel.gov/hydrogen/pdfs/54860.pdf>)



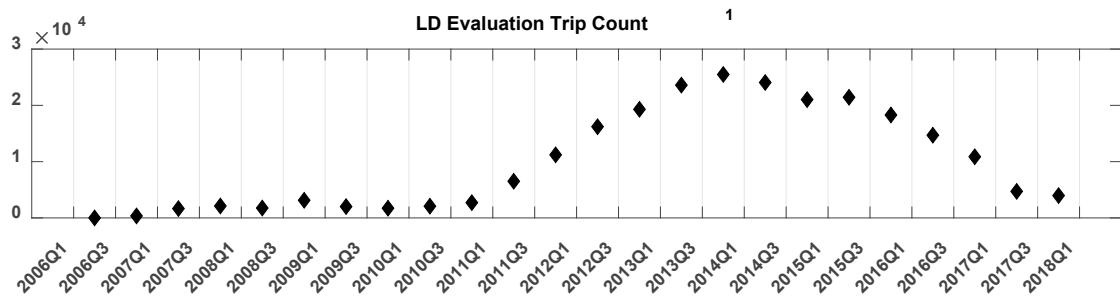
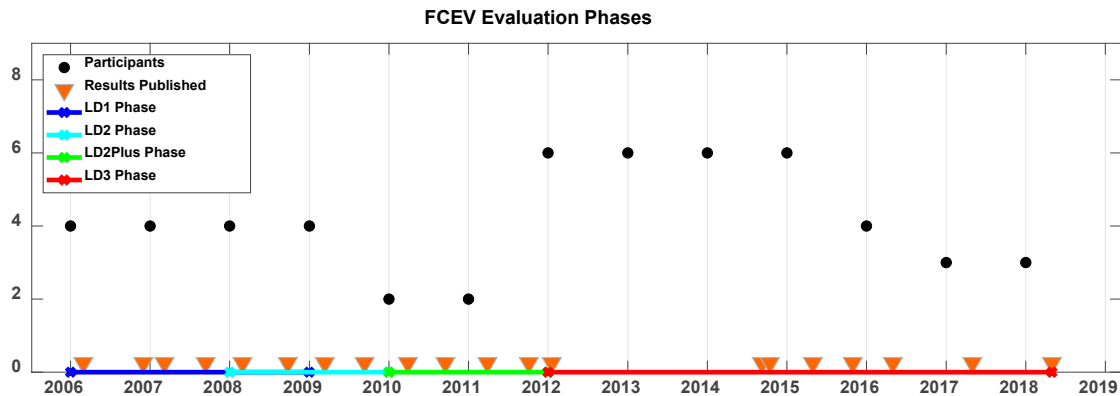
NREL cdp_fc_ev_174

Created: May-07-18 11:49 AM | Data Through: 2017Q4

Included Vehicles: Partial

Deployment

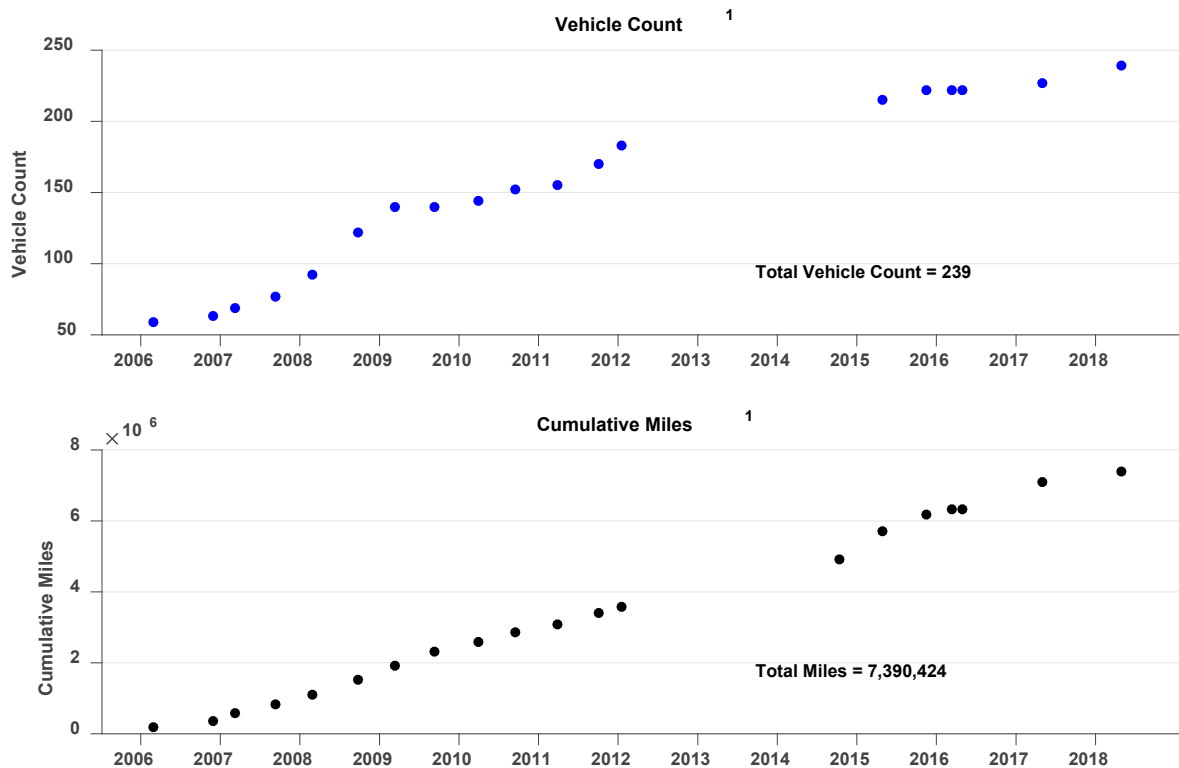
CDP-FCEV-33: FCEV Evaluation Phases, Participants, Publications, and Trip Count



1) Not all fleets in operation in 2015; chart includes trips through December 2017.

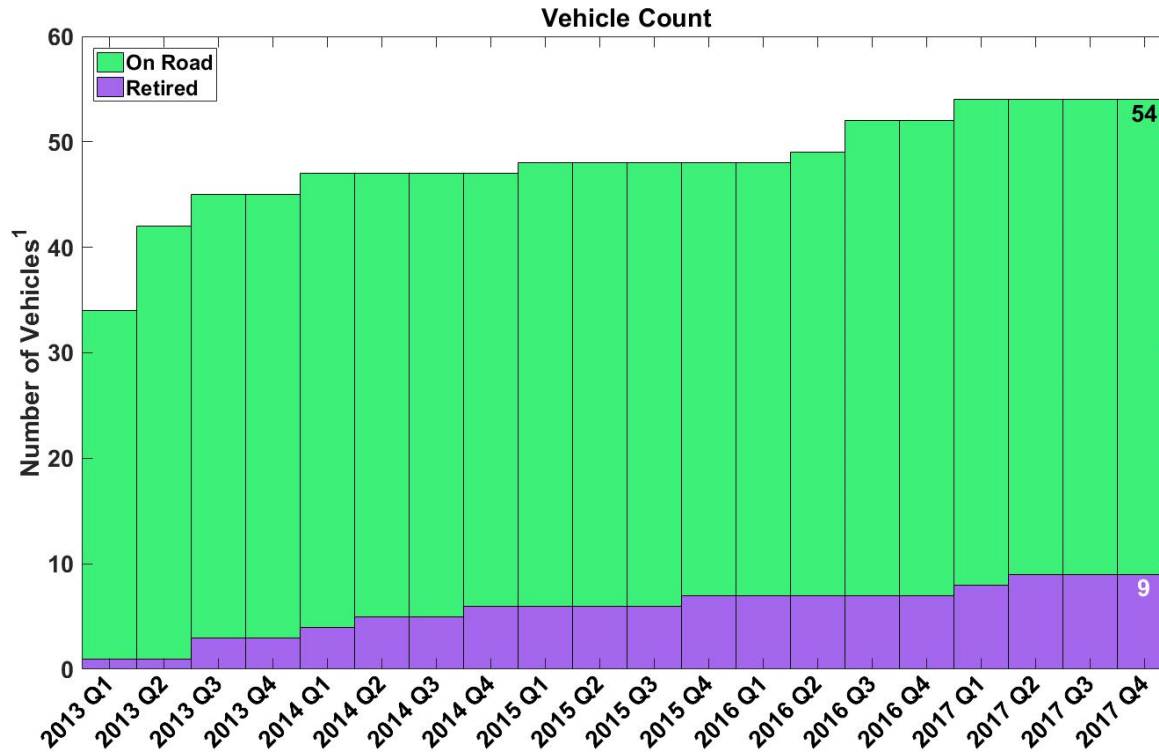
2) LD = Learning Demonstration Phase

CDP-FCEV-53: FCEV Count and Cumulative Miles



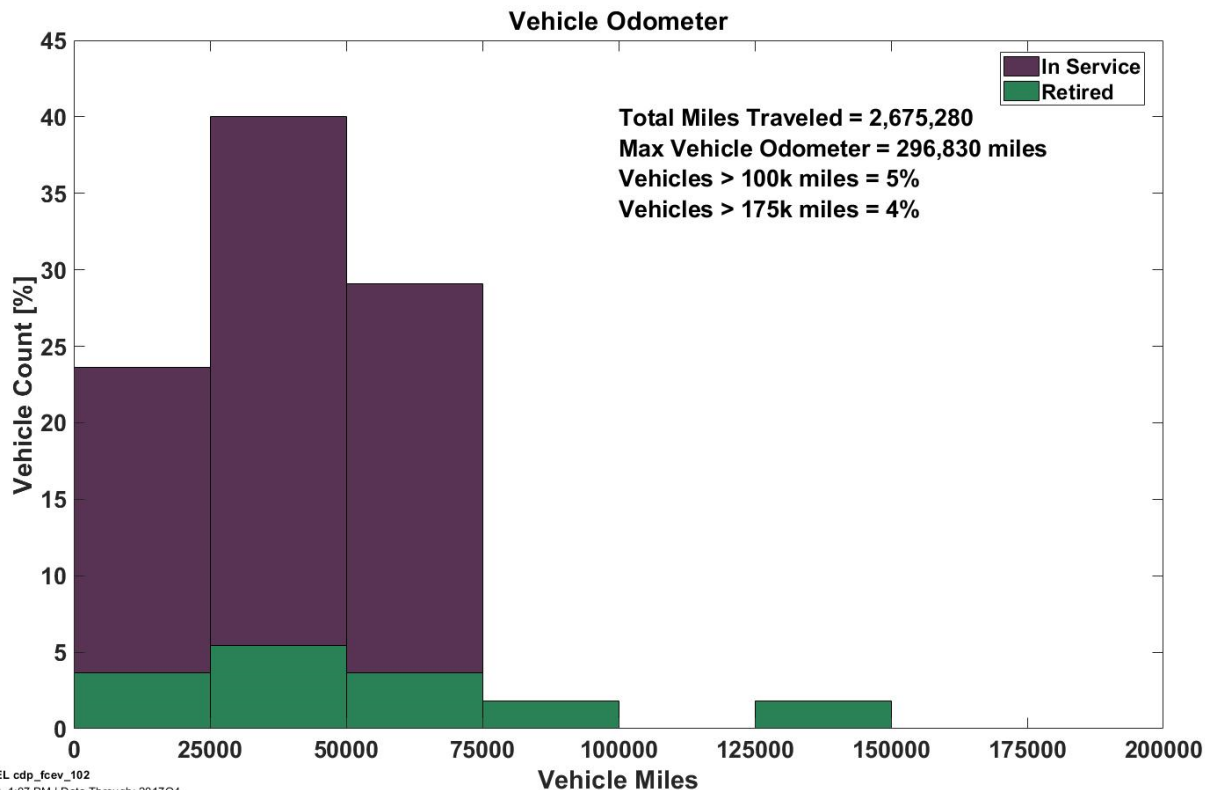
1. Vehicle count and total miles travelled calculated from the beginning of Learning Demo 1 (2006), not just current phase of projects seen in CDP-FCEV-101 and CDP-FCEV-102.

CDP-FCEV-101: Vehicle Count

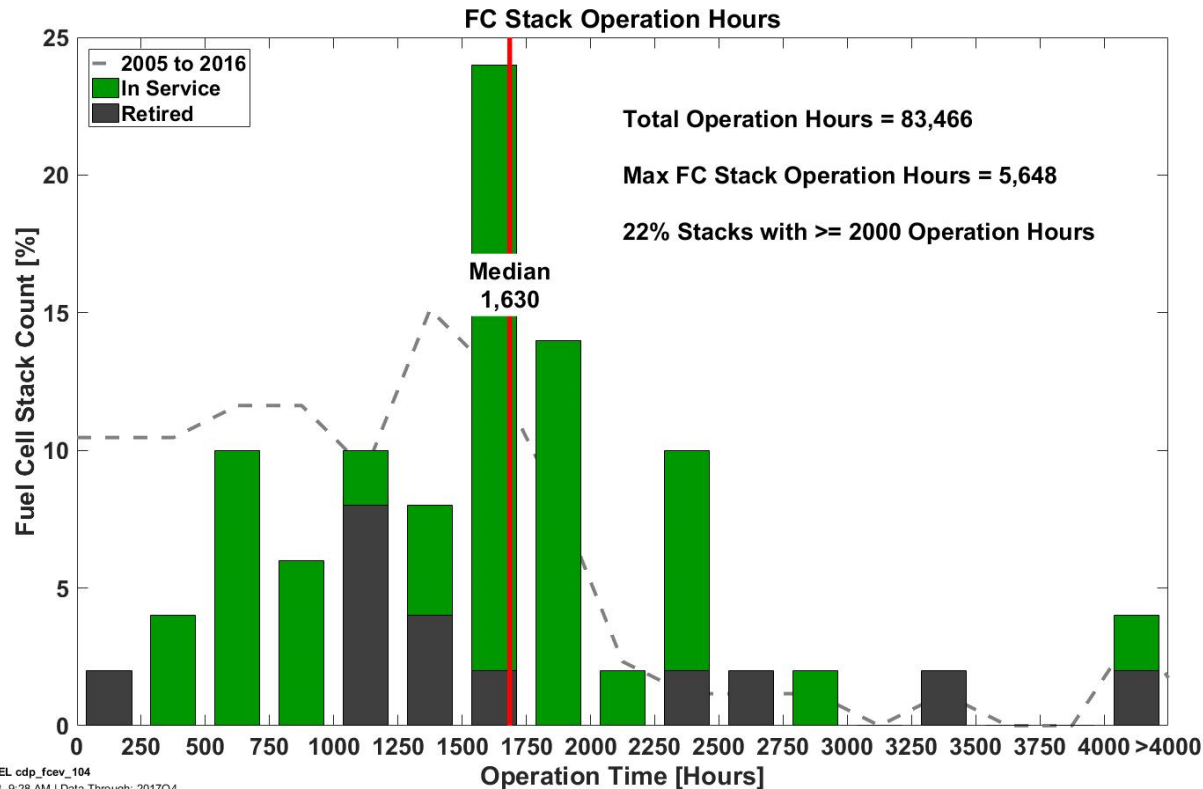


Driving Behavior

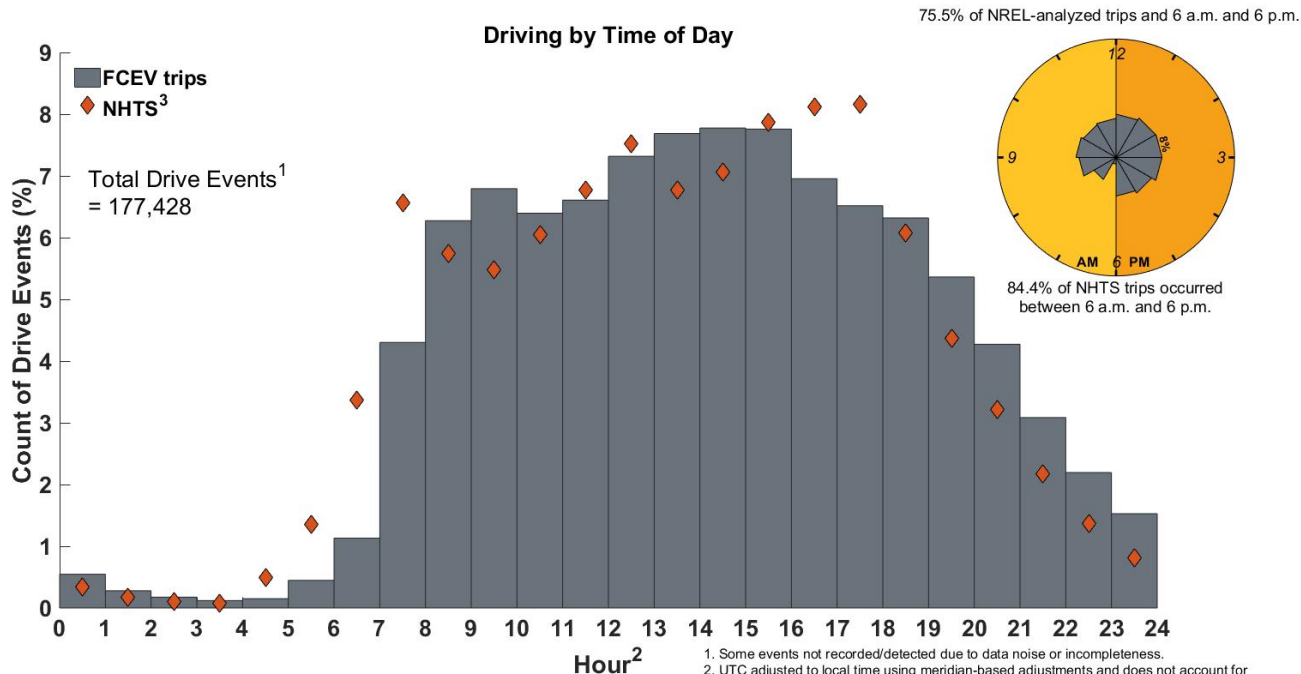
CDP-FCEV-102: Vehicle Miles



CDP-FCEV-104: Fuel Cell Stack Operation Hours

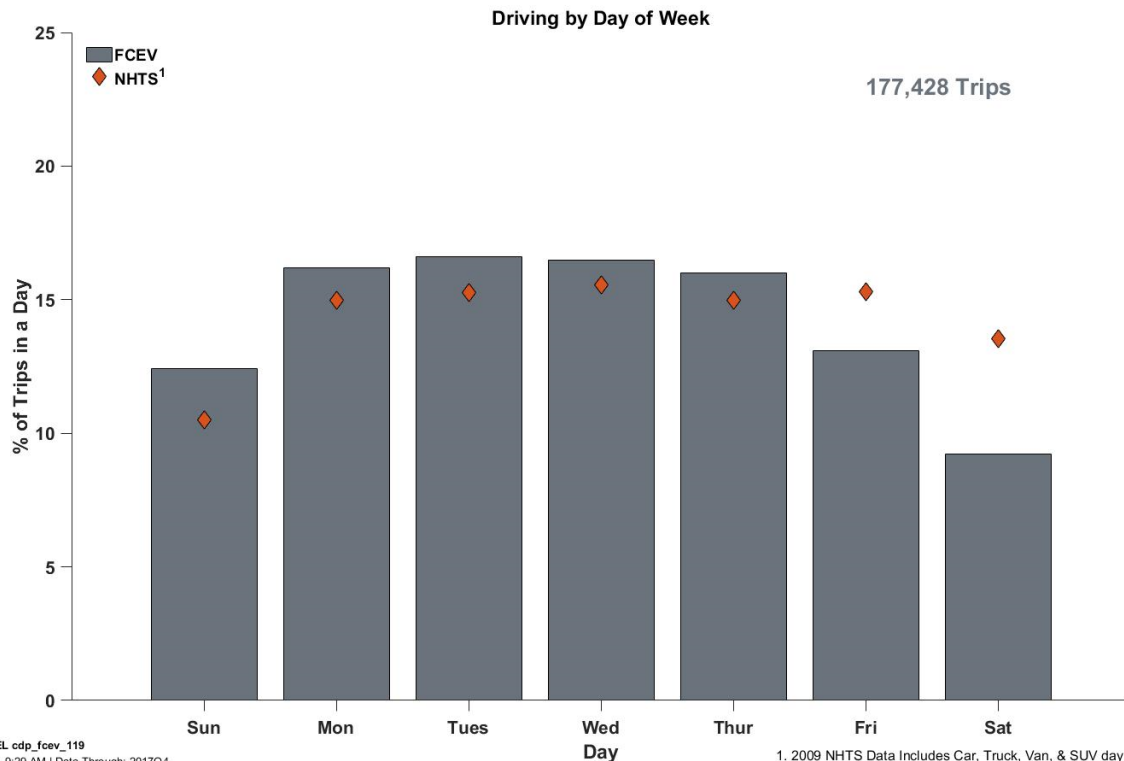



CDP-FCEV-118: Driving Start Time by Time of Day



1. Some events not recorded/detected due to data noise or incompleteness.
 2. UTC adjusted to local time using meridian-based adjustments and does not account for statutory deviations from the meridian-based system.
 3. 2009 NHTS Data Includes Car, Truck, Van, & SUV day trips
 ASCII.csv Source: <http://nhts.ornl.gov/download.shtml#2009>

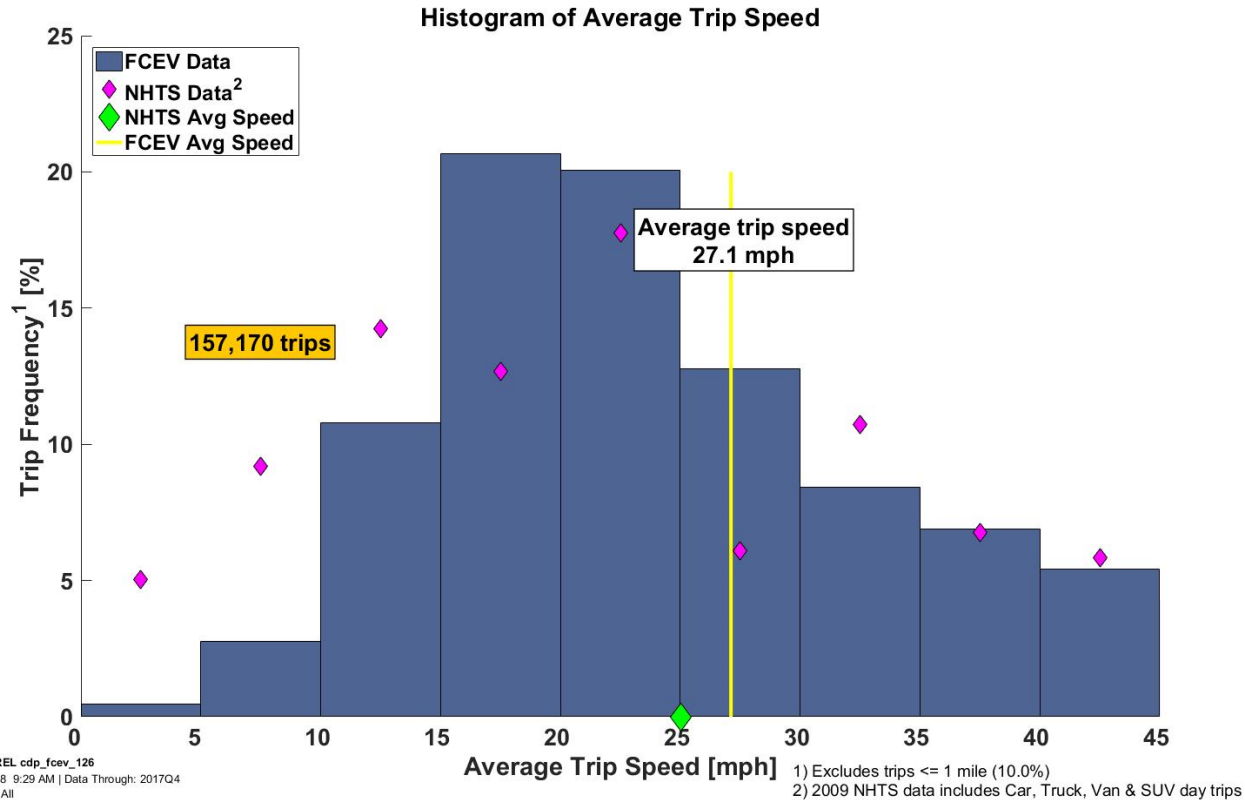
CDP-FCEV-119: Driving by Day of Week



 NREL cdp_fcev_119
Created: May-07-18 9:29 AM | Data Through: 2017Q4
Included Vehicles: All

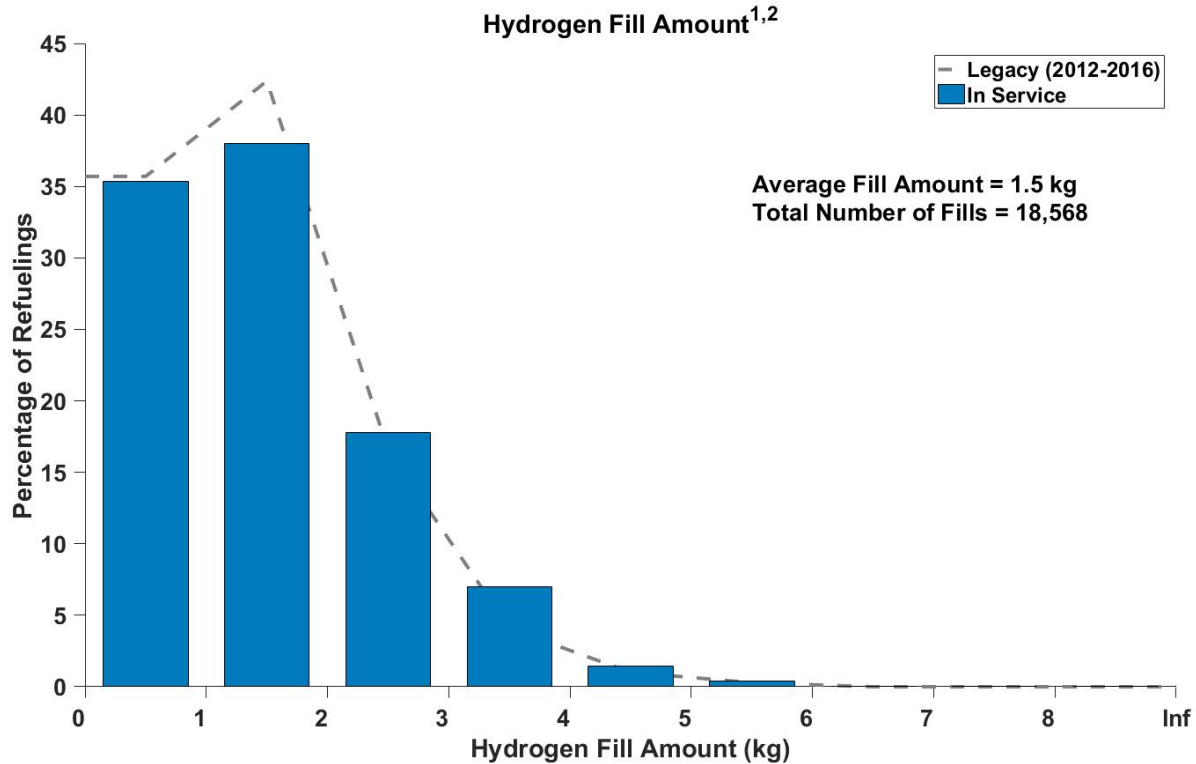
1. 2009 NHTS Data Includes Car, Truck, Van, & SUV day trips
ASCII.csv Source: <http://nhts.ornl.gov/download.shtml#2009>

CDP-FCEV-126: Average Trip Speed

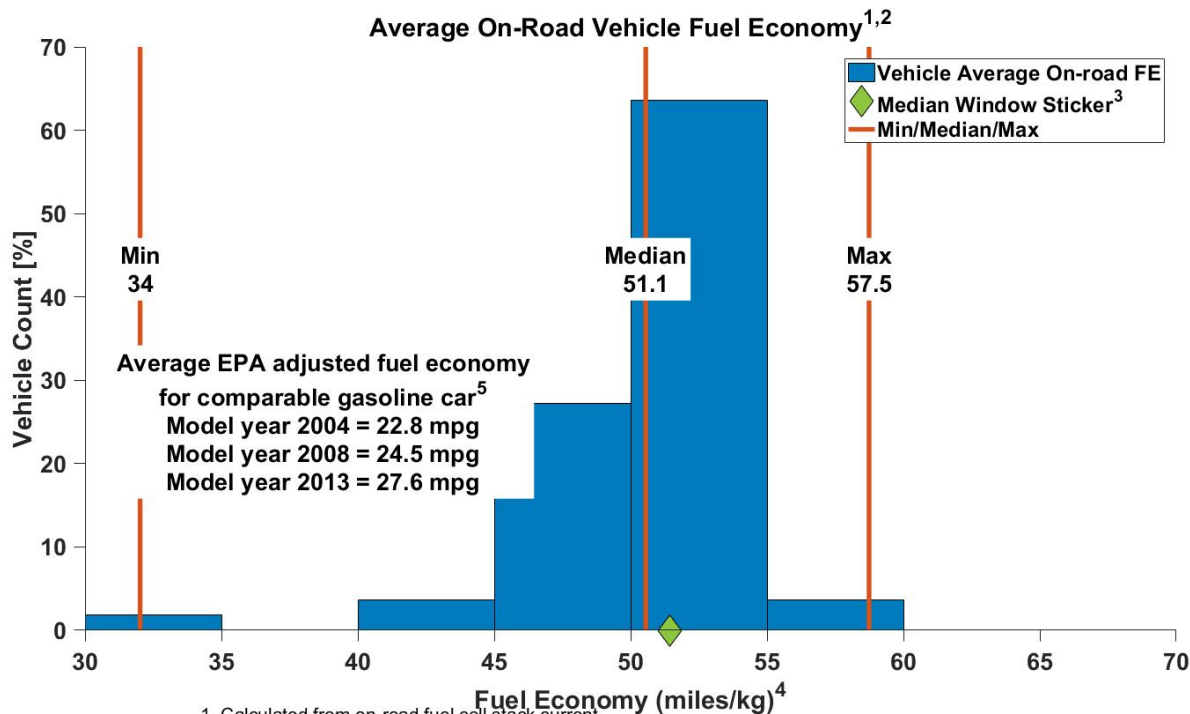


Fuel Economy

CDP-FCEV-108: Vehicle Fill Amounts

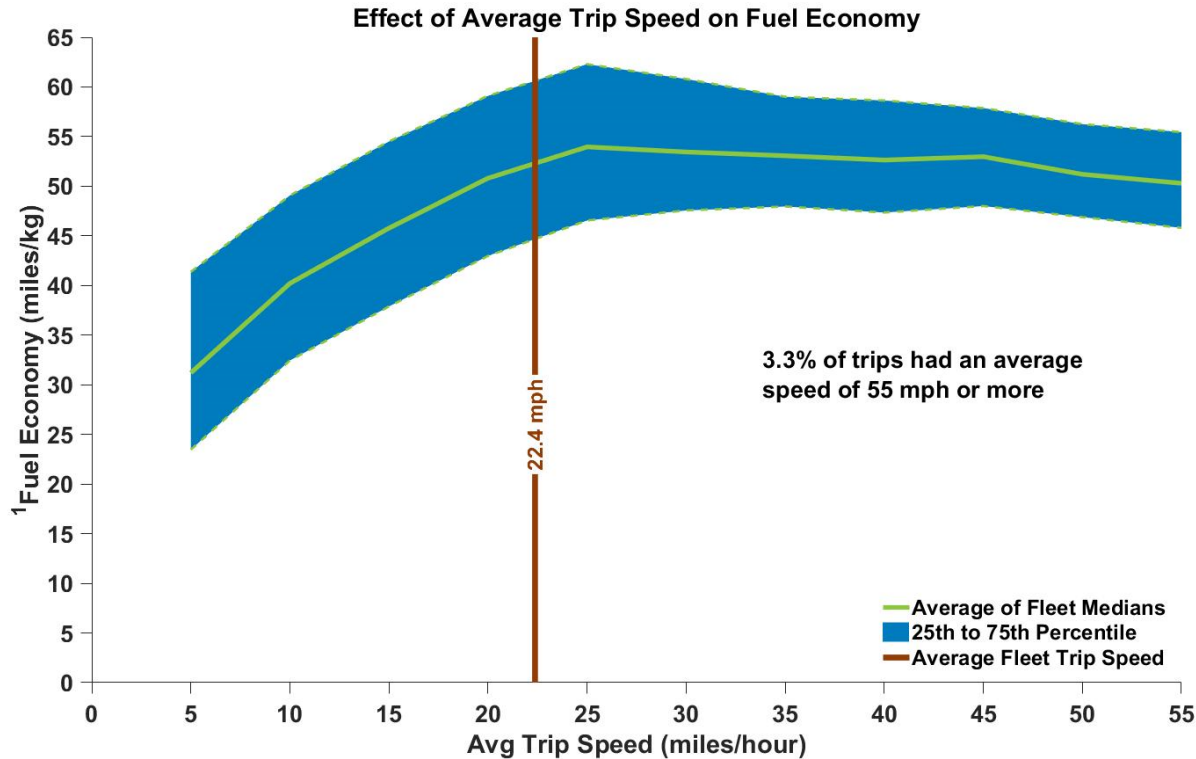


CDP-FCEV-114: Average Vehicle Fuel Economy

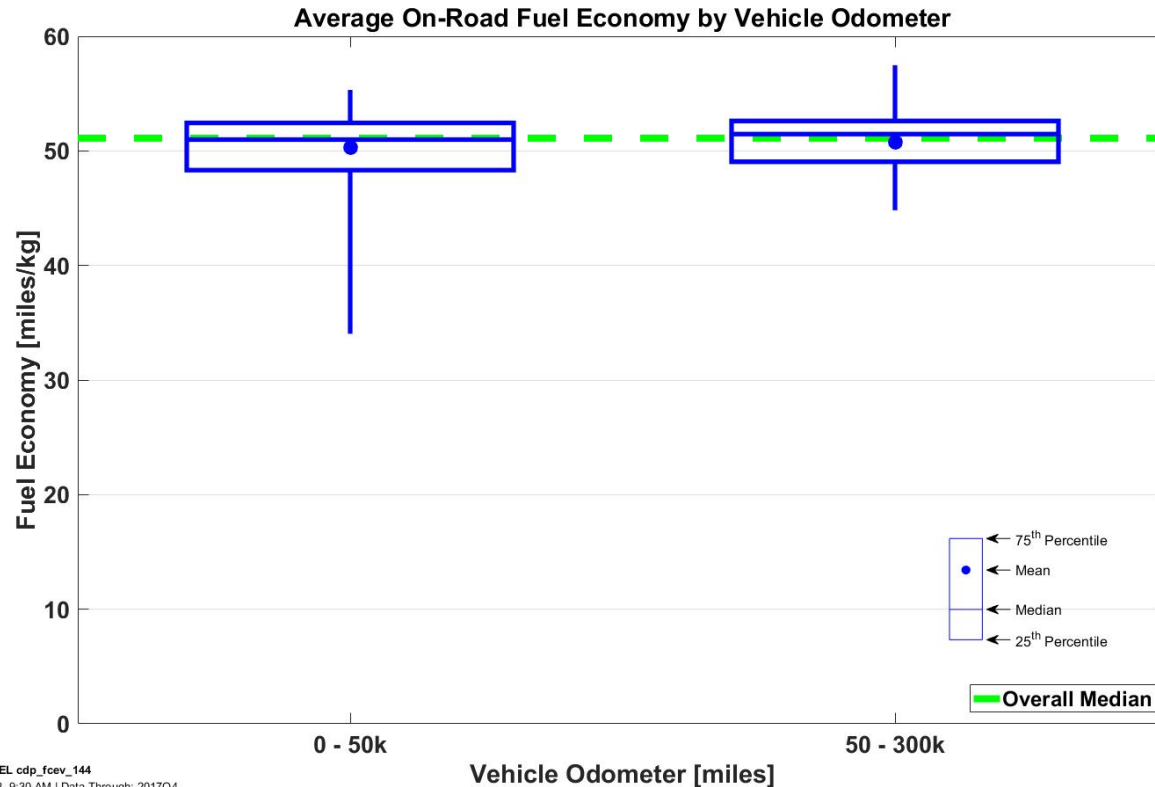


1. Calculated from on-road fuel cell stack current.
2. Excludes trips < 1 mile.
3. EPA Combined Rating.
4. 1 kg of hydrogen has the same energy content as 1 gallon (3.2 kg) of gasoline.
5. Source: EPA Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 - 2014.

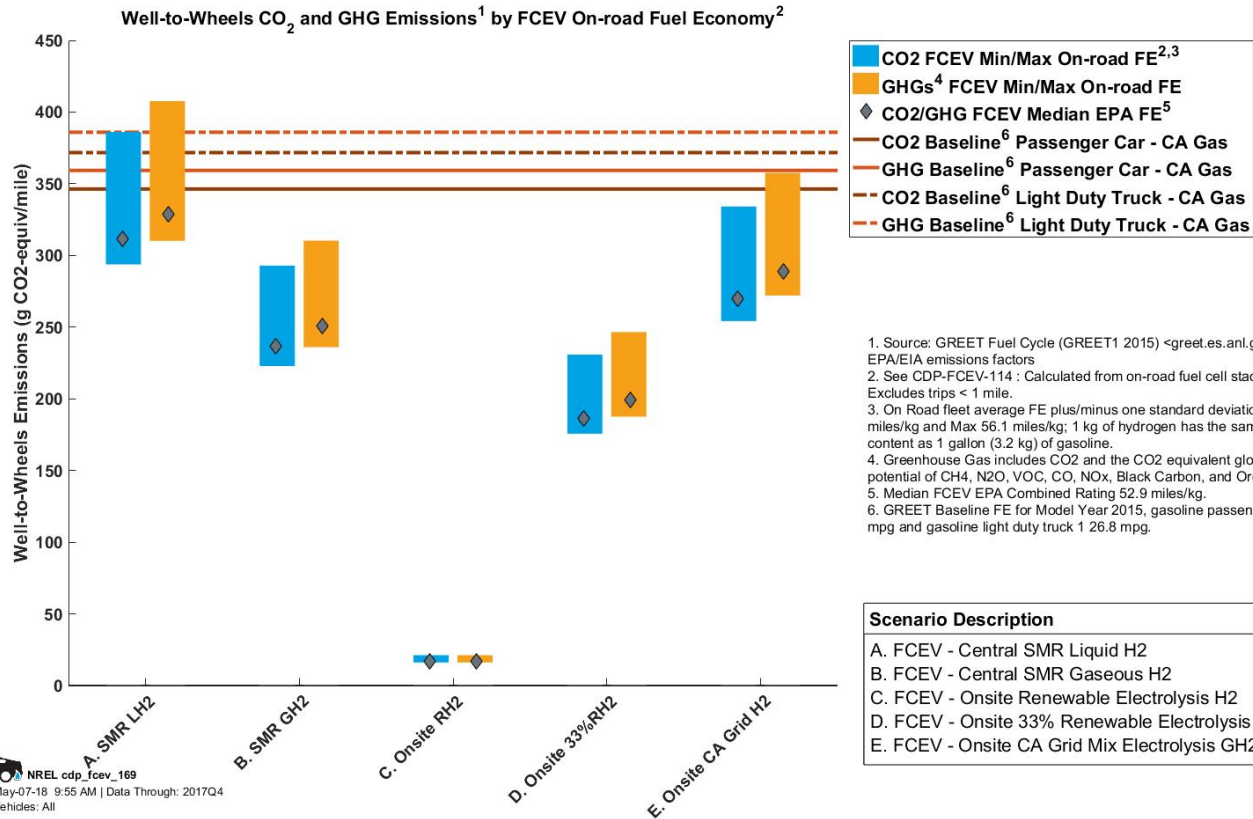
CDP-FCEV-141: Effect of Average Trip Speed on Fuel Economy



CDP-FCEV-144: Average On-Road Fuel Economy by Vehicle Odometer

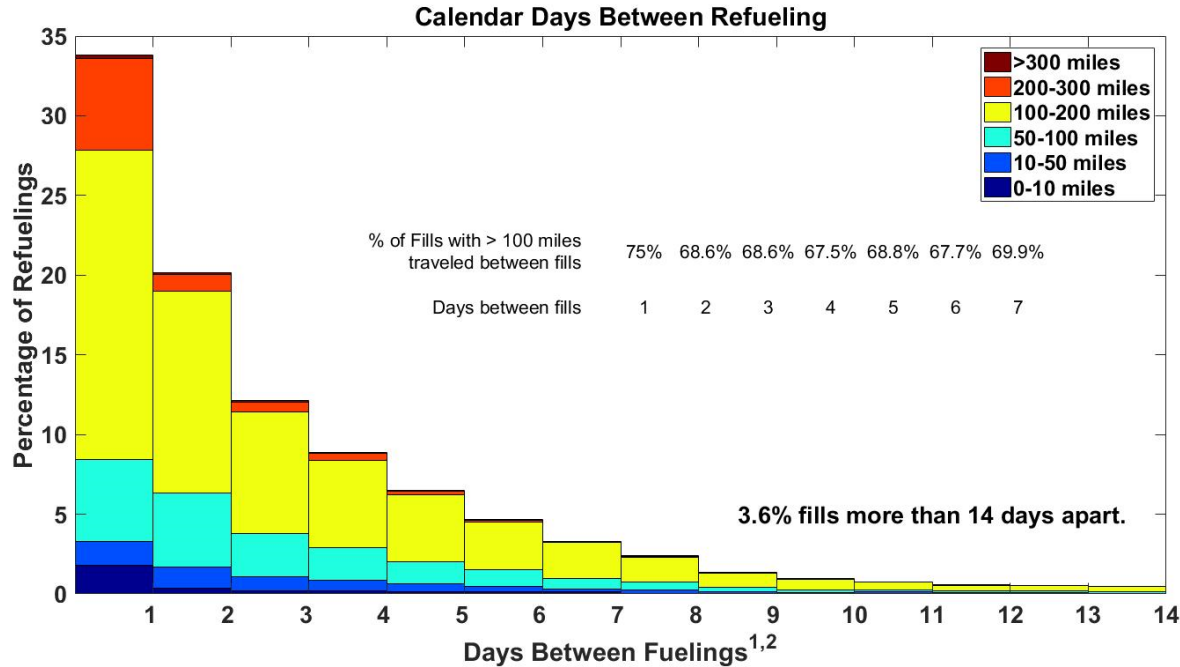


CDP-FCEV-169: GHG Emissions by Fuel Economy



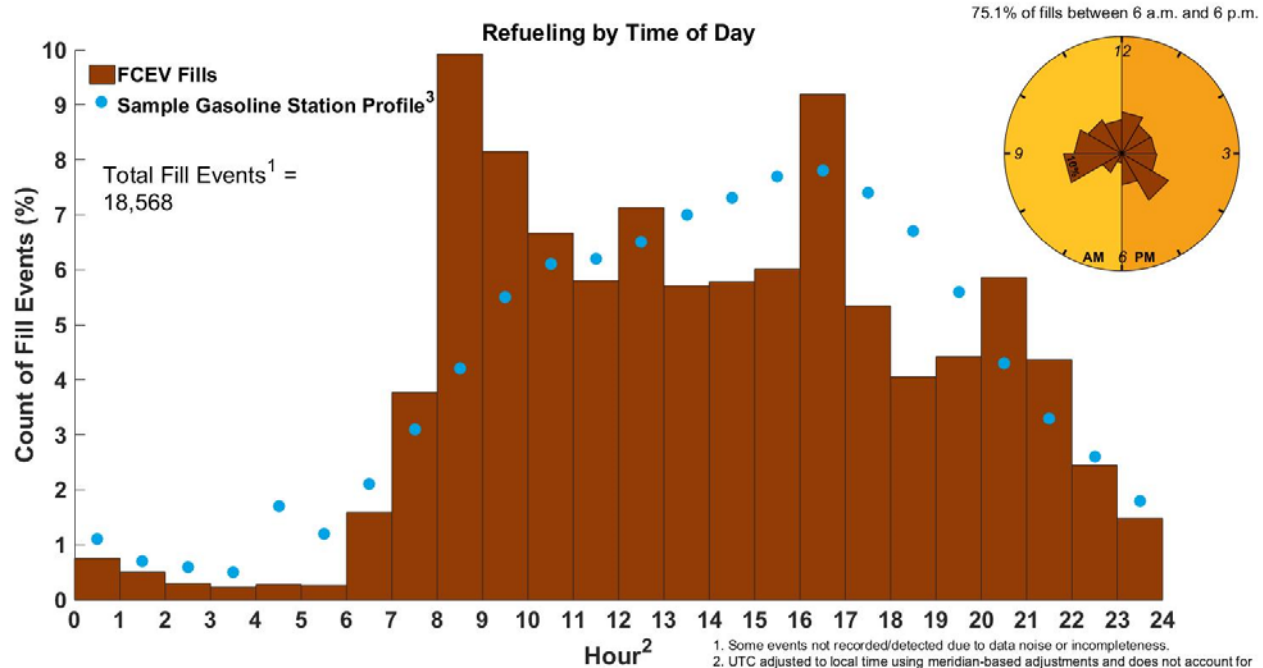
Fueling Behavior

CDP-FCEV-106: Average Calendar Days Between Refueling per Vehicle



1. Data includes fills from 2012 - 2017. Fills < 1 hour apart are excluded.
 2. Some vehicles included in the data have scheduled driving aimed at accumulating high miles and operation time over a variety of conditions. These vehicles typically fill at least once a day. These vehicles are operated on public roads and driving is typical for the region.

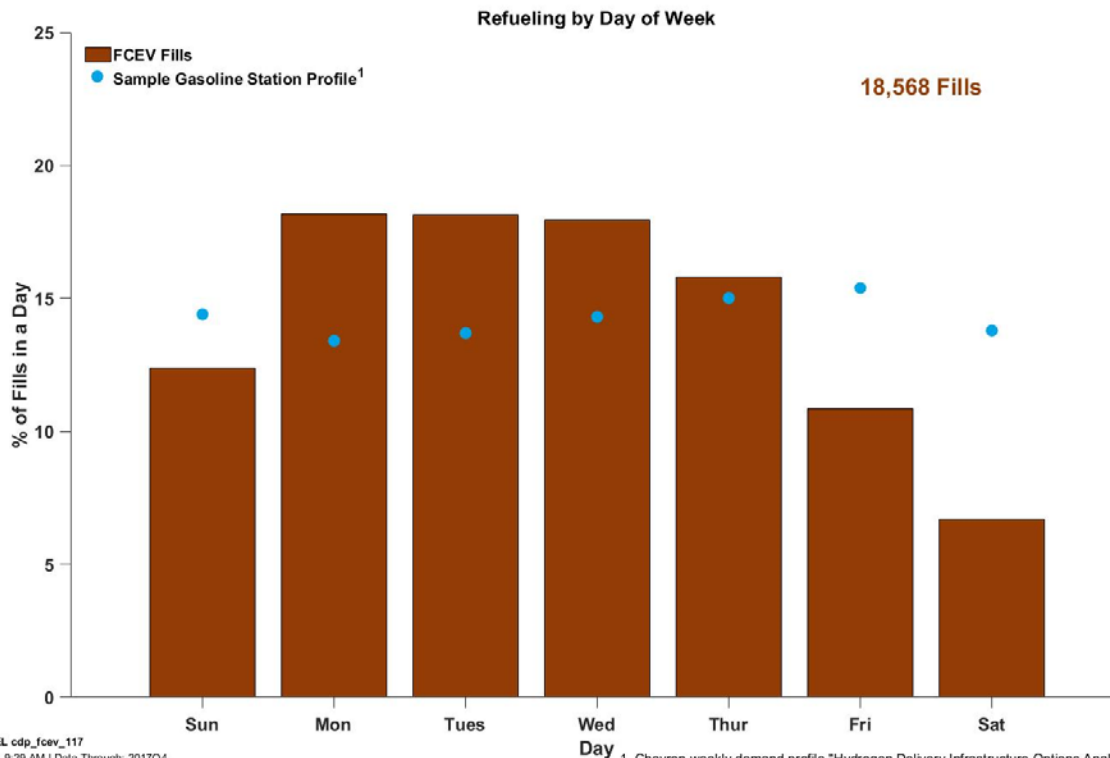
CDP-FCEV-116: Refueling by Time of Day



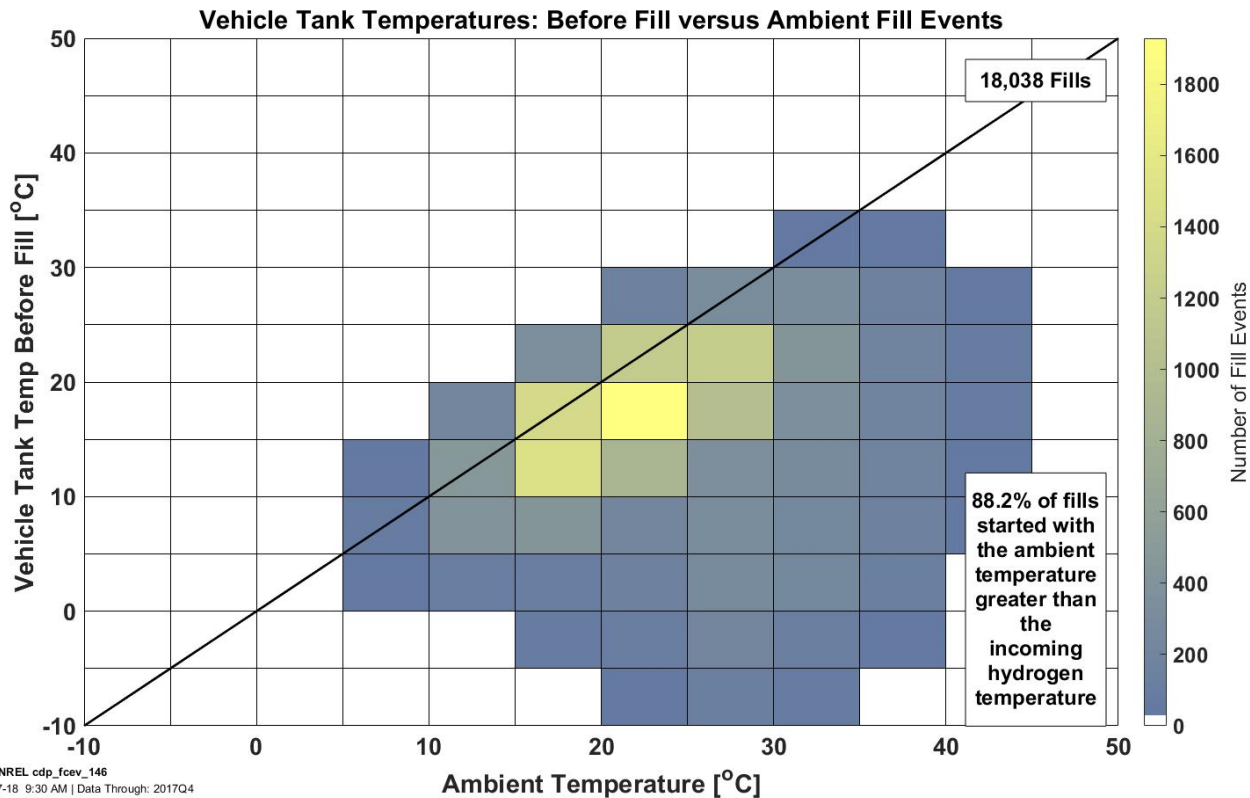
 NREL cdp_fcev_116
Created: May-07-18 9:28 AM | Data Through: 2017Q4
Included Vehicles: All

1. Some events not recorded/detected due to data noise or incompleteness.
2. UTC adjusted to local time using meridian-based adjustments and does not account for statutory deviations from the meridian-based system.
3. Friday Chevron profile "Hydrogen Delivery Infrastructure Options Analysis", T. Chen, 2008.

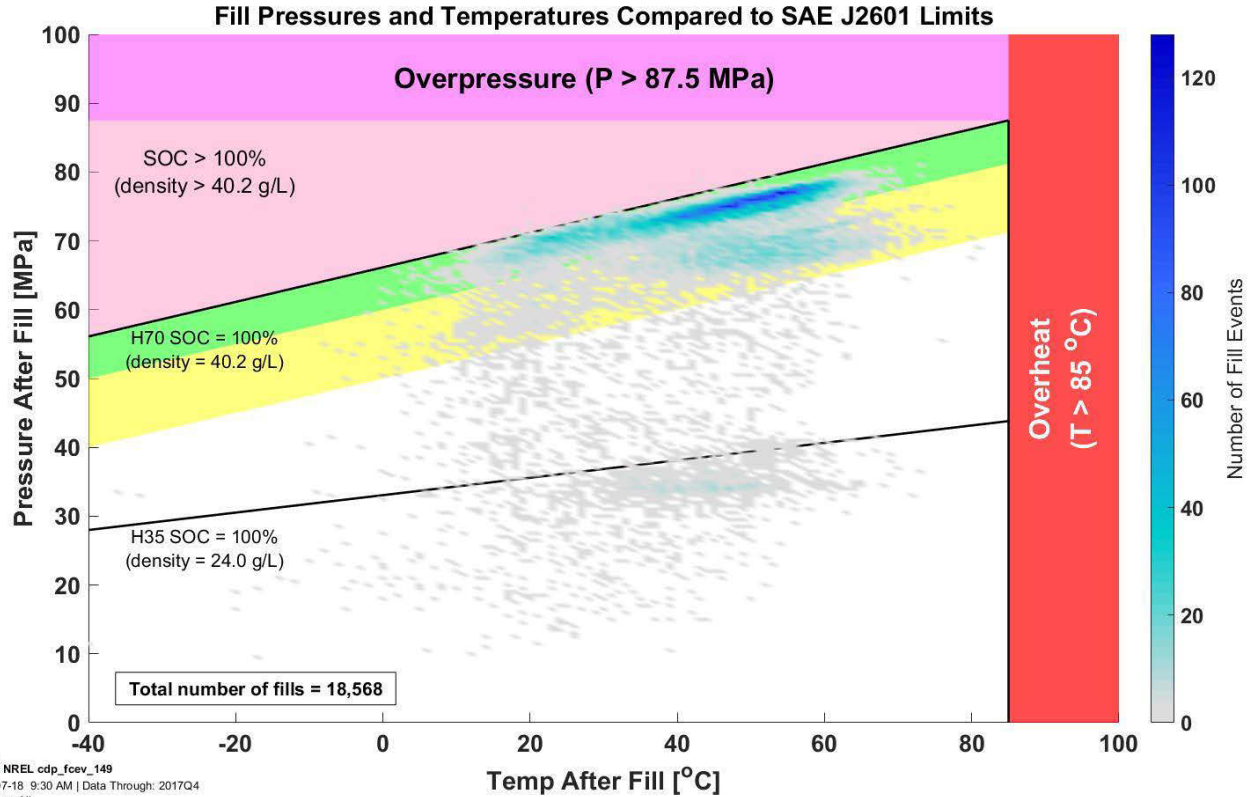
CDP-FCEV-117: Refueling by Day of Week



CDP-FCEV-146: Vehicle Tank Temperatures versus Ambient Temperatures

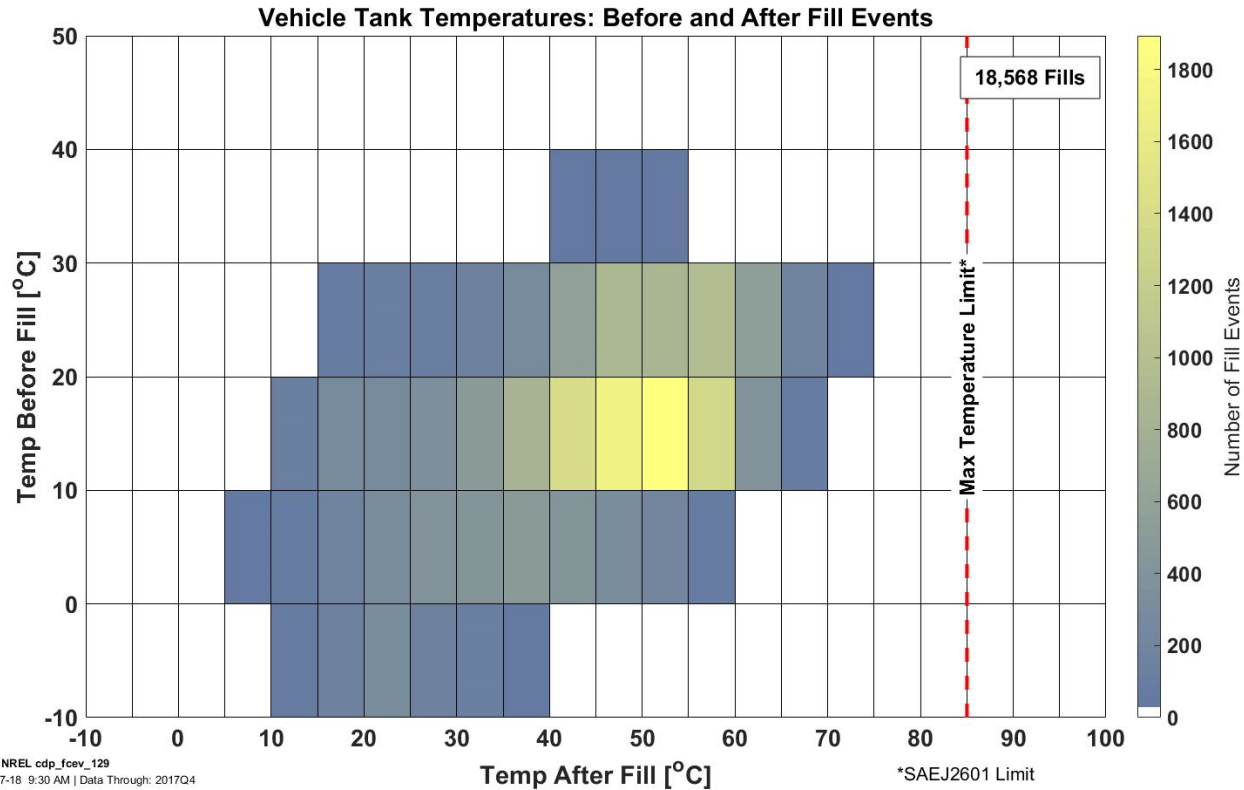


CDP-FCEV-149: Fill Pressure and Temperatures Compared with SAEJ2601 Limits

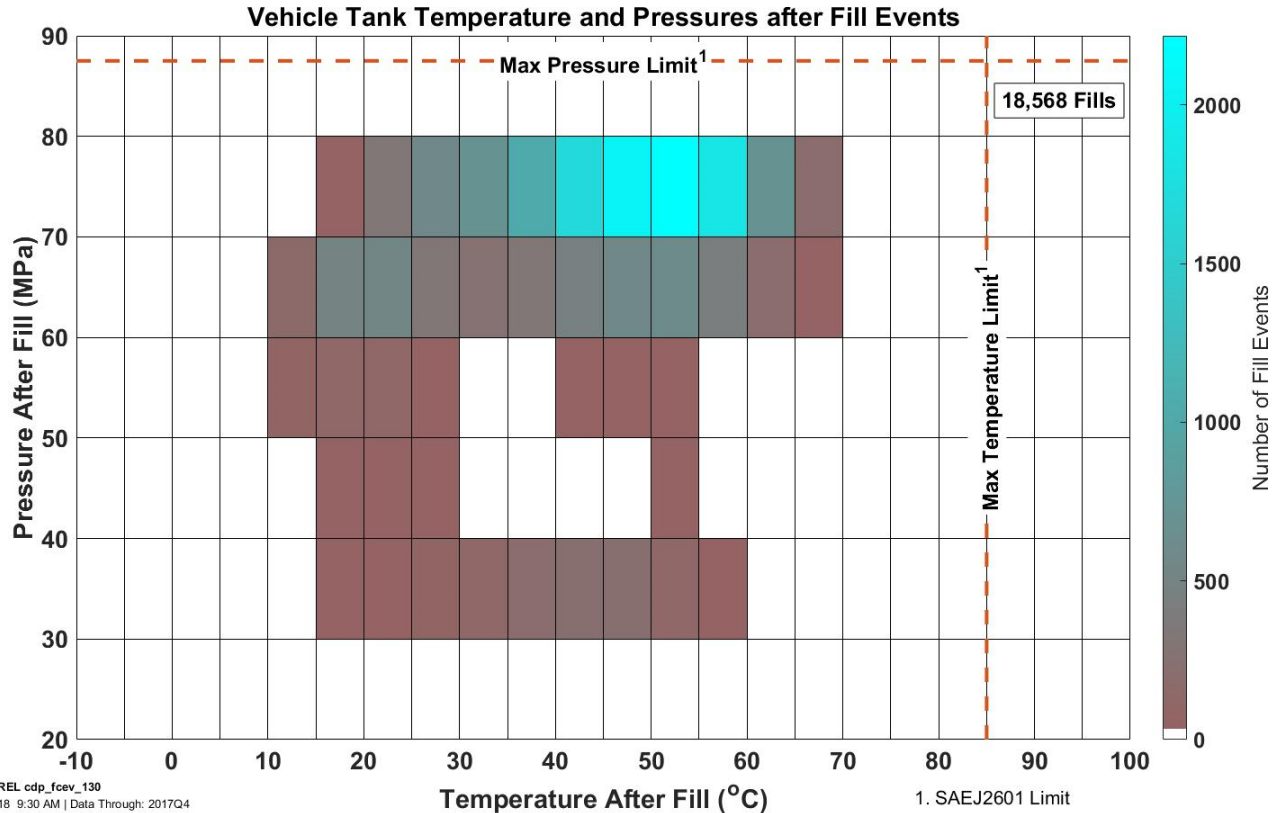


Hydrogen Performance

CDP-FCEV-129: Vehicle Tank Temperatures: Before and After a Fill



CDP-FCEV-130: Vehicle Tank Temperatures and Pressures after Fill Events



Thank you

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NREL/PR-5400-71643

This work was authored by Alliance for Sustainable Energy, LLC, the manager and operator of the National Renewable Energy Laboratory for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Fuel Cell Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

