NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Fall 2011 Composite Data Products: National FCEV Learning Demonstration

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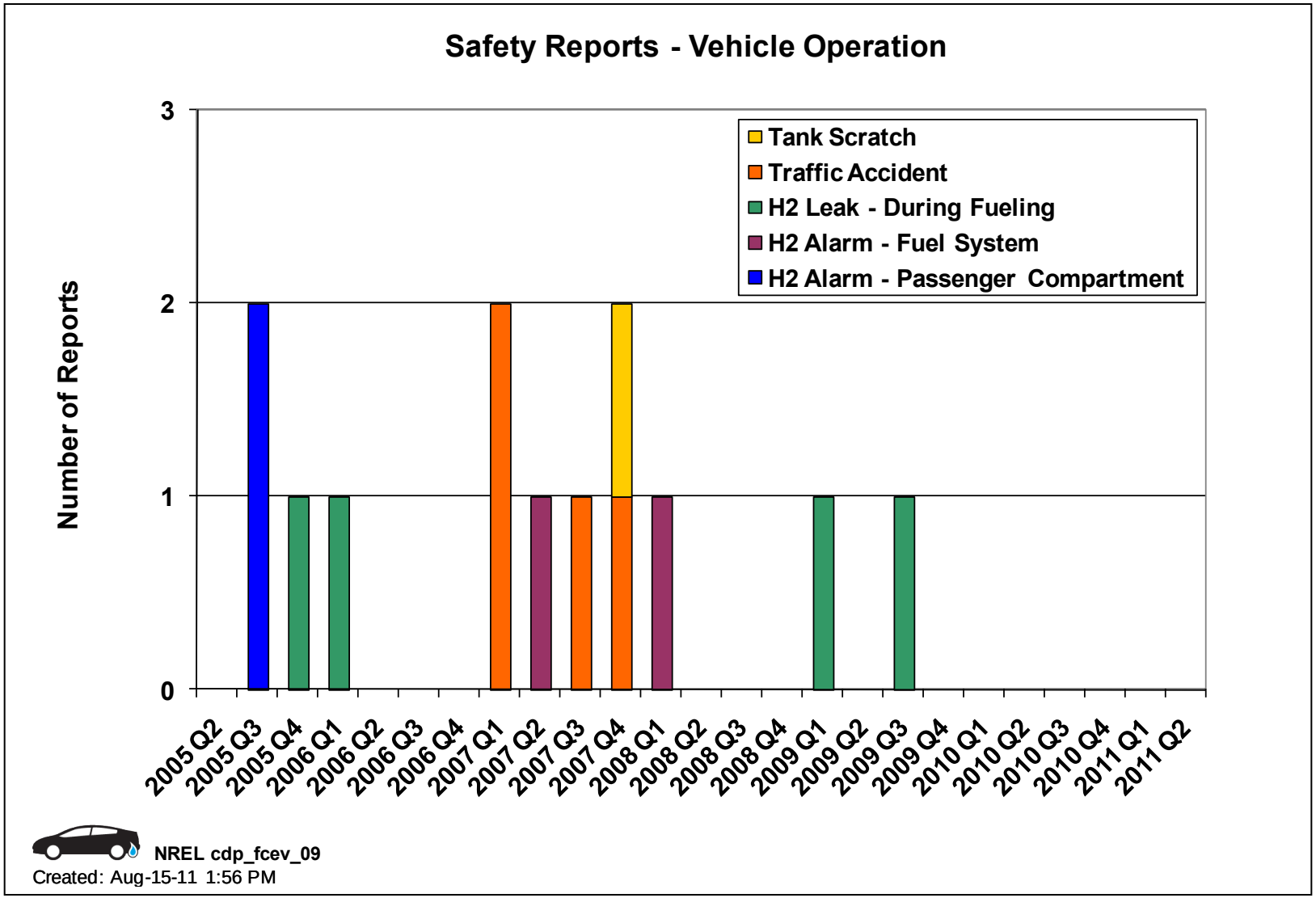
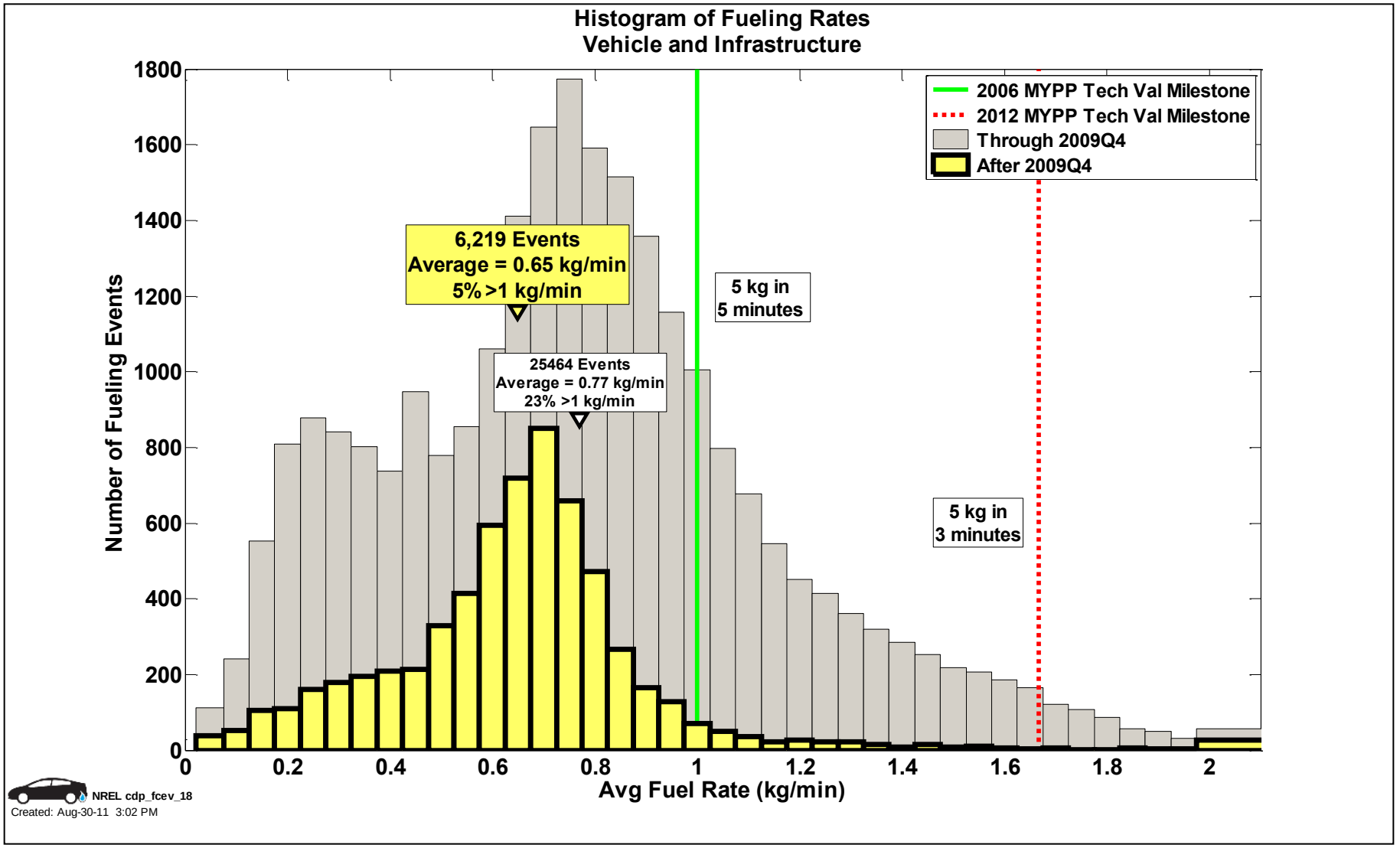
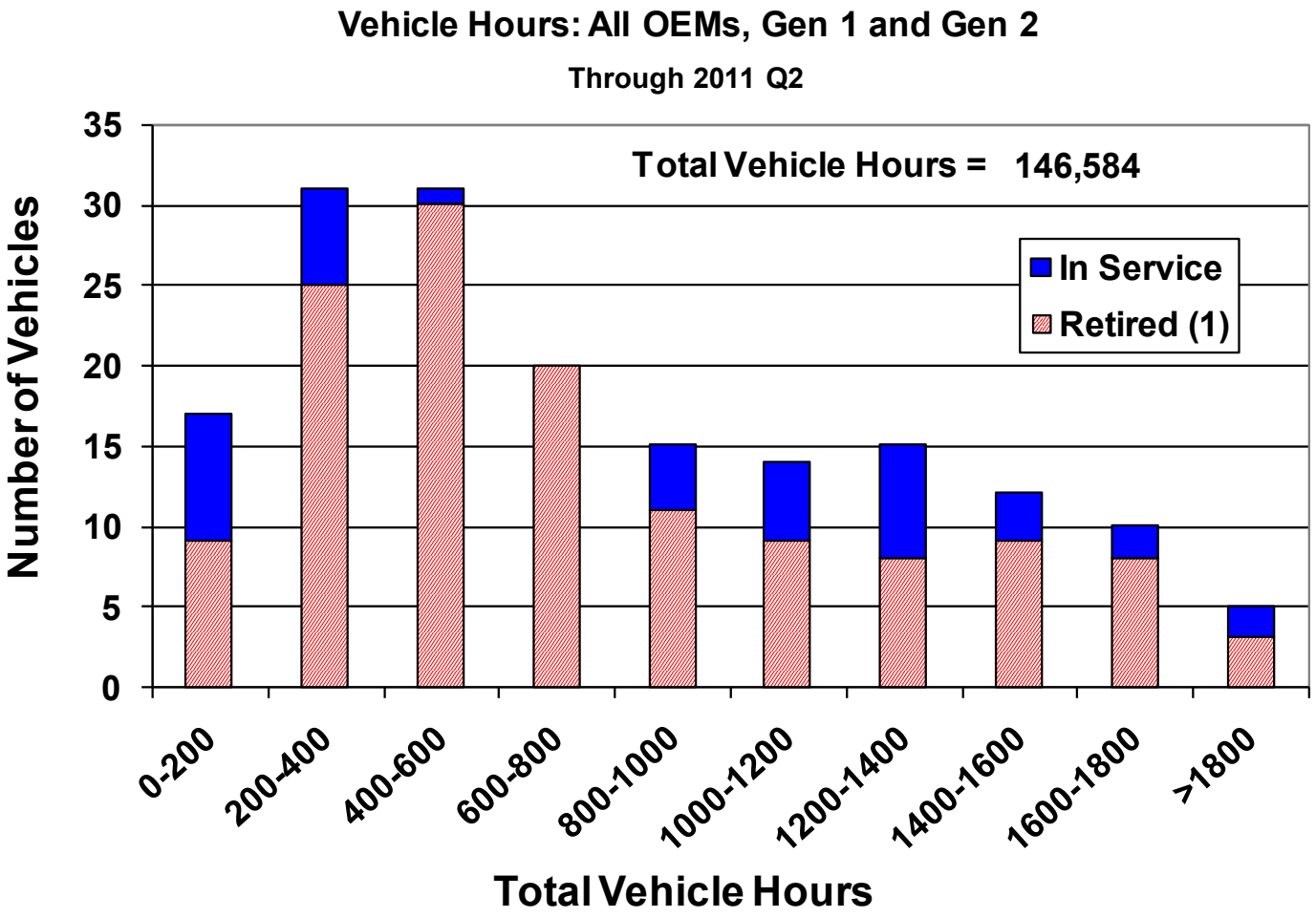
CDP#9: Safety Reports – Vehicles



CDP#18: Refueling Rates



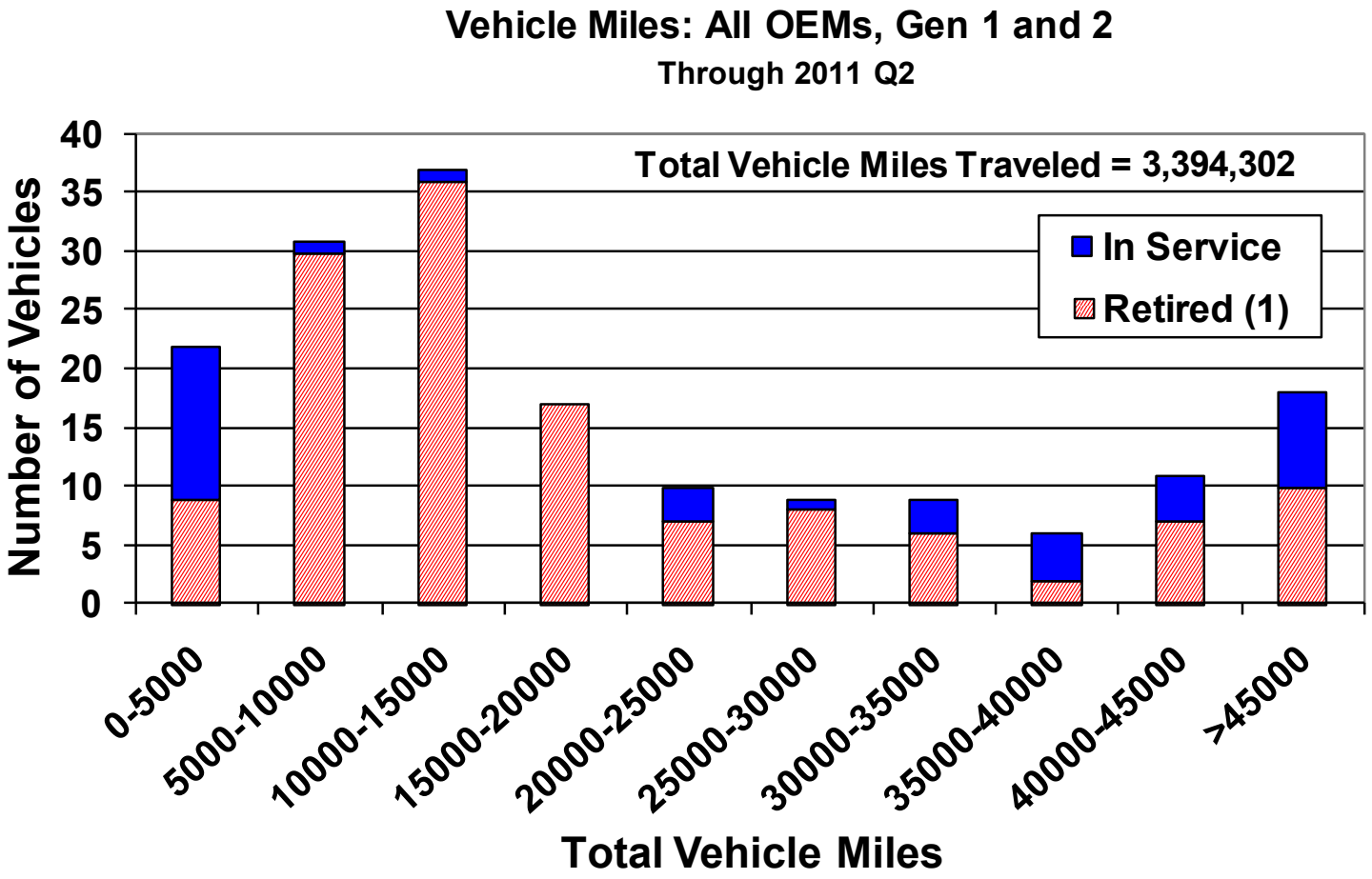
CDP#22: Vehicle Operating Hours



NREL cdp_fcev_22
Created: Sep-01-11 11:37 AM

(1) Retired vehicles have left DOE fleet and are no longer providing data to NREL
Some project teams concluded in Fall/Winter 2009

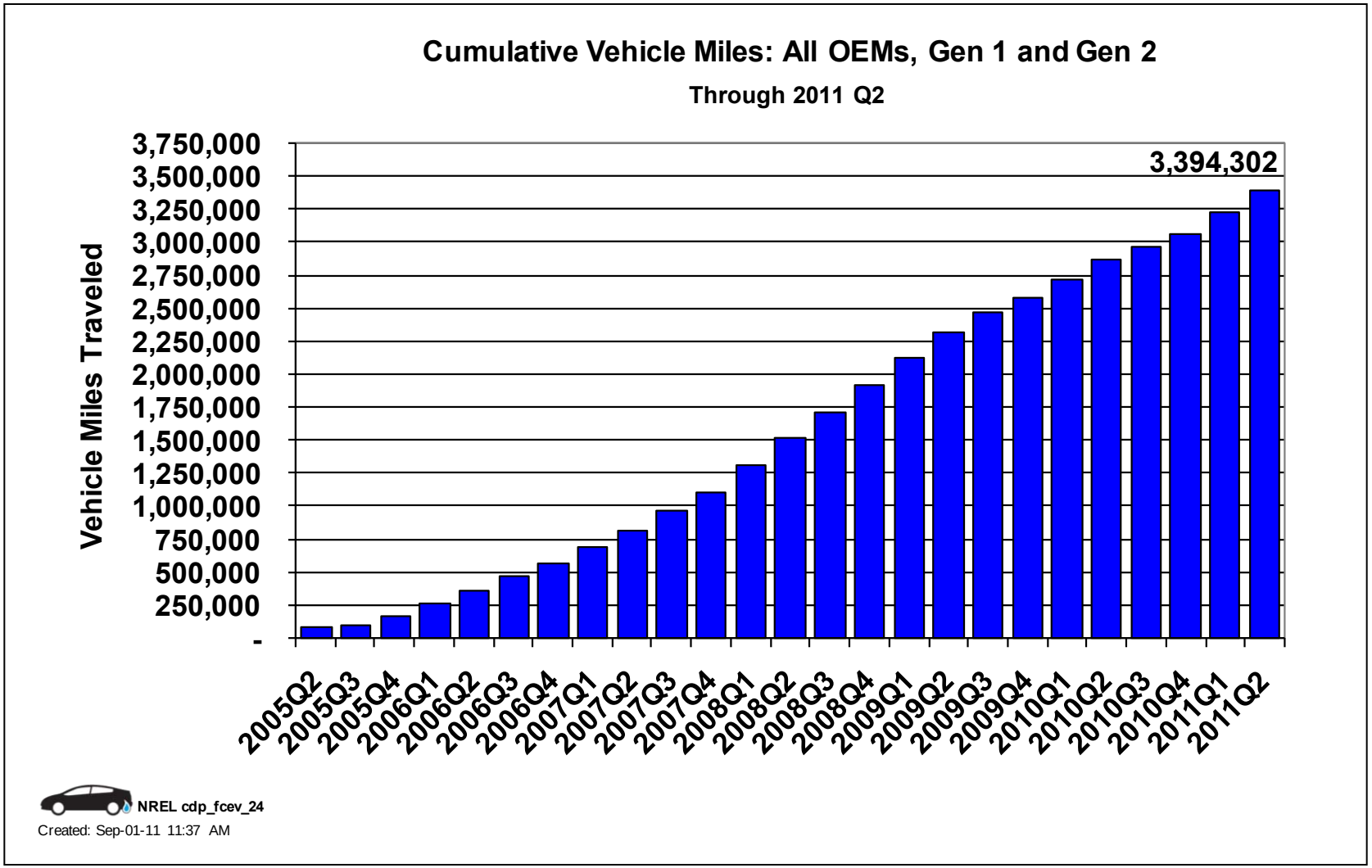
CDP#23: Vehicles vs. Miles Traveled



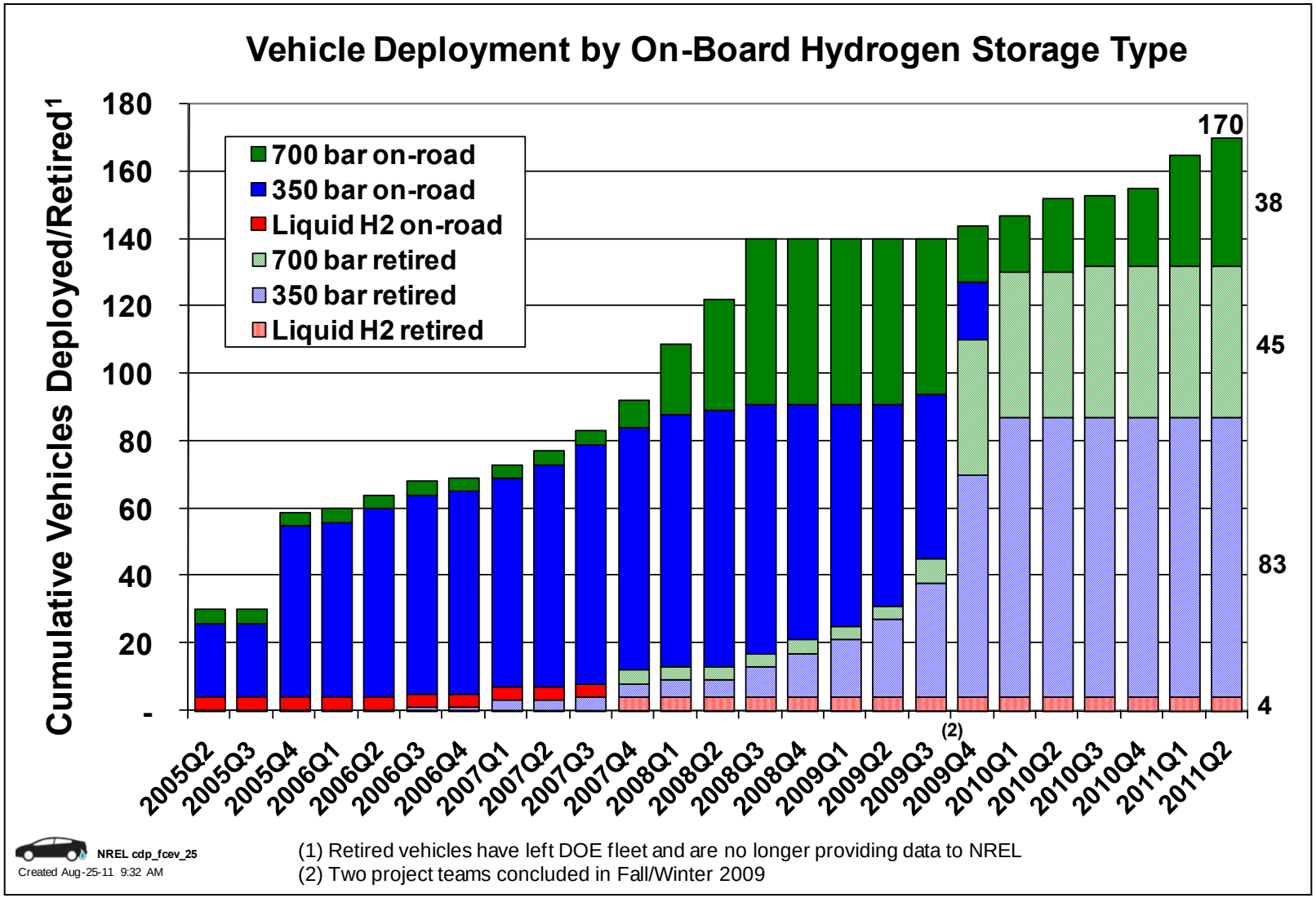
NREL cdp_fcev_23
Created: Sep-01-11 11:37 AM

(1) Retired vehicles have left DOE fleet and are no longer providing data to NREL
Some project teams concluded in Fall/Winter 2009

CDP#24: Cumulative Vehicle Miles Traveled

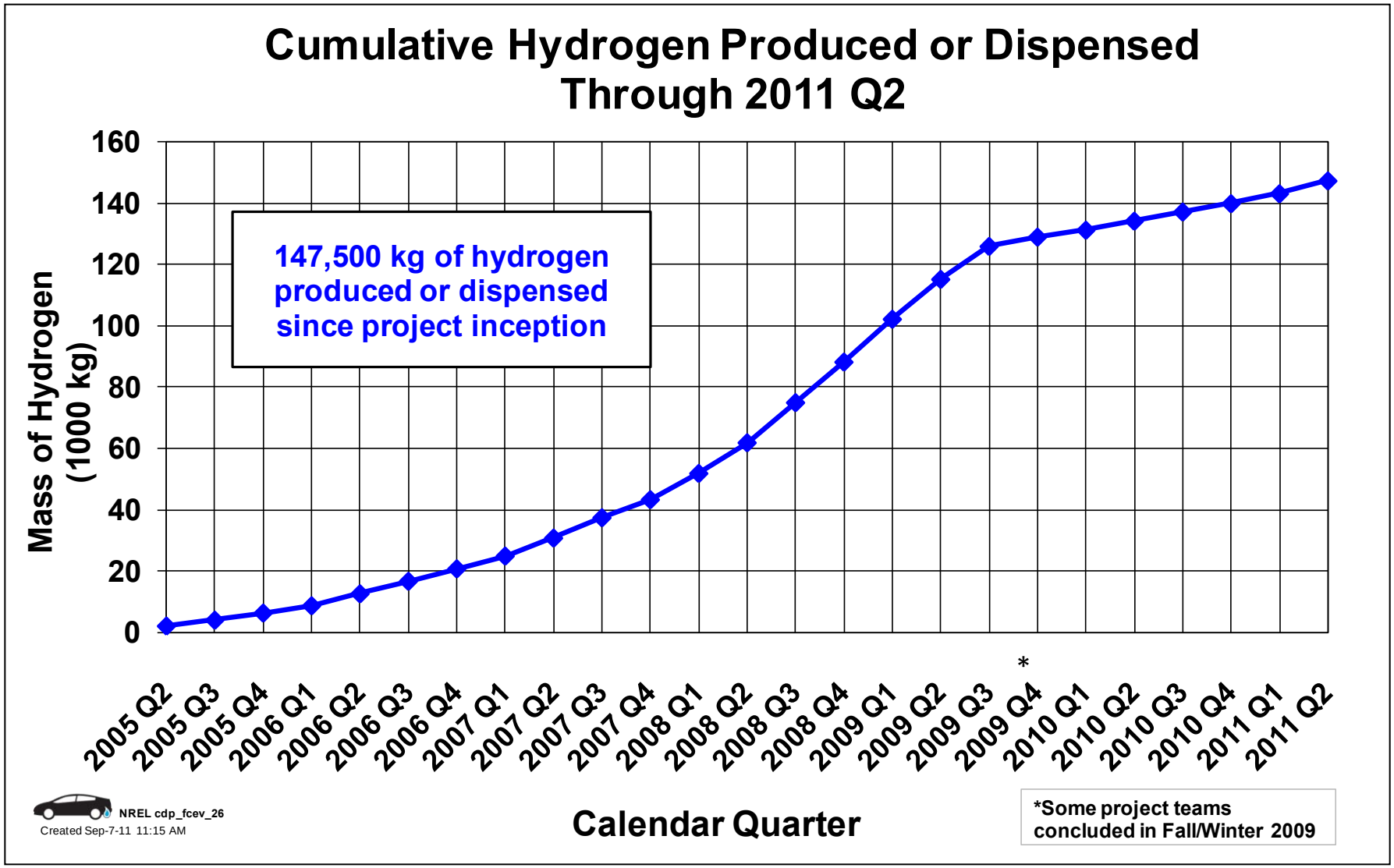


CDP#25: Vehicle H2 Storage Technologies

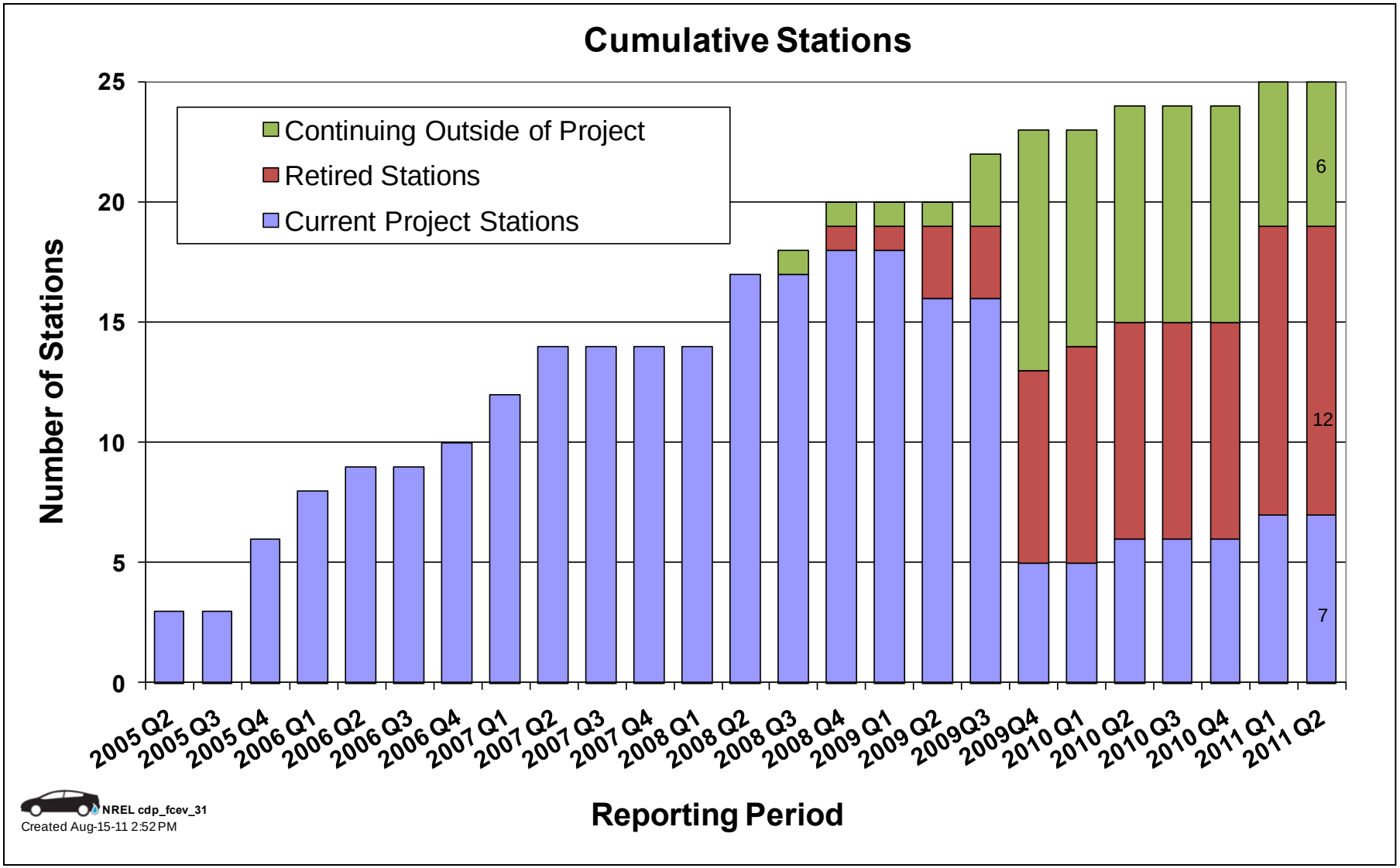


(1) Retired vehicles have left DOE fleet and are no longer providing data to NREL
(2) Two project teams concluded in Fall/Winter 2009

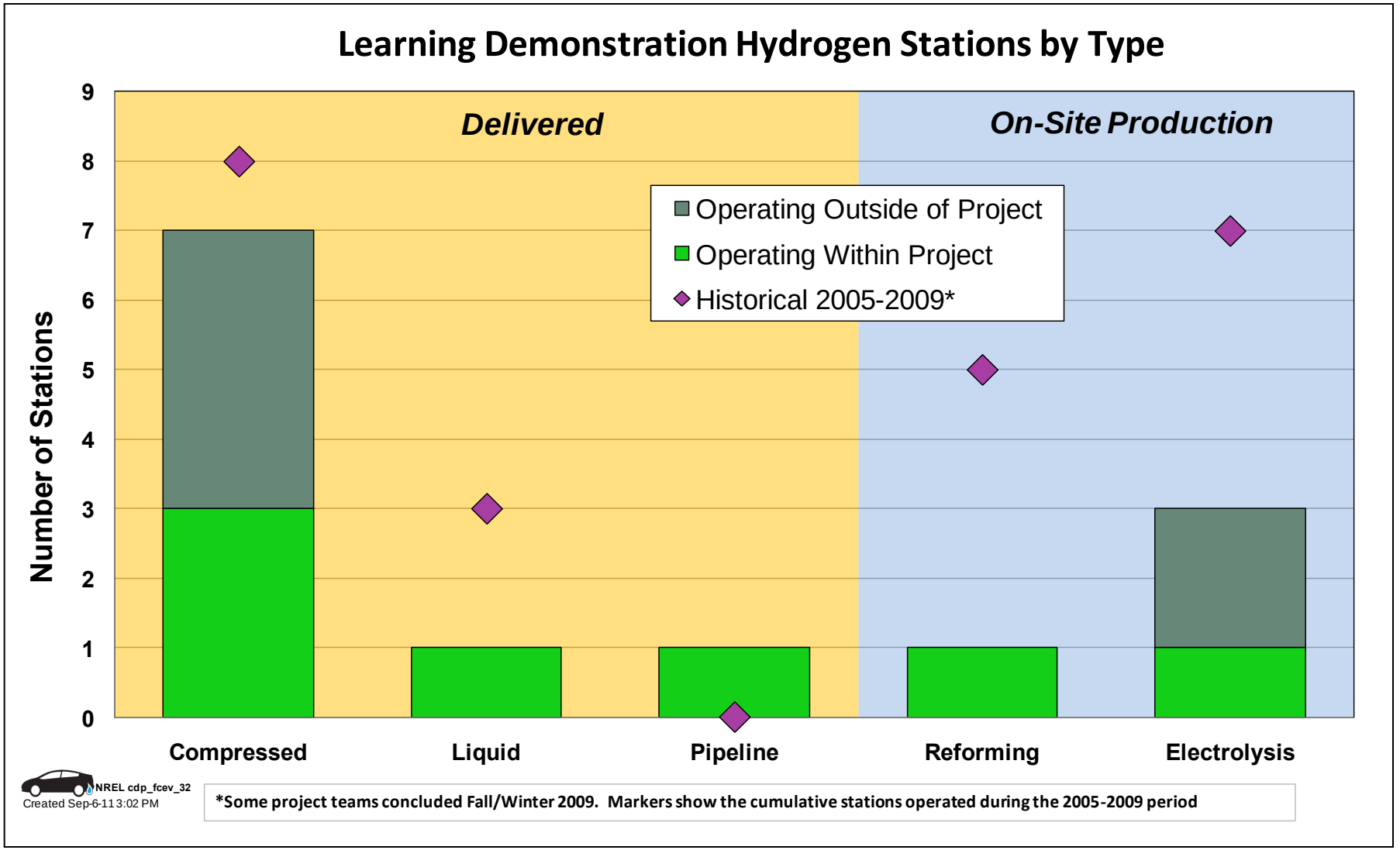
CDP#26: Cumulative H2 Produced or Dispensed



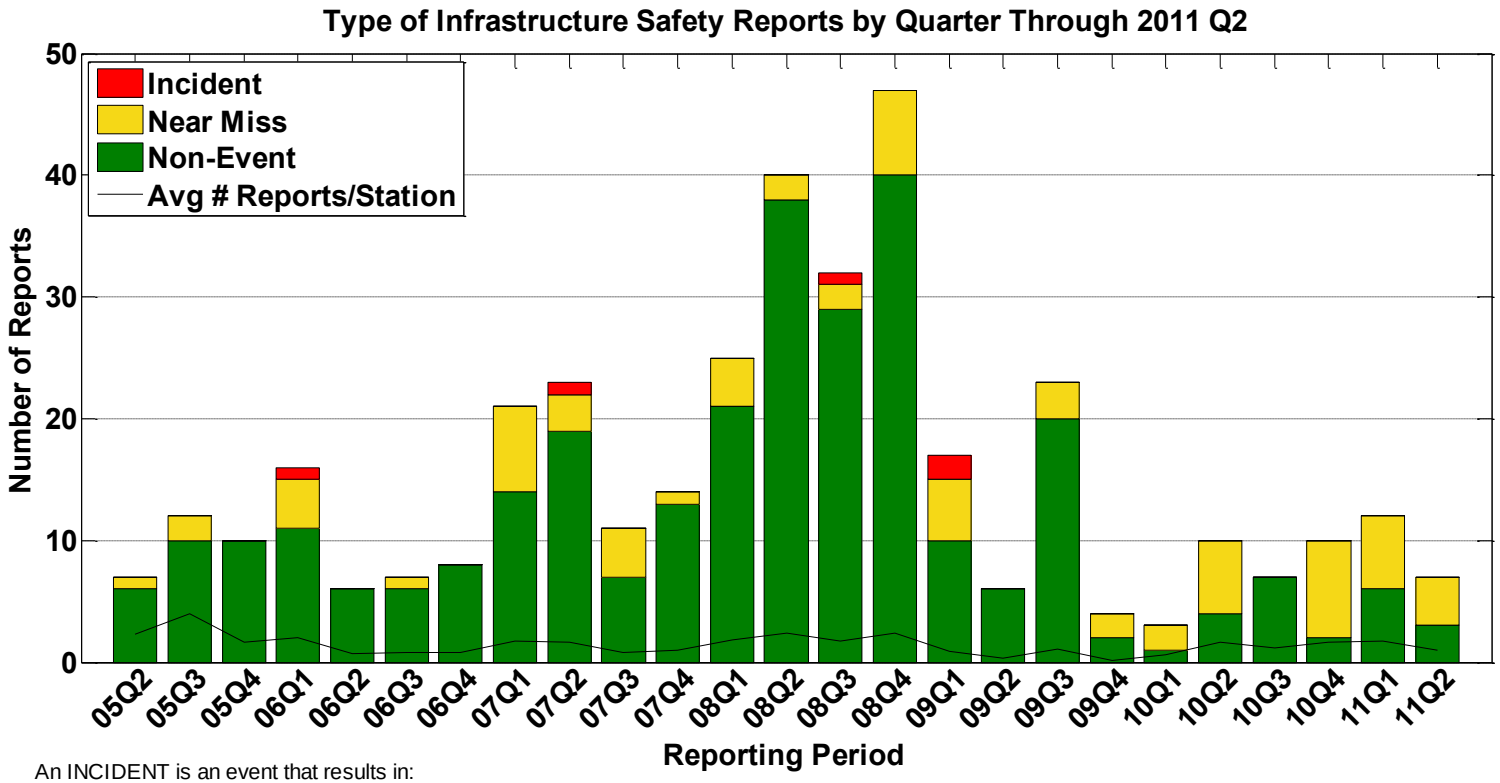
CDP#31: Number of Online Stations



CDP#32: Infrastructure Hydrogen Production Methods



CDP#36: Type of Infrastructure Safety Report By Quarter



An INCIDENT is an event that results in:

- a lost time accident and/or injury to personnel
- damage/unplanned downtime for project equipment, facilities or property
- impact to the public or environment
- any hydrogen release that unintentionally ignites or is sufficient to sustain a flame if ignited
- release of any volatile, hydrogen containing compound (other than the hydrocarbons used as common fuels)

A NEAR-MISS is:

- an event that under slightly different circumstances could have become an incident
- unplanned H2 release insufficient to sustain a flame

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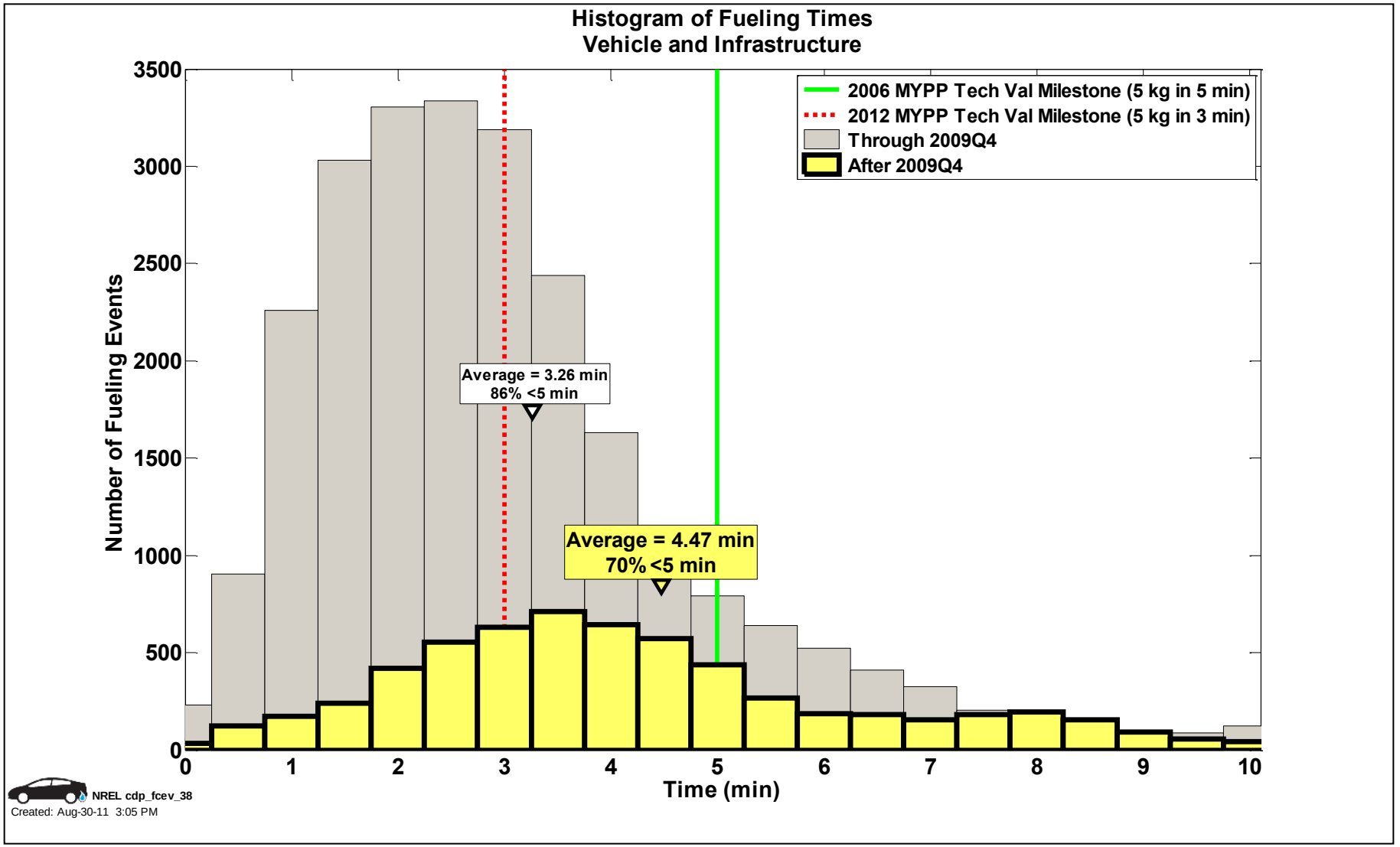
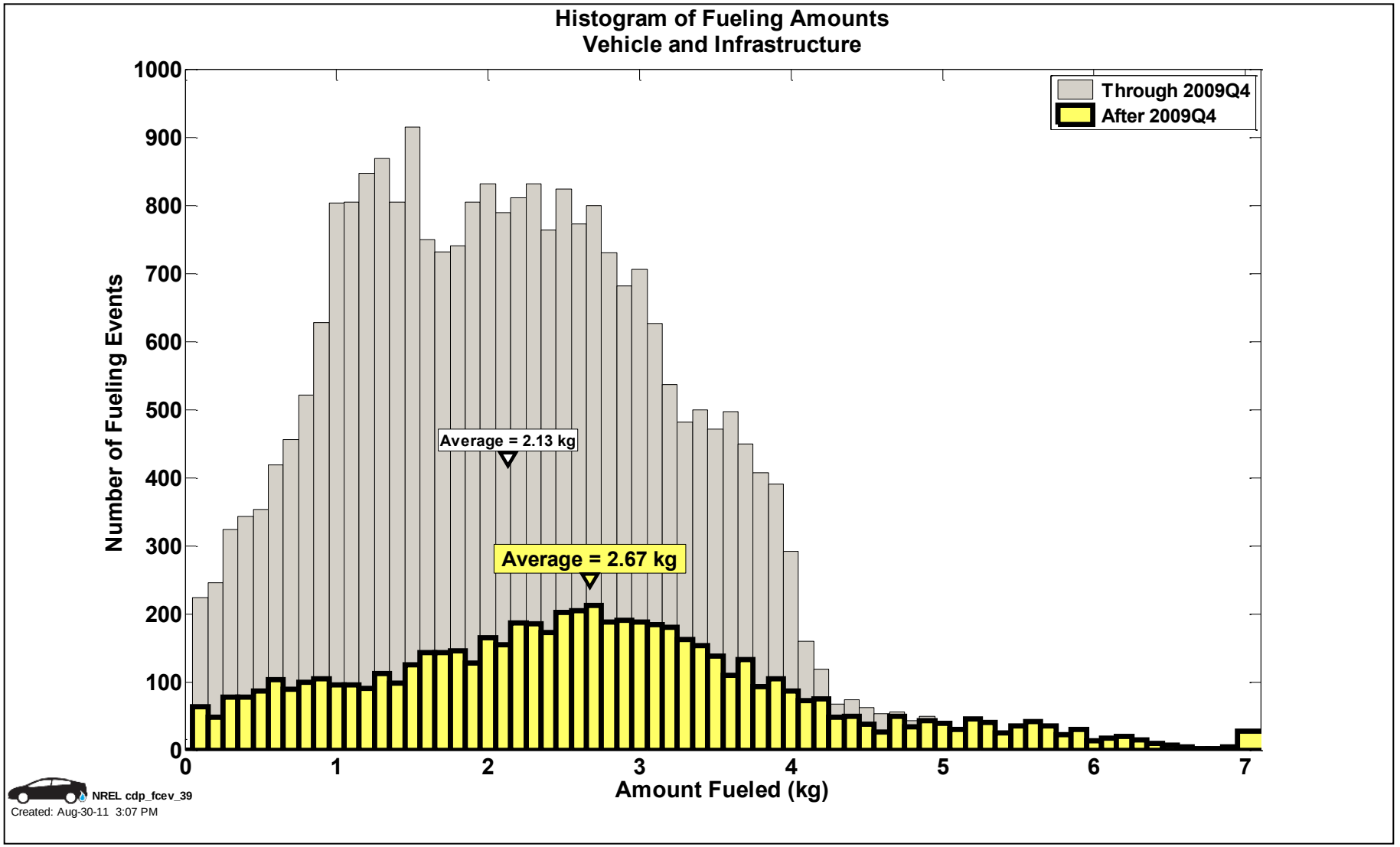
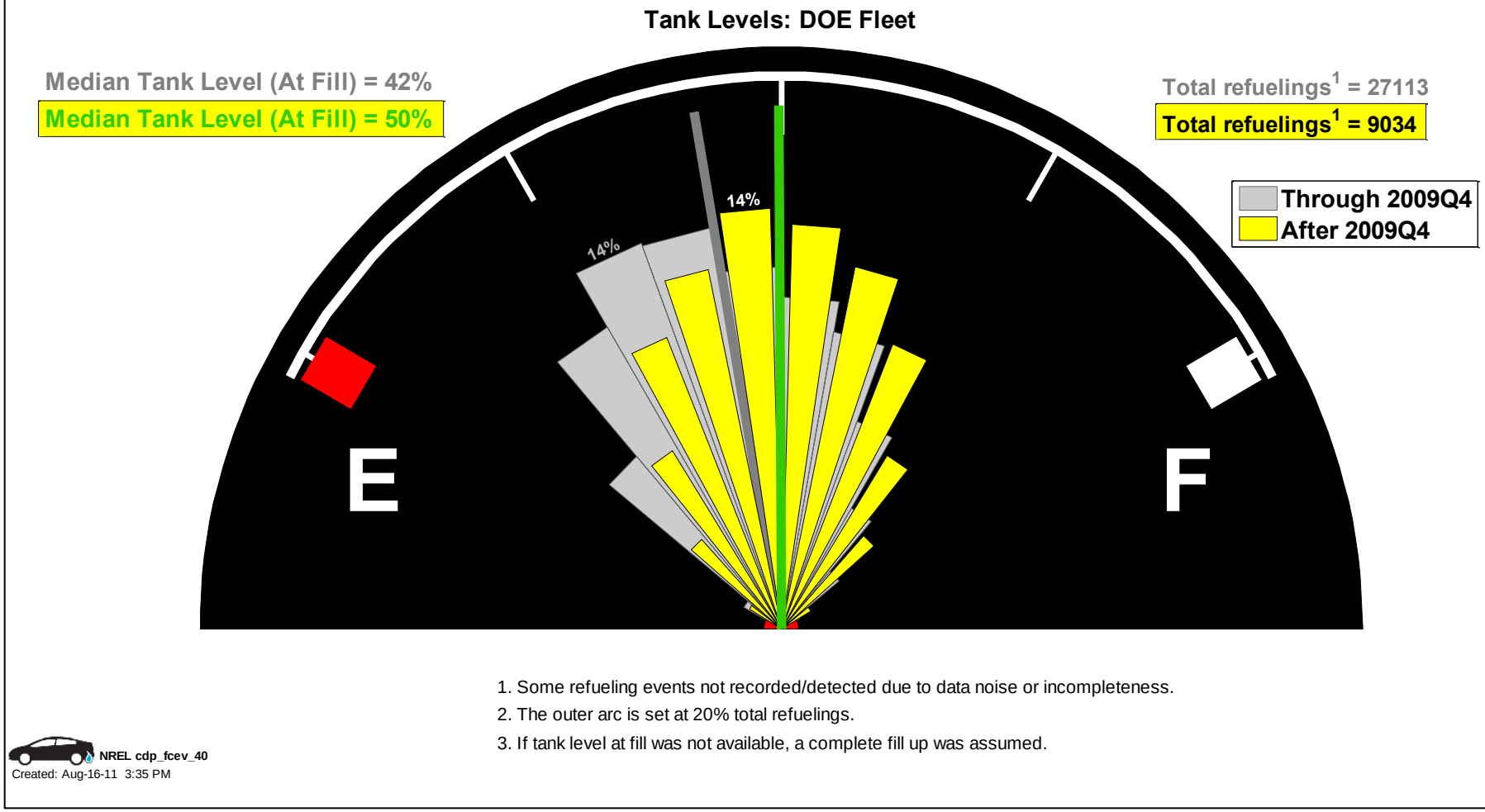
CDP#38: Refueling Times



CDP#39: Refueling Amounts



CDP#40: H2 Tank Level at Refueling



1. Some refueling events not recorded/detected due to data noise or incompleteness.
2. The outer arc is set at 20% total refuelings.
3. If tank level at fill was not available, a complete fill up was assumed.

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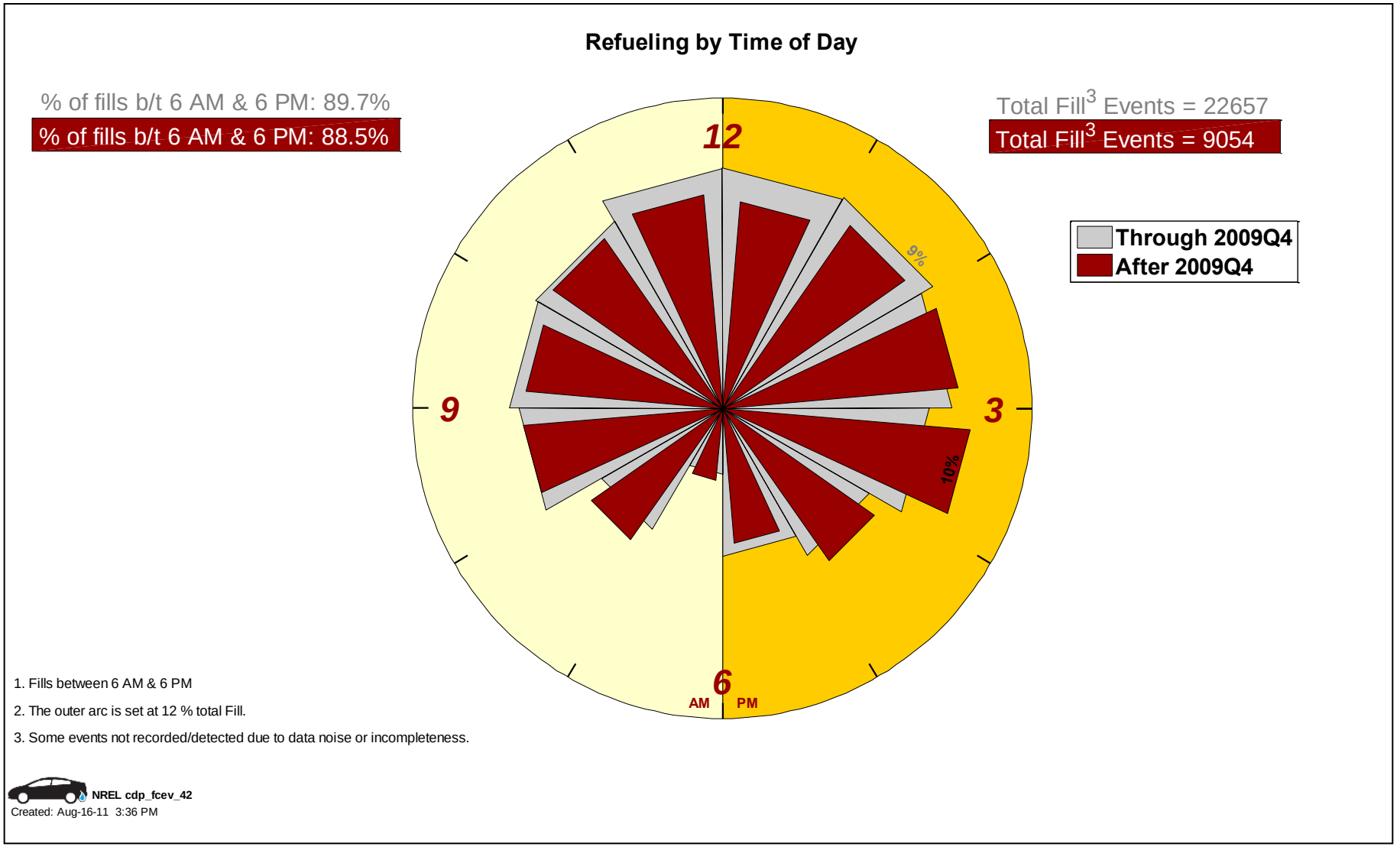
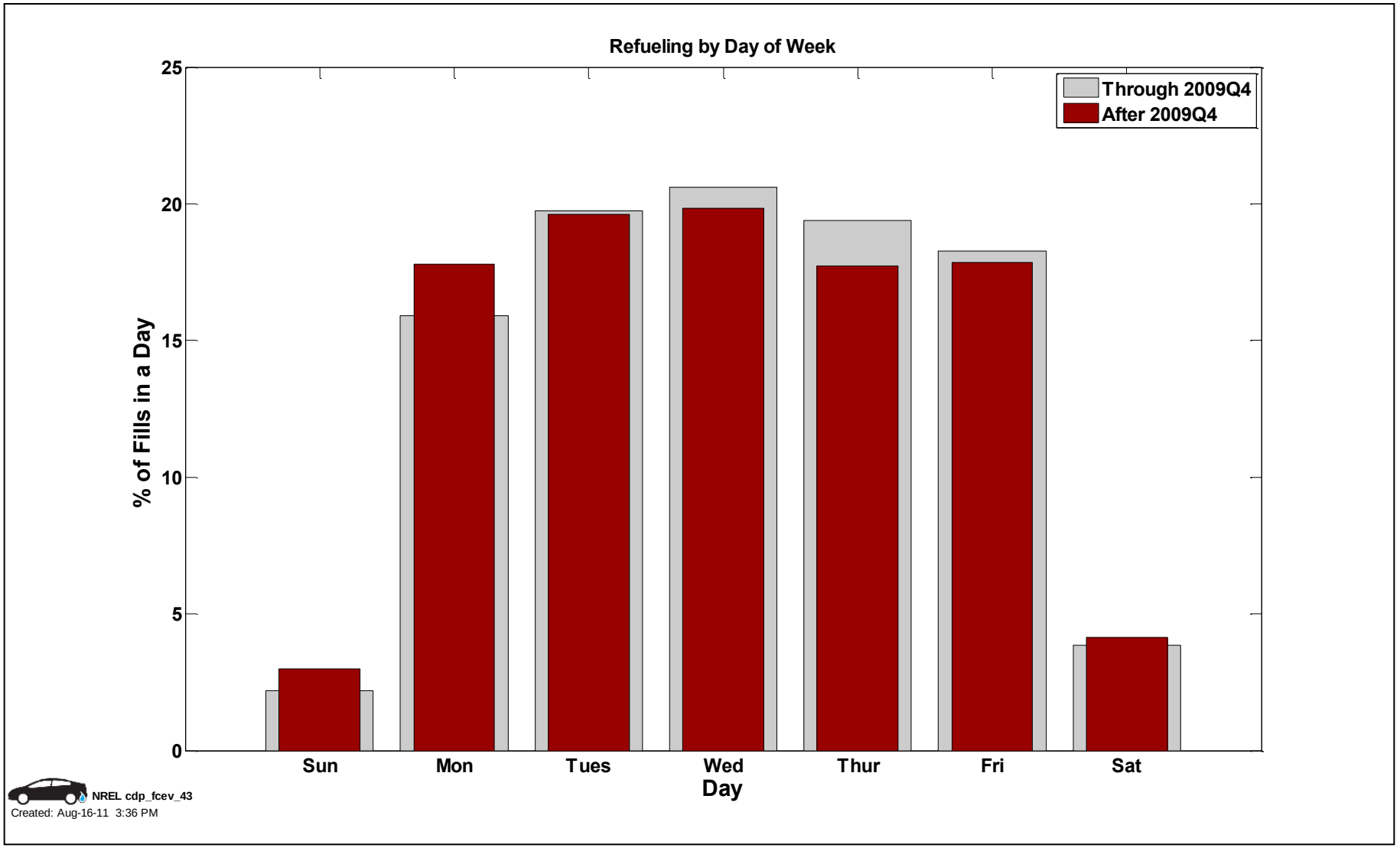
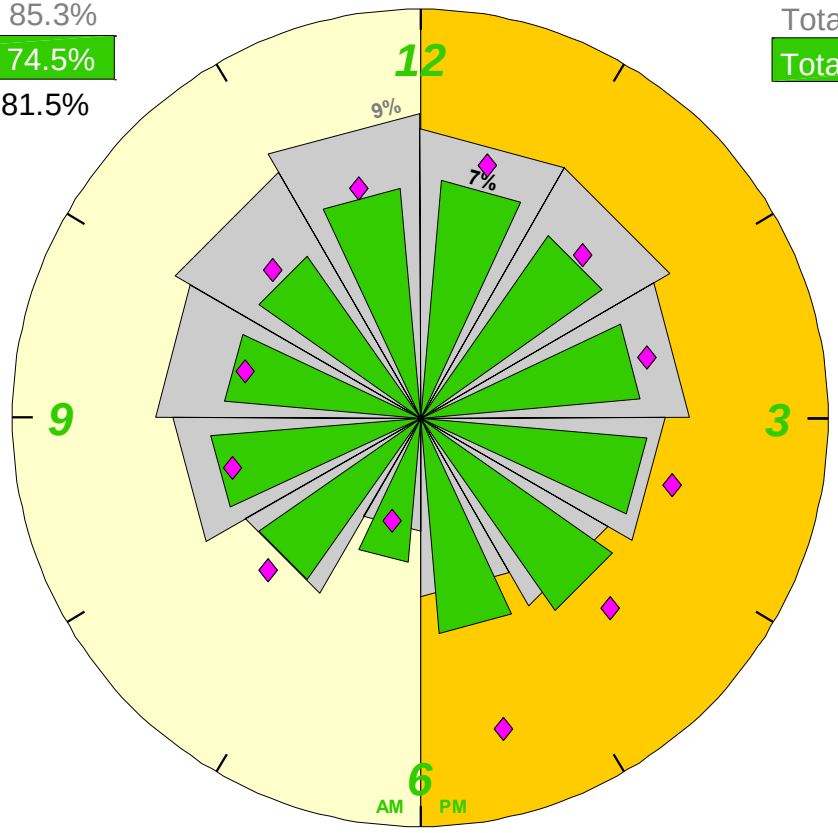
CDP#42: Refueling by Time of Day



CDP#43: Refueling by Day of Week



CDP#44: Driving Start Time – Day



% of driving trips b/t 6 AM & 6 PM: 85.3%

% of driving trips b/t 6 AM & 6 PM: 74.5%

% of NHTS trips b/t 6 AM & 6 PM: 81.5%

Total Driving[3] Events = 295222

Total Drive[3] Events = 36839

1. Driving trips between 6 AM & 6 PM
2. The outer arc is set at 12 % total Driving.
3. Some events not recorded/detected due to data noise or incompleteness.

2001 NHTS Data Includes Car, Truck, Van, & SUV day trips

ASCII.csv Source: http://nhts.ornl.gov/download.shtml#2001

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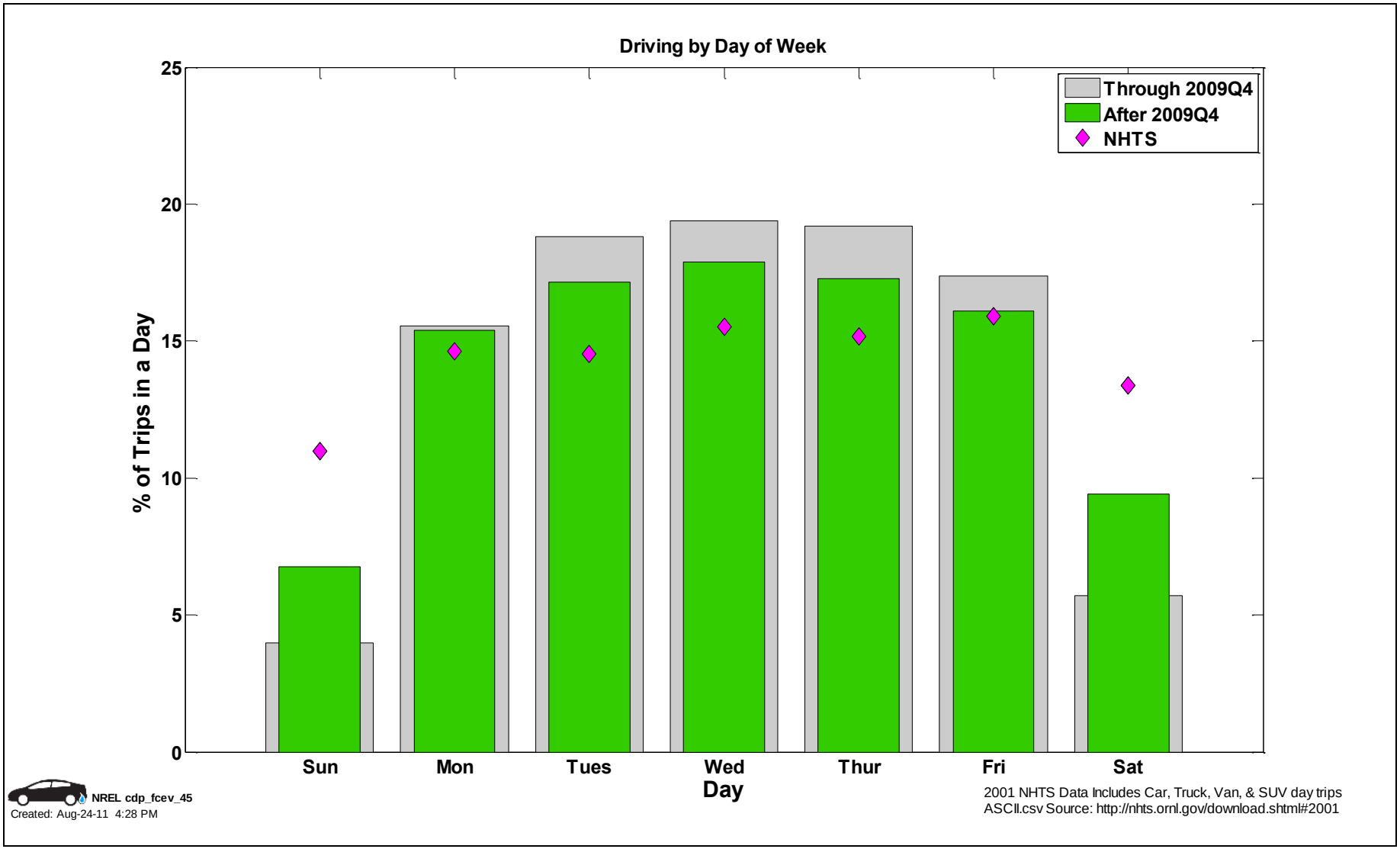
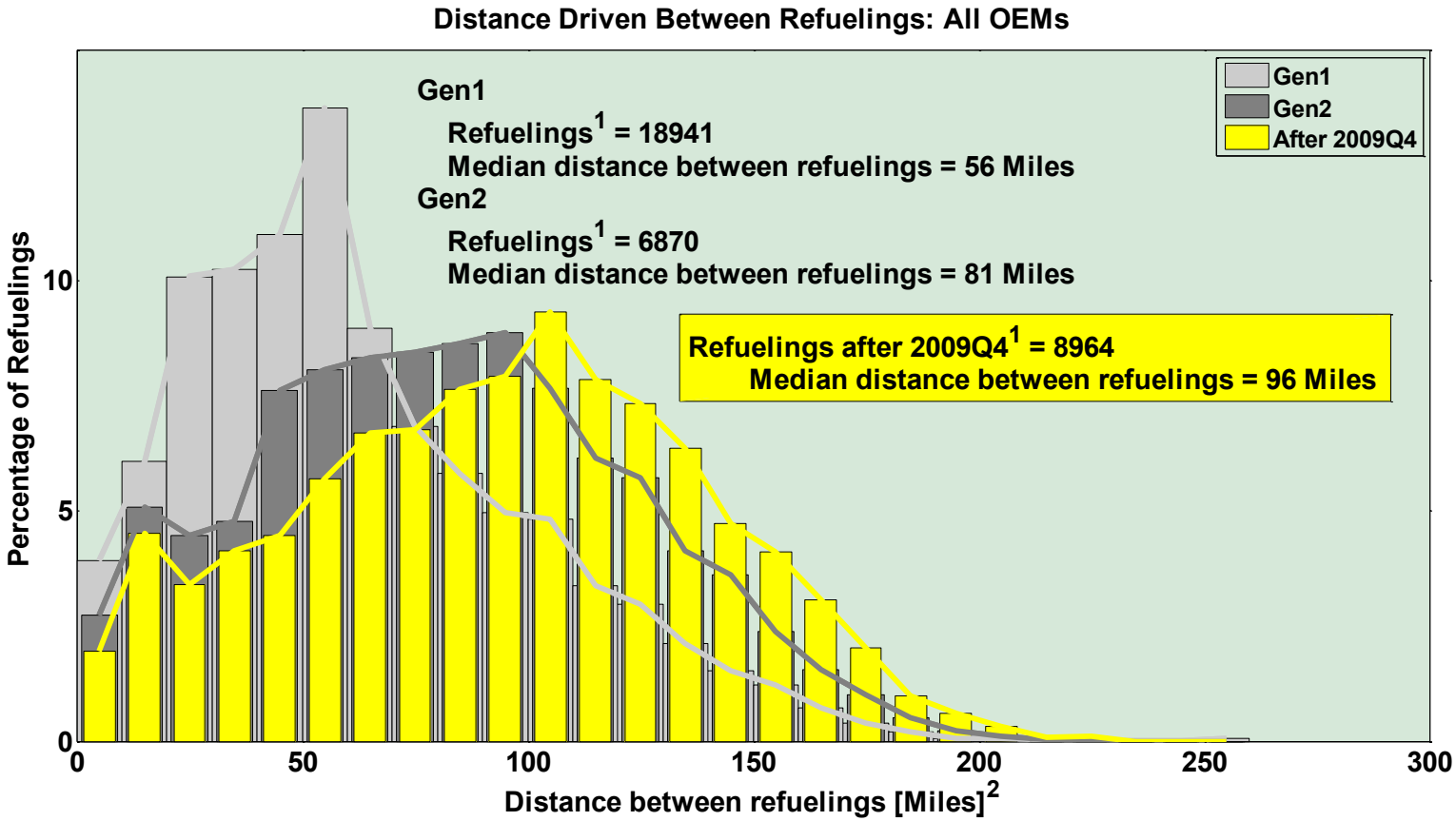
CDP#45: Driving by Day of Week



CDP#80: Miles Between Refuelings



1. Some refueling events are not detected/reported due to data noise or incompleteness.
2. Distance driven between refuelings is indicative of driver behavior and does not represent the full range of the vehicle.

NREL cdp_fcev_80
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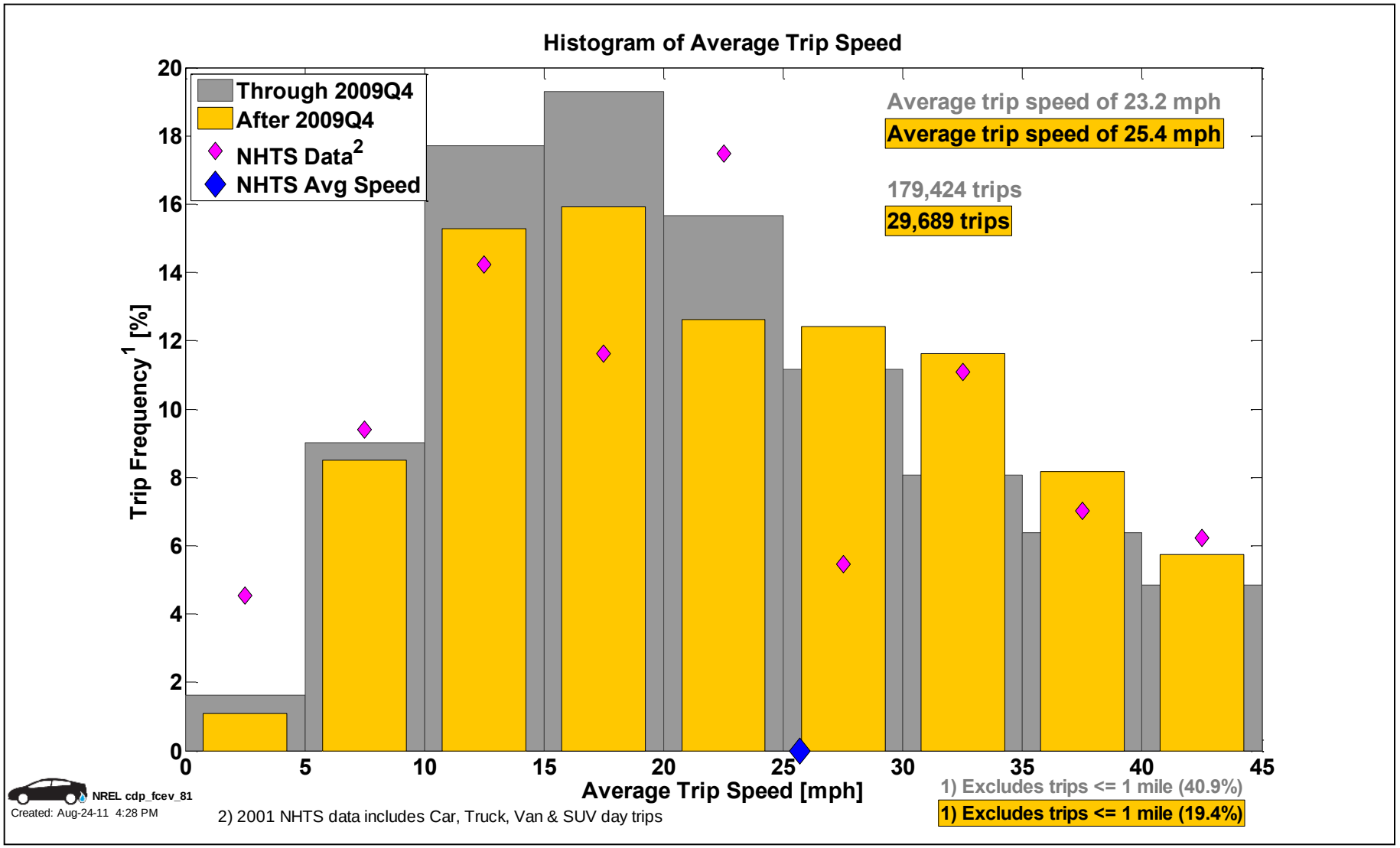
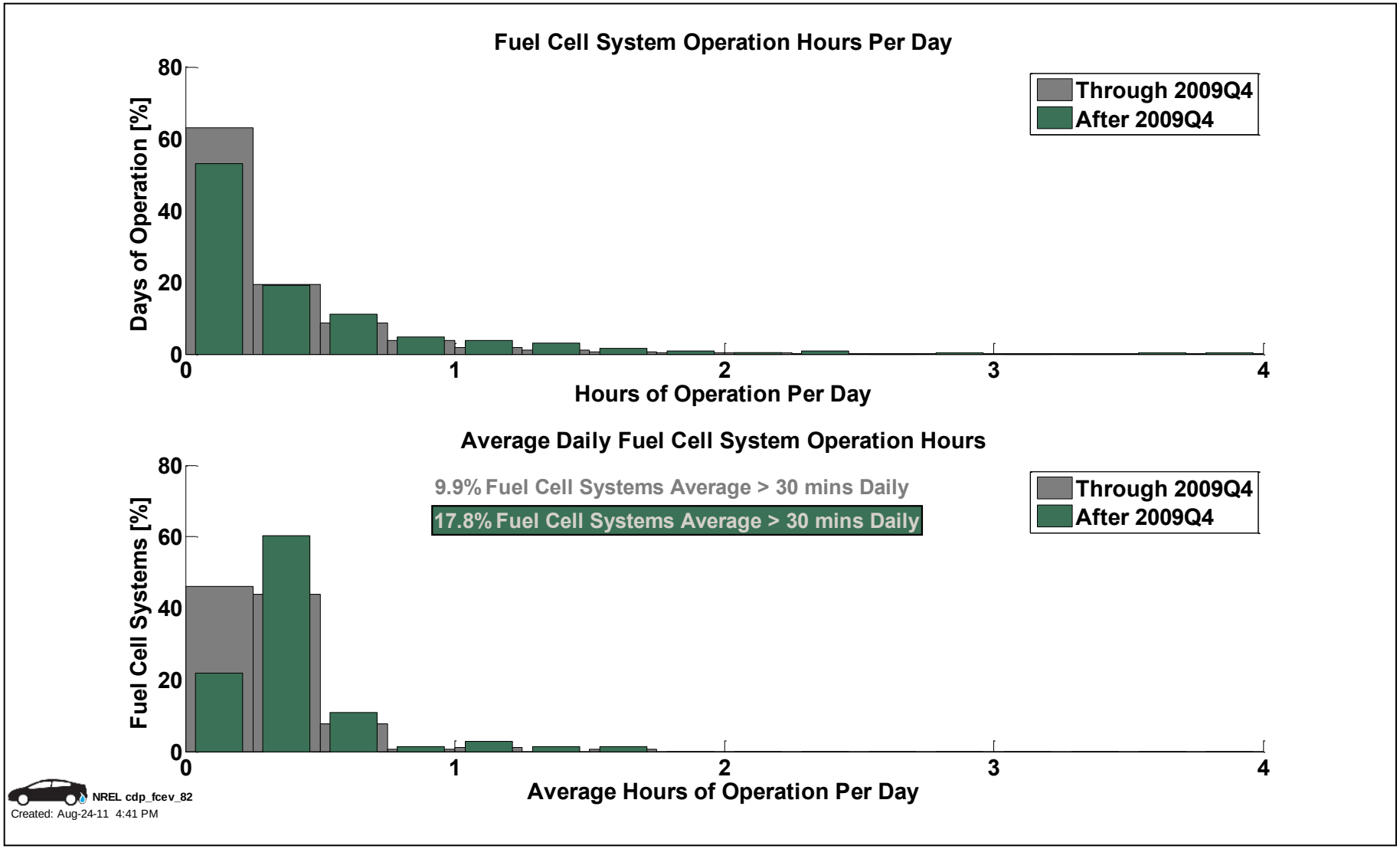
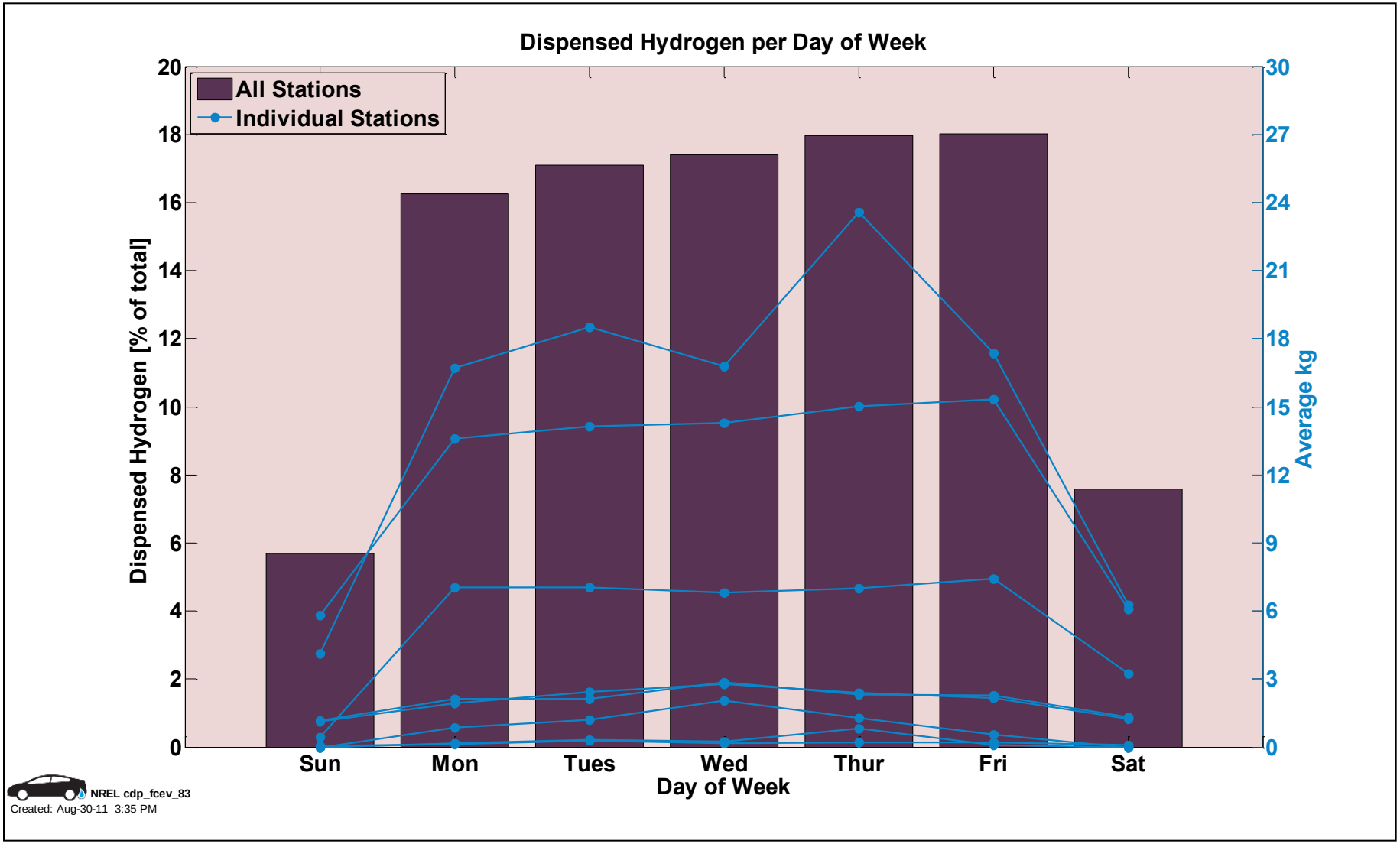
CDP#81: Average Trip Speed



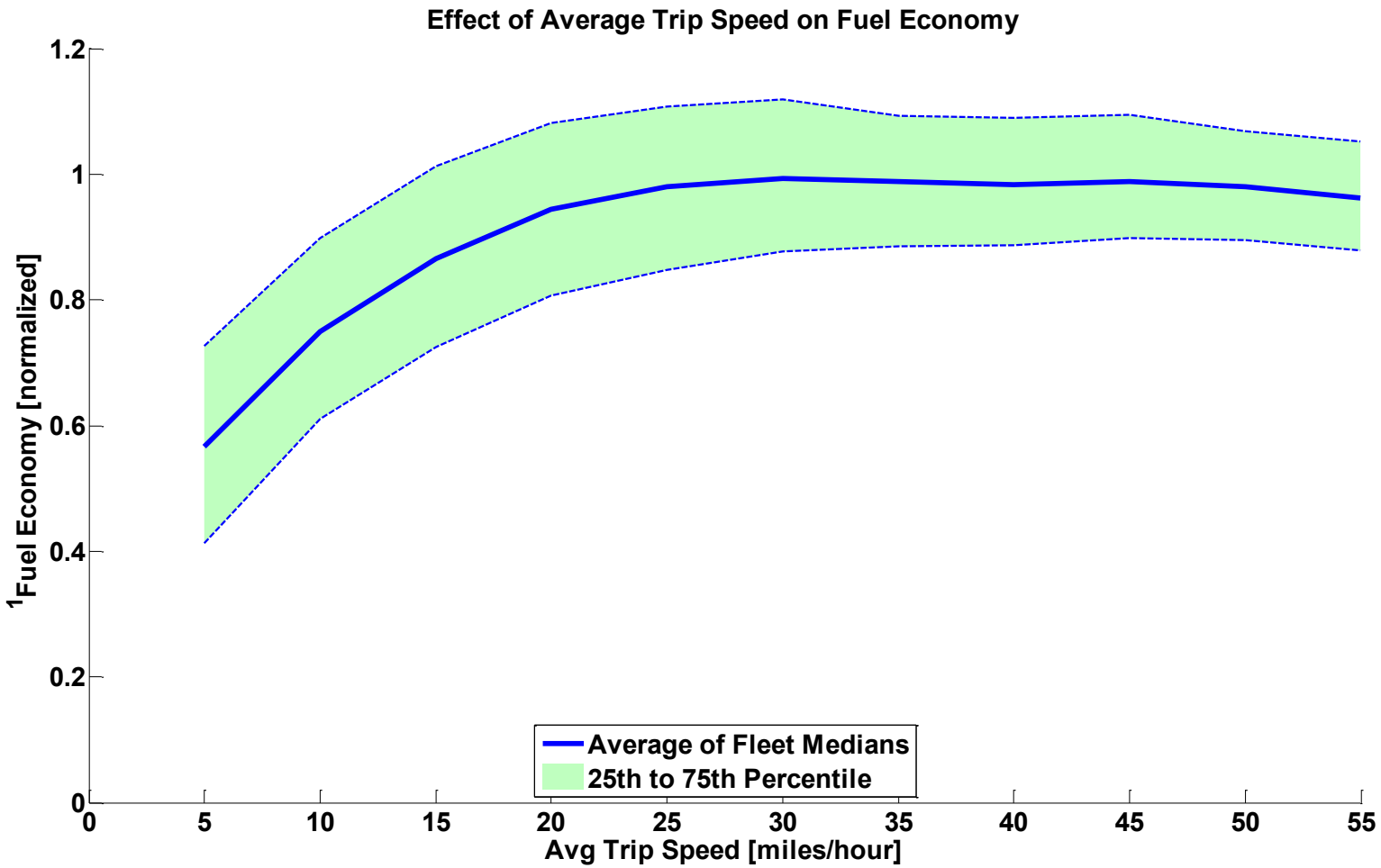
CDP#82: Daily FC Operation Hours in Automotive Application



CDP#83: Hydrogen Dispensed by Day of Week



CDP#84: Effect of Average Trip Speed on Fuel Economy



(1) Data after 2009Q4. The data has been normalized to the max of the median curve for each fleet. Data binned every 5 mph for calculating median and percentiles.

NREL cdp_fcev_84
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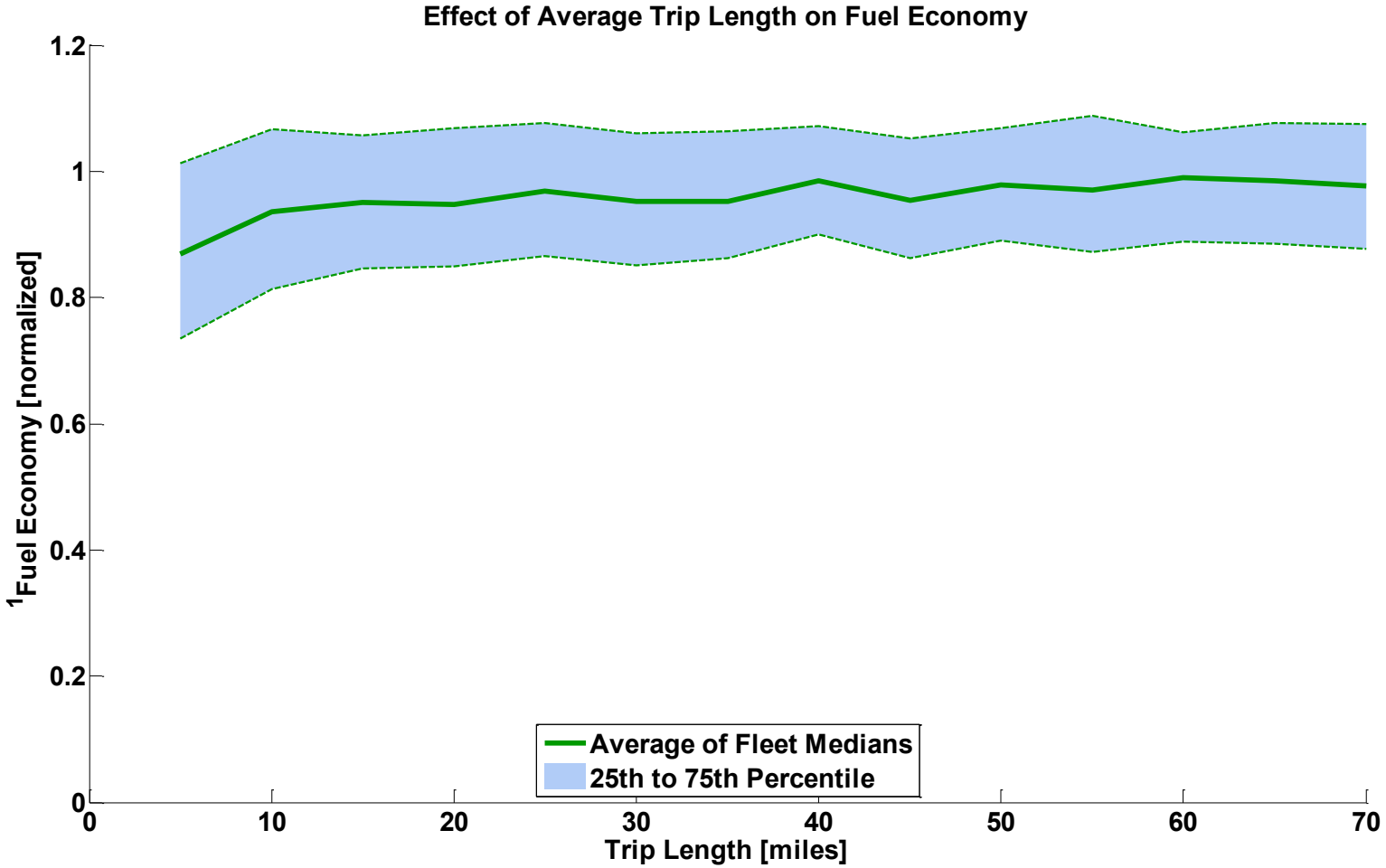
CDP#85: Effect of Trip Length on Fuel Economy



(1) Data after 2009Q4. The data has been normalized to the max of the median curve for each fleet. Data binned every 5 miles for calculating median and percentiles.

NREL cdp_fcev_85
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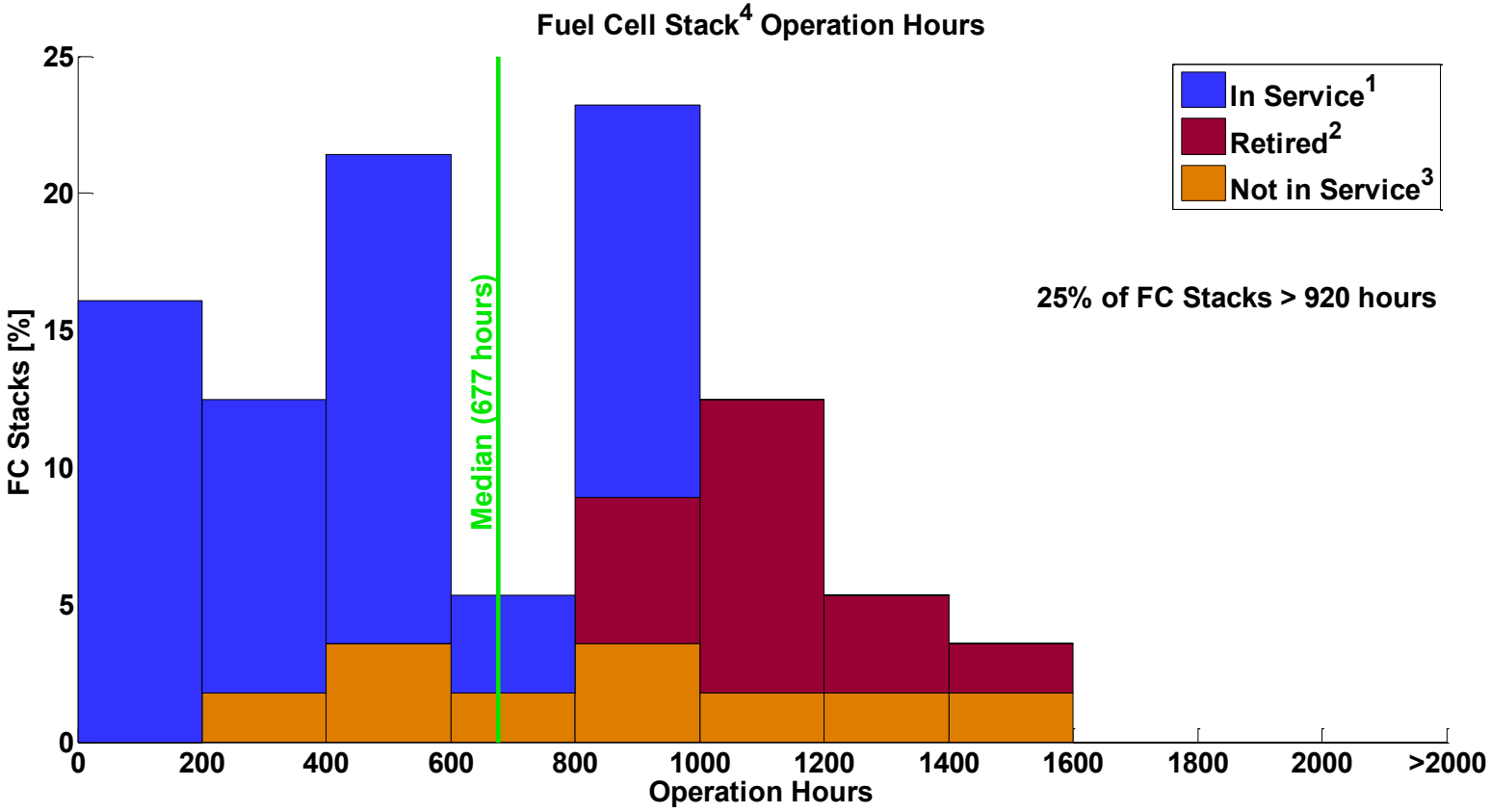
CDP#86: Fuel Cell Stack Operation Hours



1) Stacks that are in service and accumulating operation hours.
2) Stacks retired due to low-performance or catastrophic failure.
3) Indicates stacks that are no longer accumulating hours either a) temporarily or b) have been retired for non- stack performance related issues or c)removed from DOE program.
4) Only includes systems operating after 2009Q4.

NREL cdp_fcev_86
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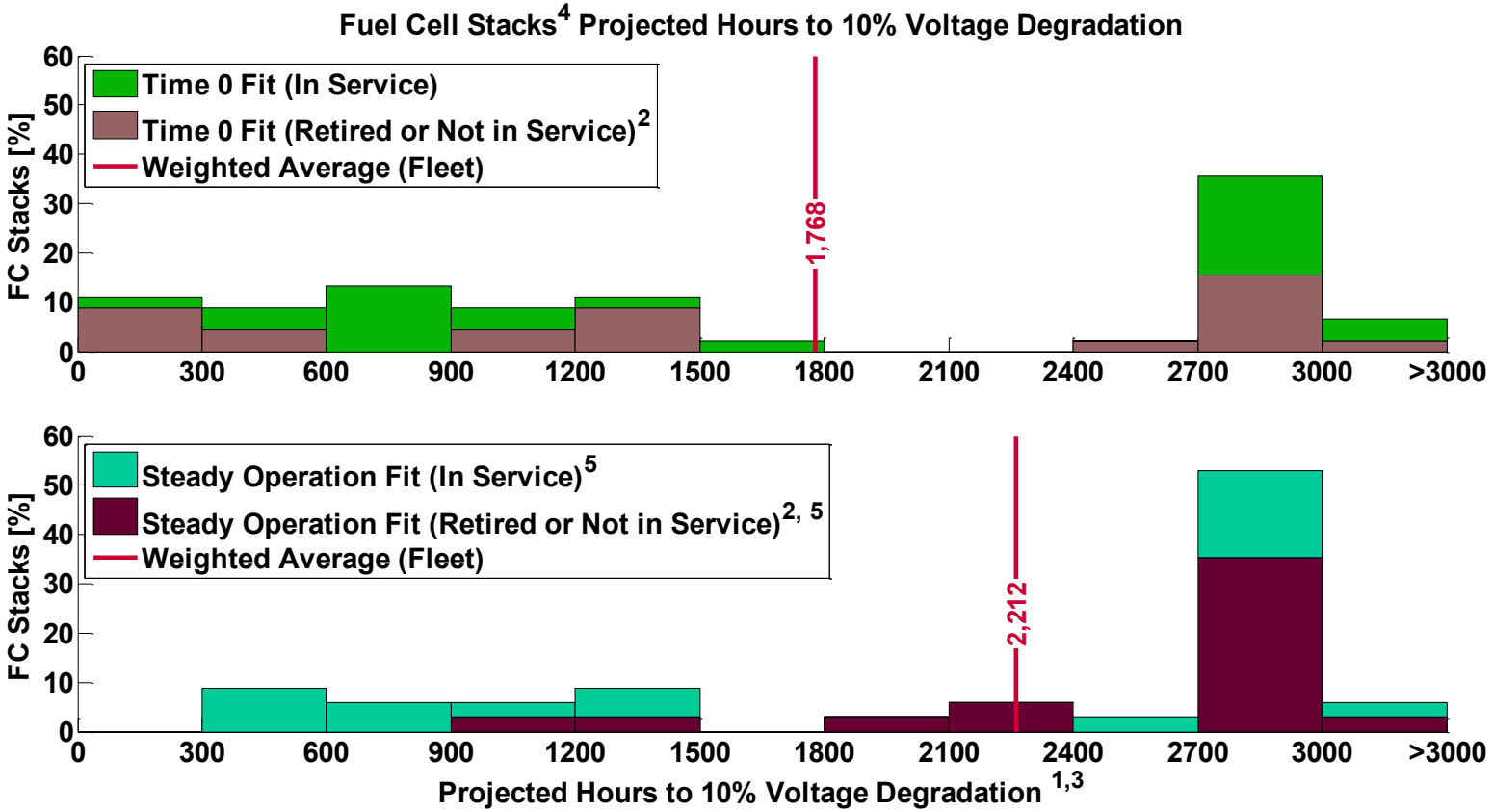
CDP#87: Fuel Cell Stacks Projected Hours to 10% Voltage Degradation with Two Fits



1) Projection using field data, calculated at high stack current, from operation hour 0 or a steady operation period. Projected hours may differ from an OEM's end-of-life criterion and does not address "catastrophic" failure modes.
2) Indicates stacks that are no longer accumulating hours either a) temporarily or b) have been retired for non- stack performance related issues or c) removed from DOE program.
3) Projected hours limited based on demonstrated hours.
4) Only includes systems operating after 2009Q4.
5) Not all stacks have a steady operation fit which is calculated from data after 200 hr break-in period. The steady operation starting hour is an approximation of the period after initial break-in where degradation levels to a more steady rate.

NREL cdp_fcev_87
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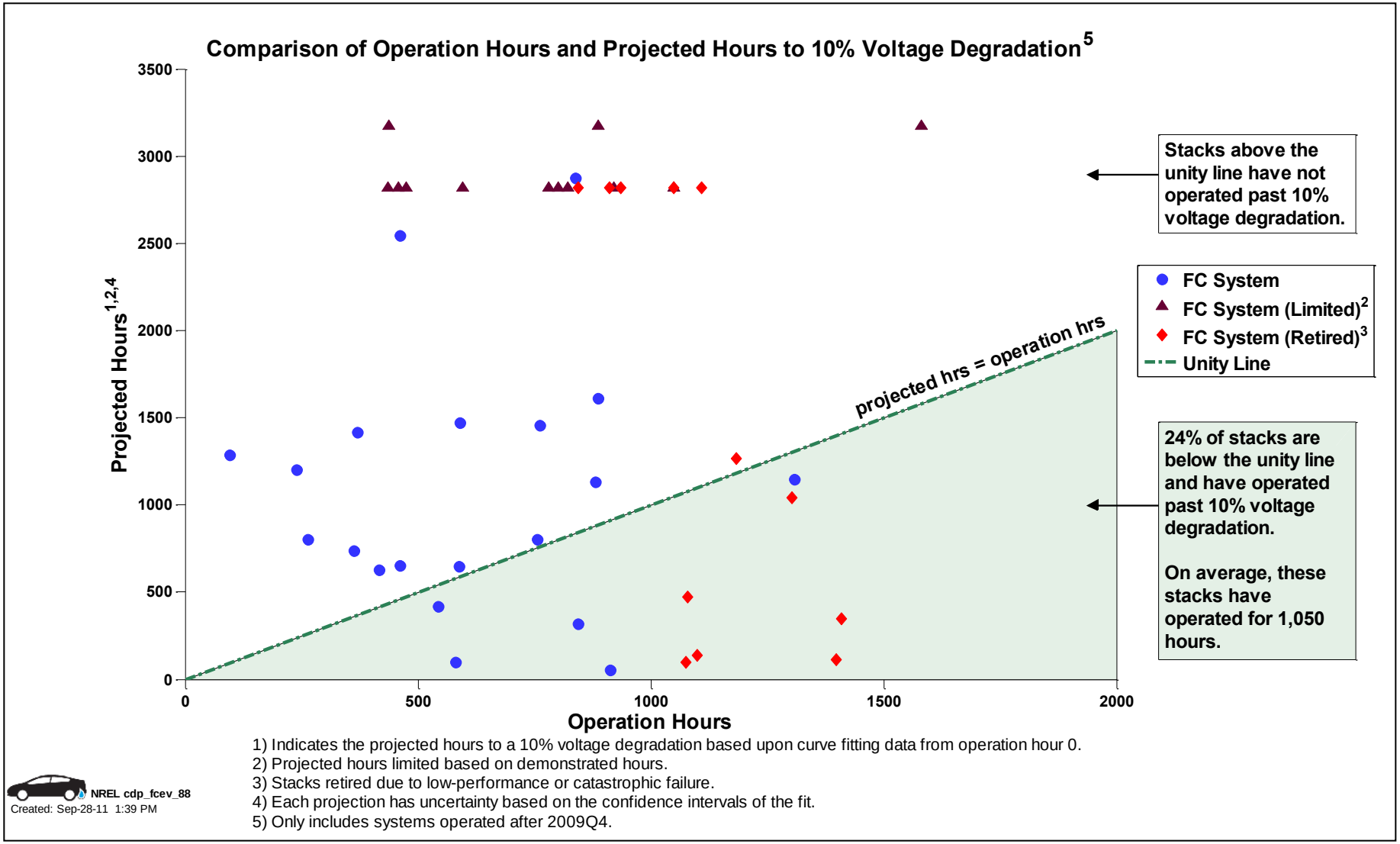
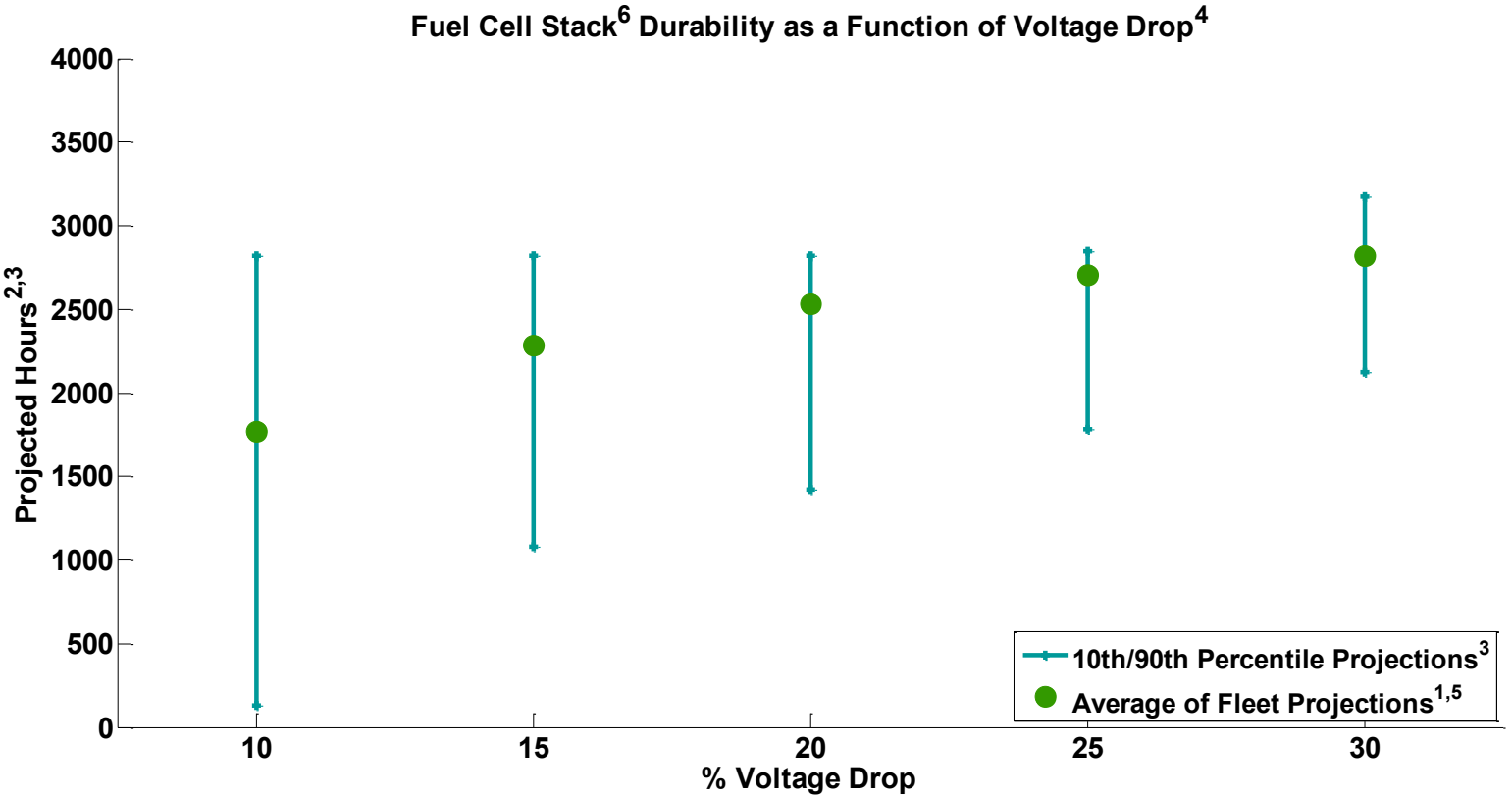
CDP#88: Comparison of Fuel Cell Operation Hours and Projected Hours to 10% Voltage Degradation



CDP#89: Fuel Cell Stack Durability as a Function of Voltage Drop



1) 10% Voltage degradation is a DOE metric for assessing fuel cell performance not an indication of an OEM's end-of-life criteria.
2) Projections using field data and calculated at high stack current.
3) 10th and 90th percentiles spans the range of stack projection. The included stacks satisfy a minimum number of operation hours and weighting factor.
4) The projected hours vary based on the percentage of voltage degradation, but the projected hours do not imply that all stacks will (or do) operate to these voltage degradation levels.
5) Each fleet has one voltage projection value that is the weighted average of the fleet's fuel cell stack projections.
6) Only includes systems operated after 2009Q4.

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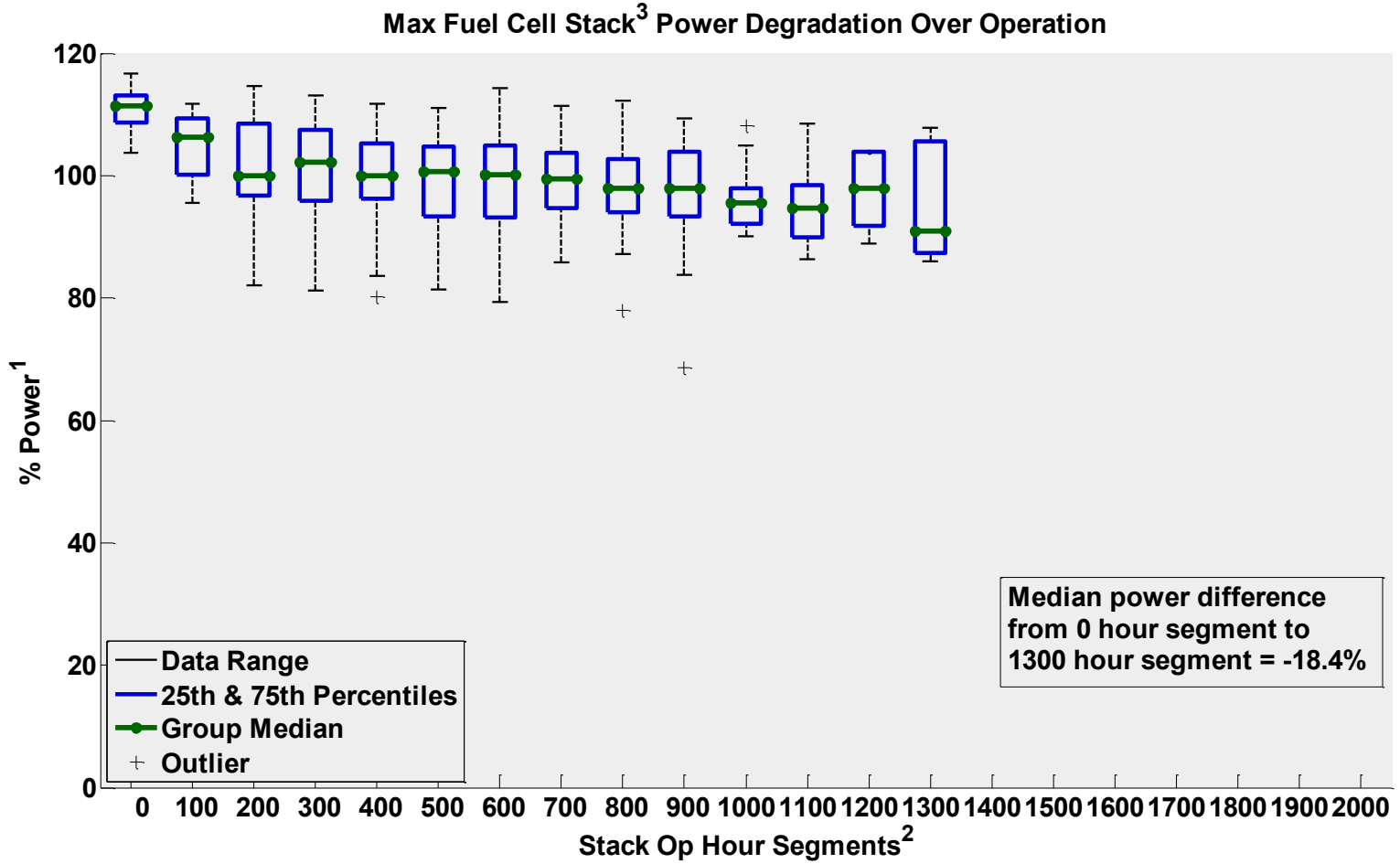
CDP#90: Max Fuel Cell Stack Power Degradation Over Operation



1) Normalized by fleet median value at 200 hours.
2) Each segment point is median FC power (+-50 hrs). Box not drawn if fewer than 3 points in segment.
3) Only includes systems operated after 2009Q4.

NREL cdp_fcev_90
Created: Sep-23-11 10:14 AM