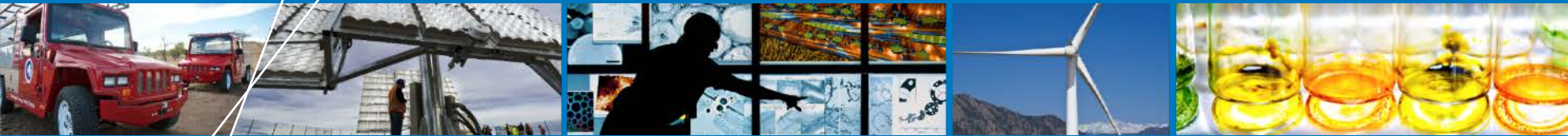


ARRA Material Handling Equipment Composite Data Products Data through Quarter 3 of 2014



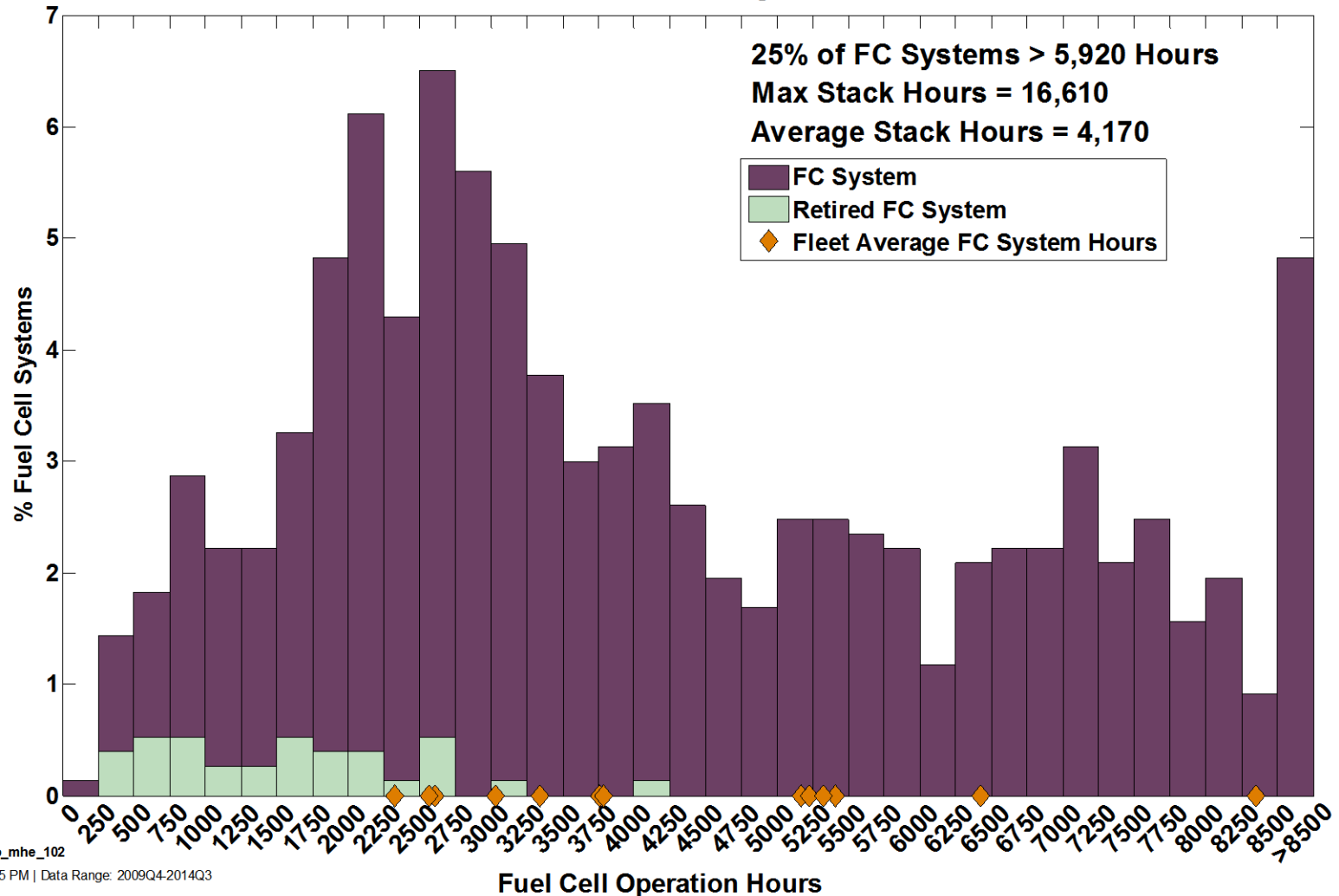
Chris Ainscough, Jennifer Kurtz

May 2015

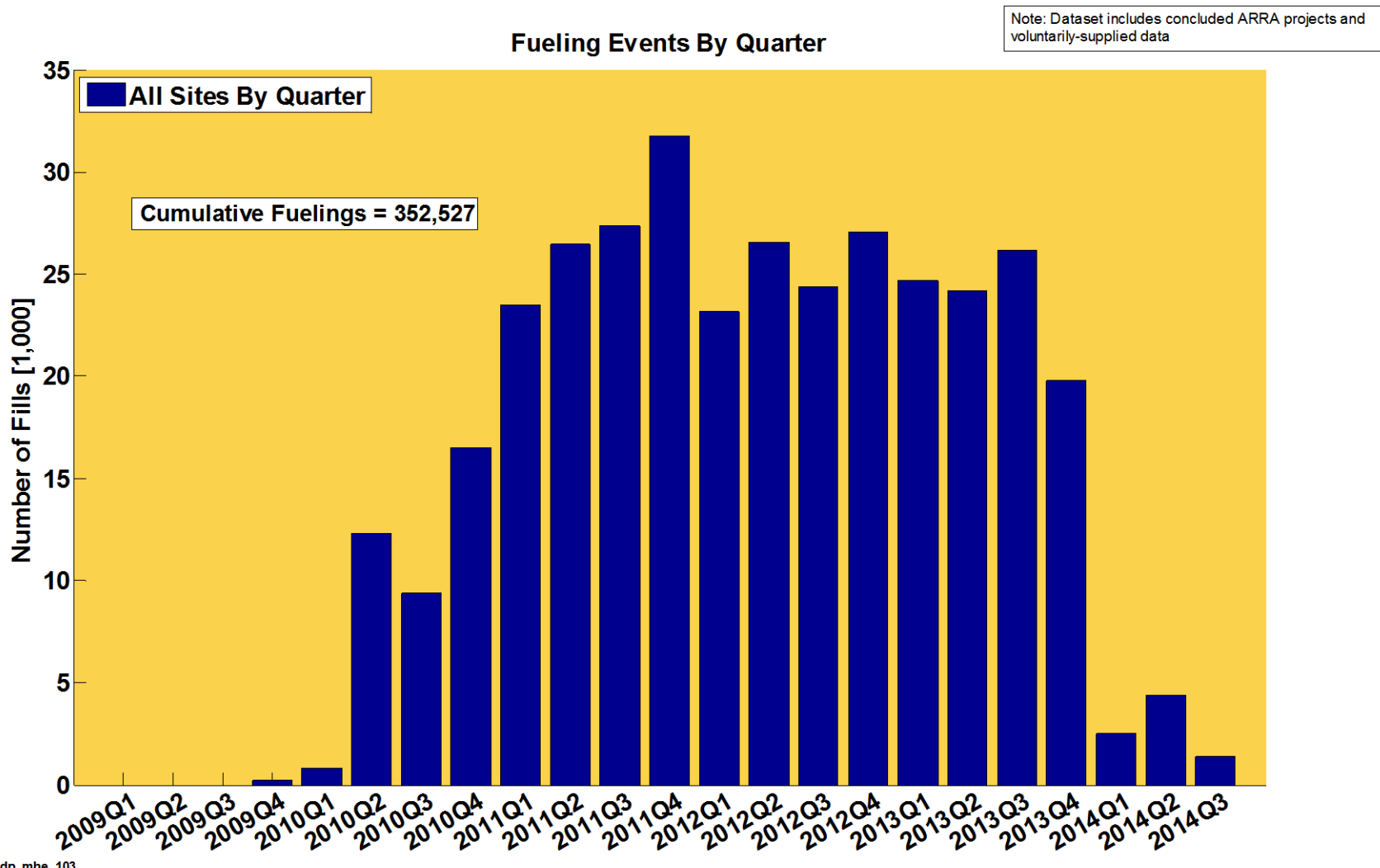
Fuel Cell System Operation Hours

Cumulative Fuel Cell Operation Hours
Combined Fleet Through 2014Q3

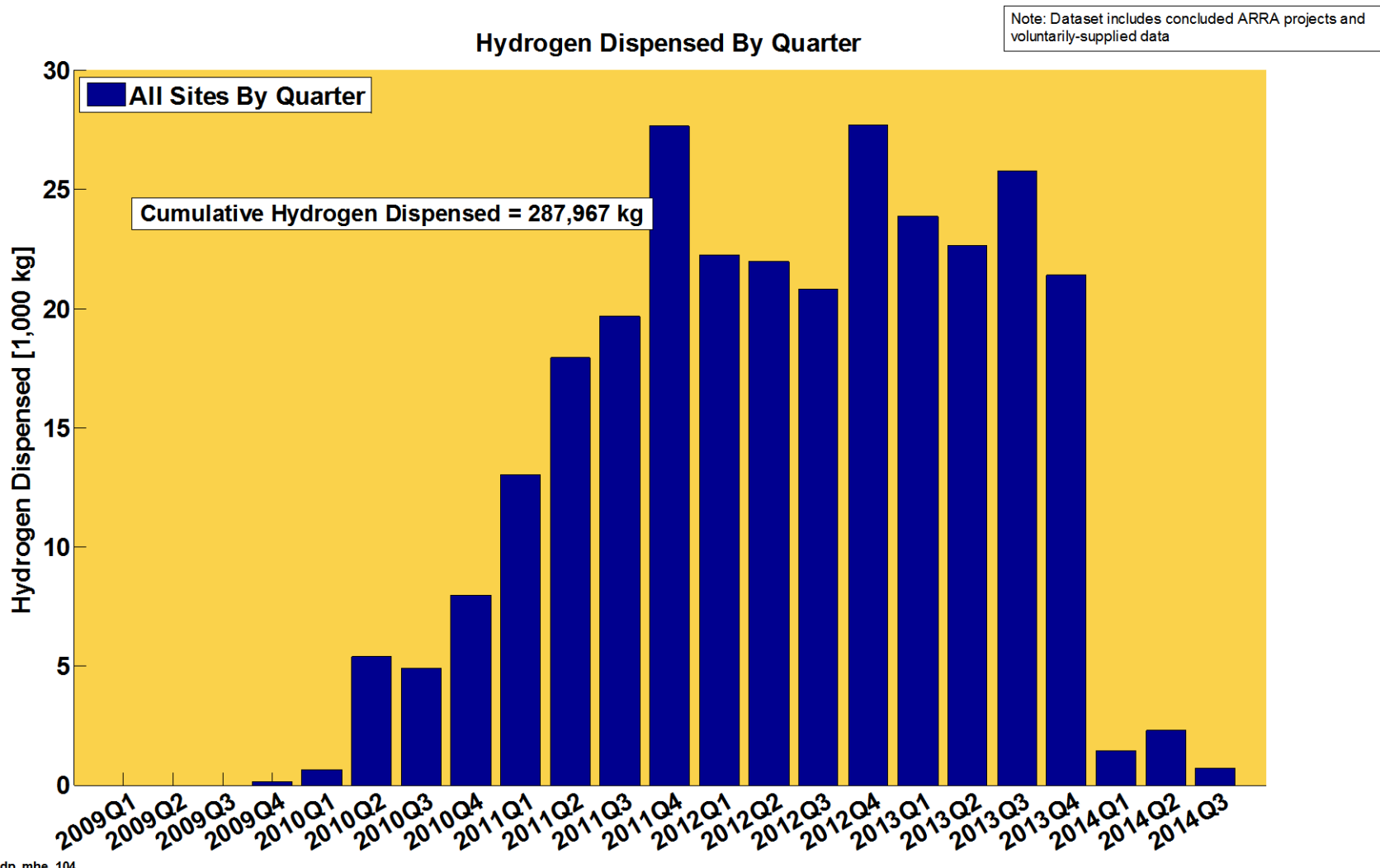
Note: Dataset includes concluded ARRA projects and voluntarily-supplied data



Fueling Events by Quarter



Hydrogen Dispensed by Quarter

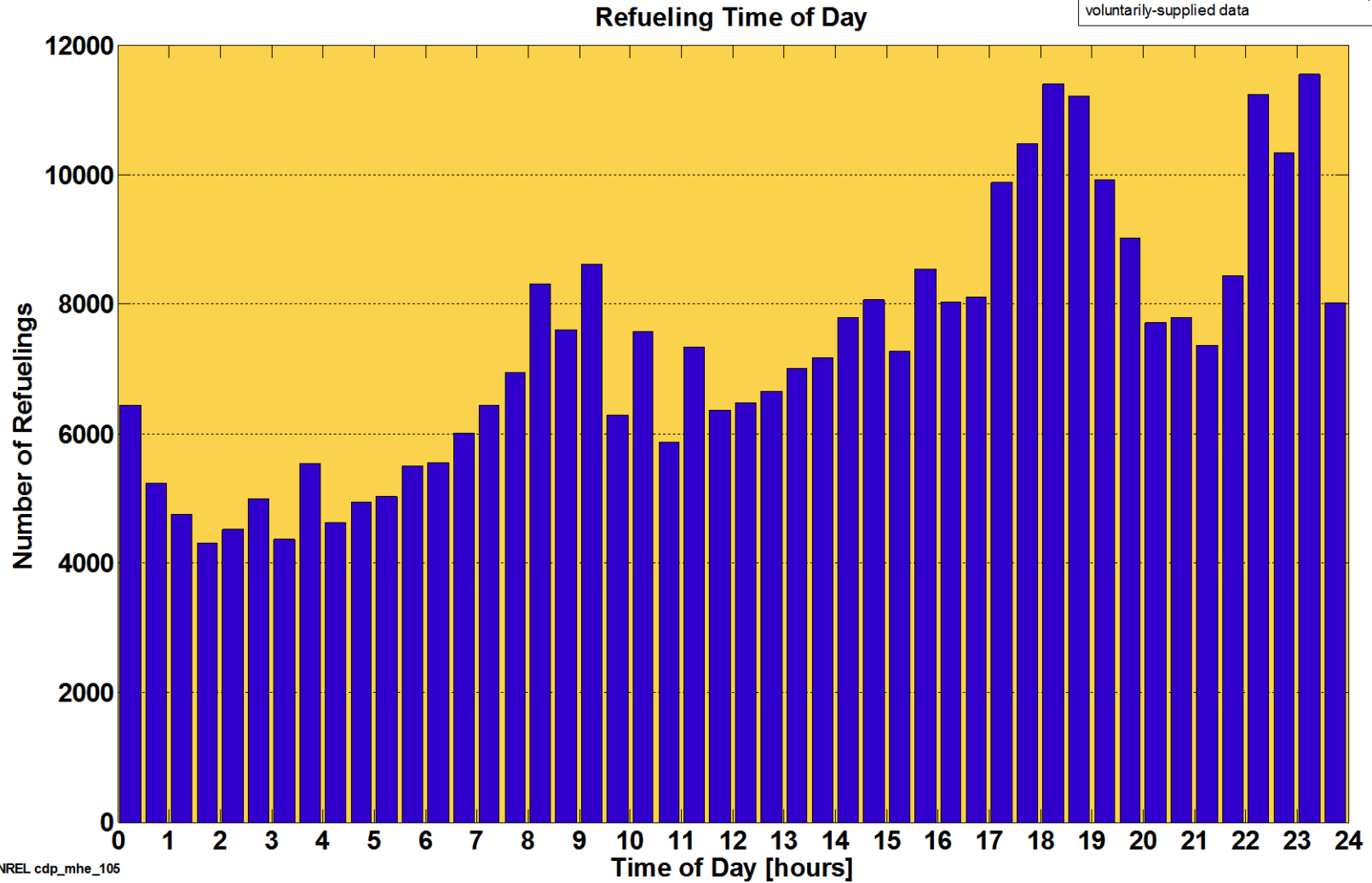


NREL cdp_mhe_104

Created: Mar-31-15 4:15 PM | Data Range: 2009Q4-2014Q3

Refueling Time of Day

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data



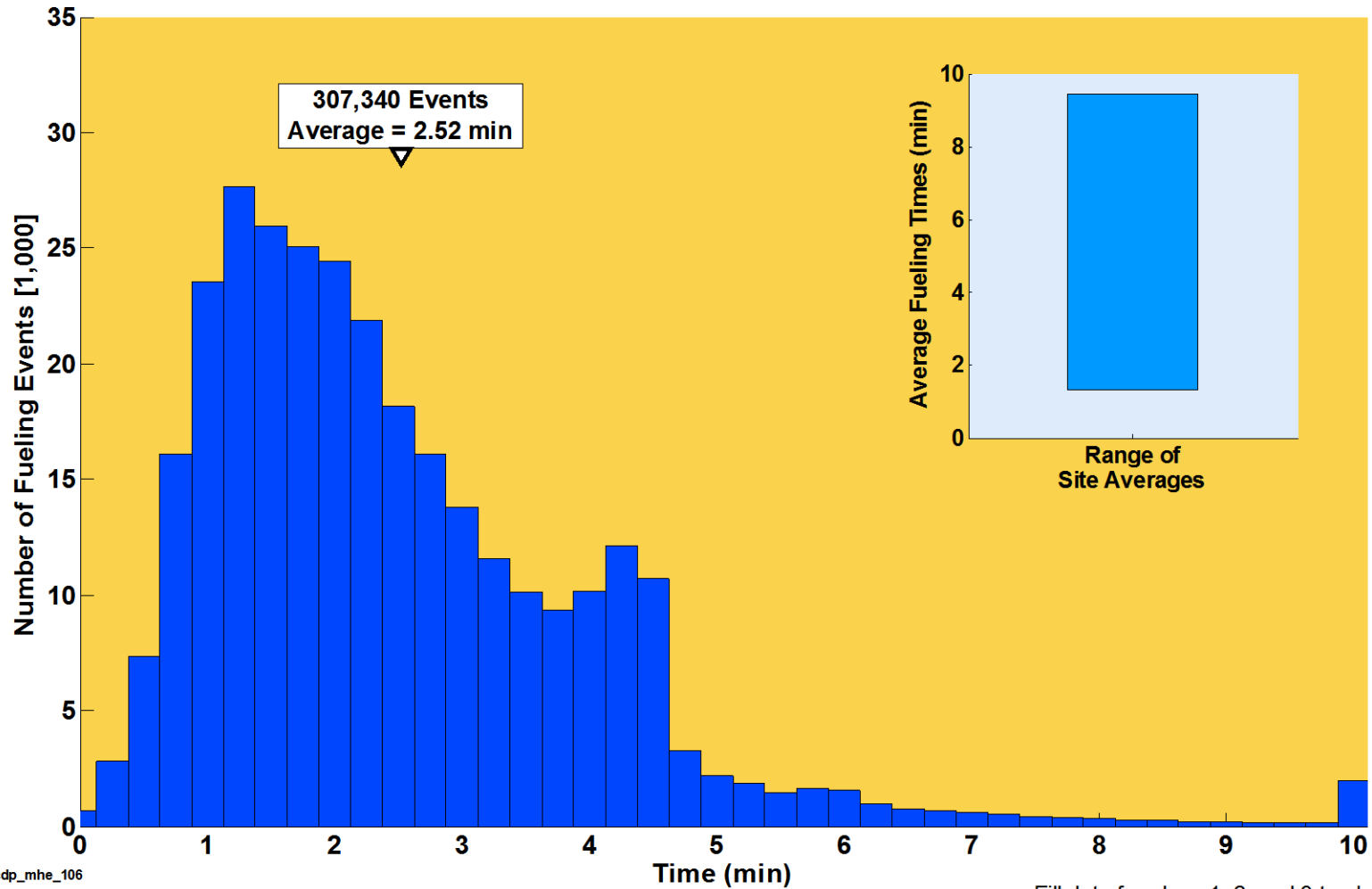
NREL cdp_mhe_105

Created: Mar-31-15 4:19 PM | Data Range: 2009Q4-2014Q3

Histogram of Fueling Times

Histogram of Fueling Times Combined Fleet

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data

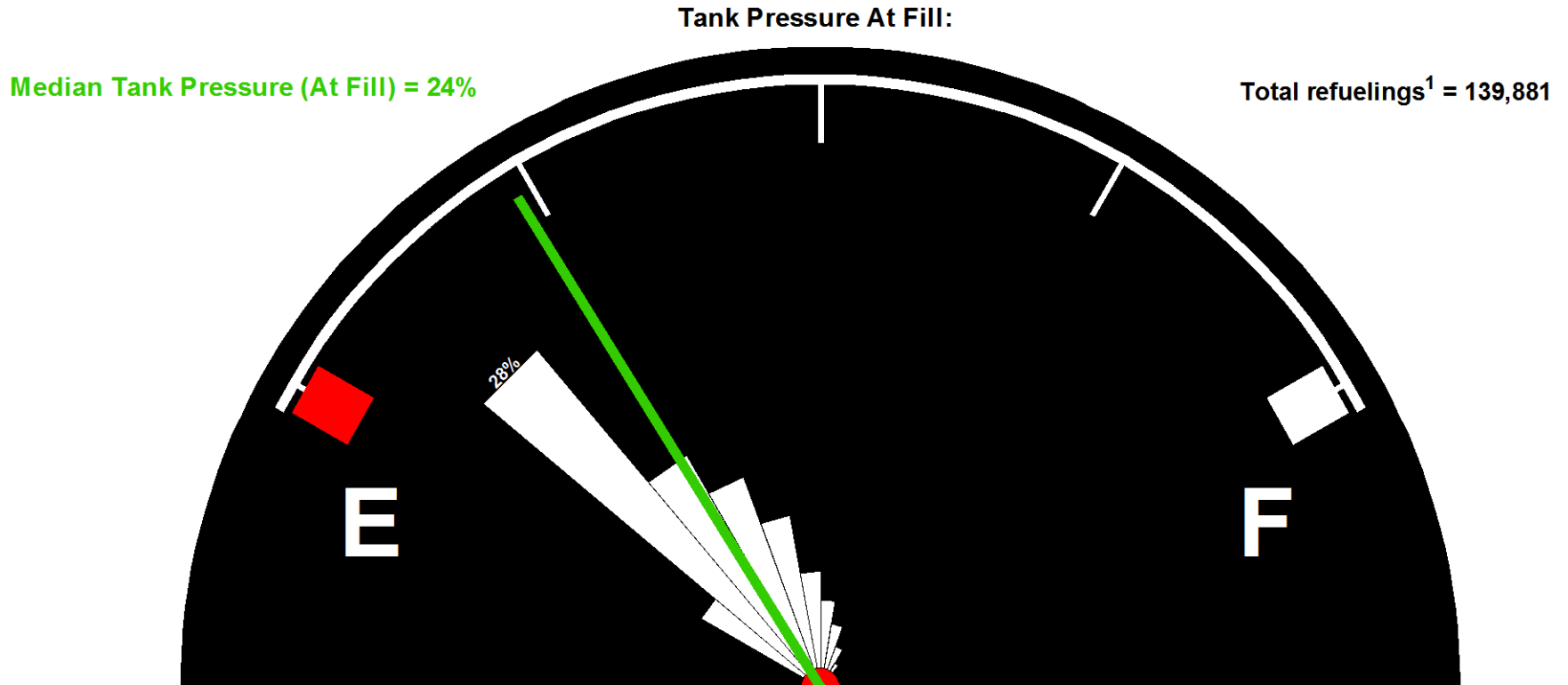


Fill data for class 1, 2, and 3 trucks



Tank Pressure Level at Fueling

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data



1. Some refueling events not recorded/detected due to data noise or incompleteness.
2. The outer arc is set at 40% total refuelings.
3. Full Pressure is either 3600 psi or 5000 psi.



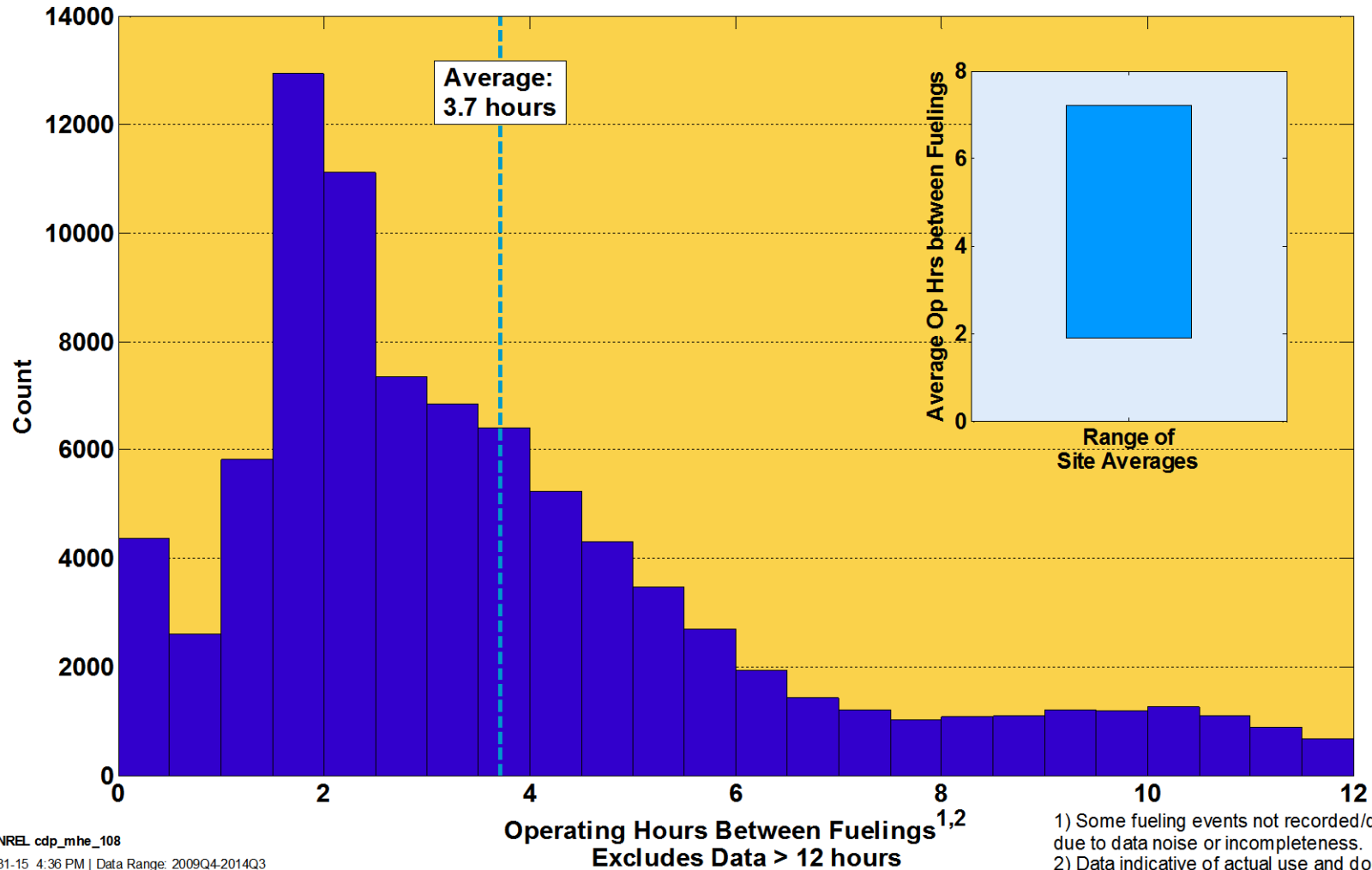
NREL cdp_mhe_107

Created: Mar-31-15 4:35 PM | Data Range: 2009Q4-2014Q3

Operation Time between Fueling

Operating Time Between Fuelings Combined Fleet

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data



NREL cdp_mhe_108

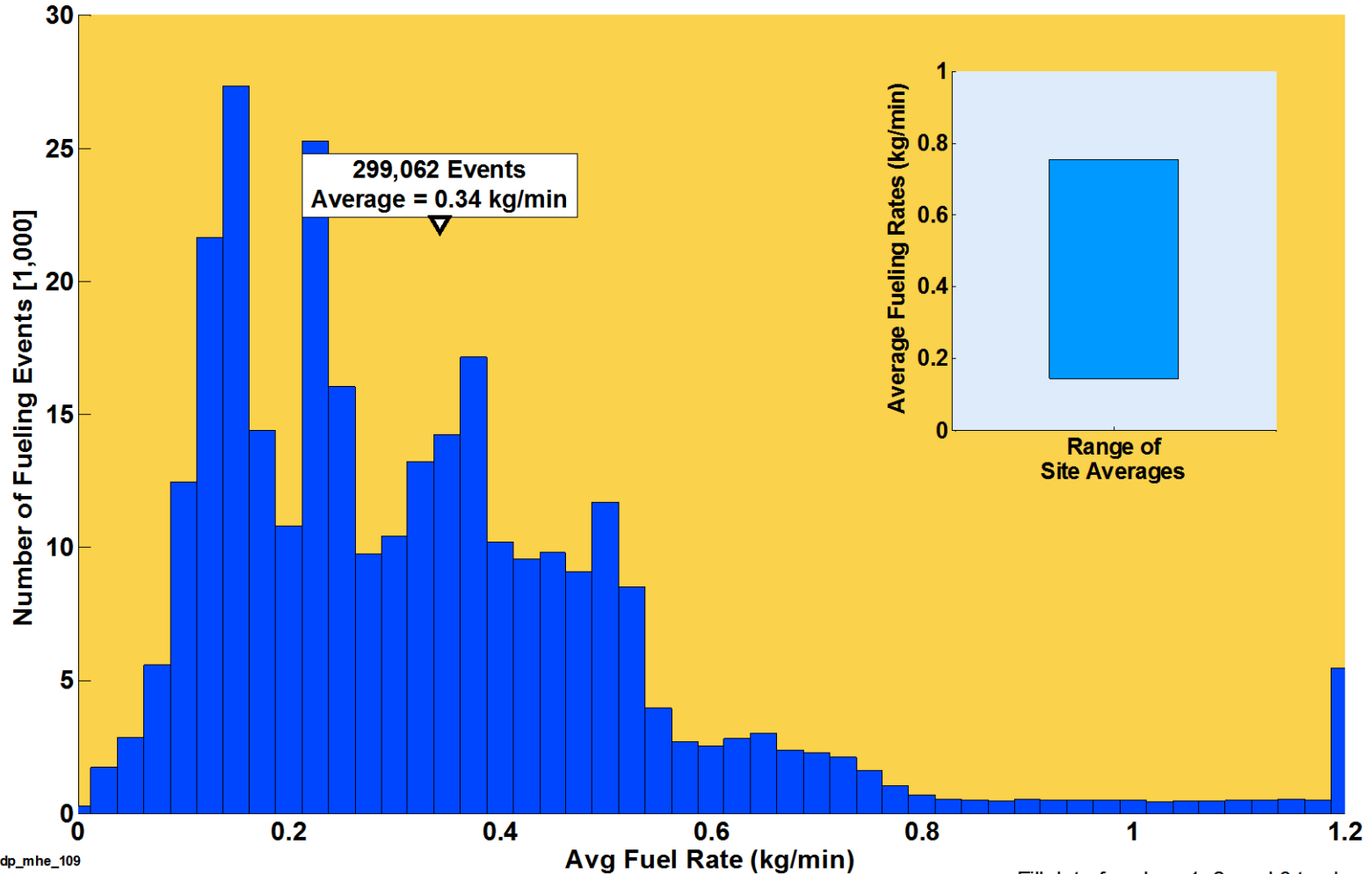
Created: Mar-31-15 4:36 PM | Data Range: 2009Q4-2014Q3

- 1) Some fueling events not recorded/detected due to data noise or incompleteness.
- 2) Data indicative of actual use and does not represent the max capability of the systems.

Histogram of Fueling Rates

Histogram of Fueling Rates Combined Fleet

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data



NREL cdp_mhe_109

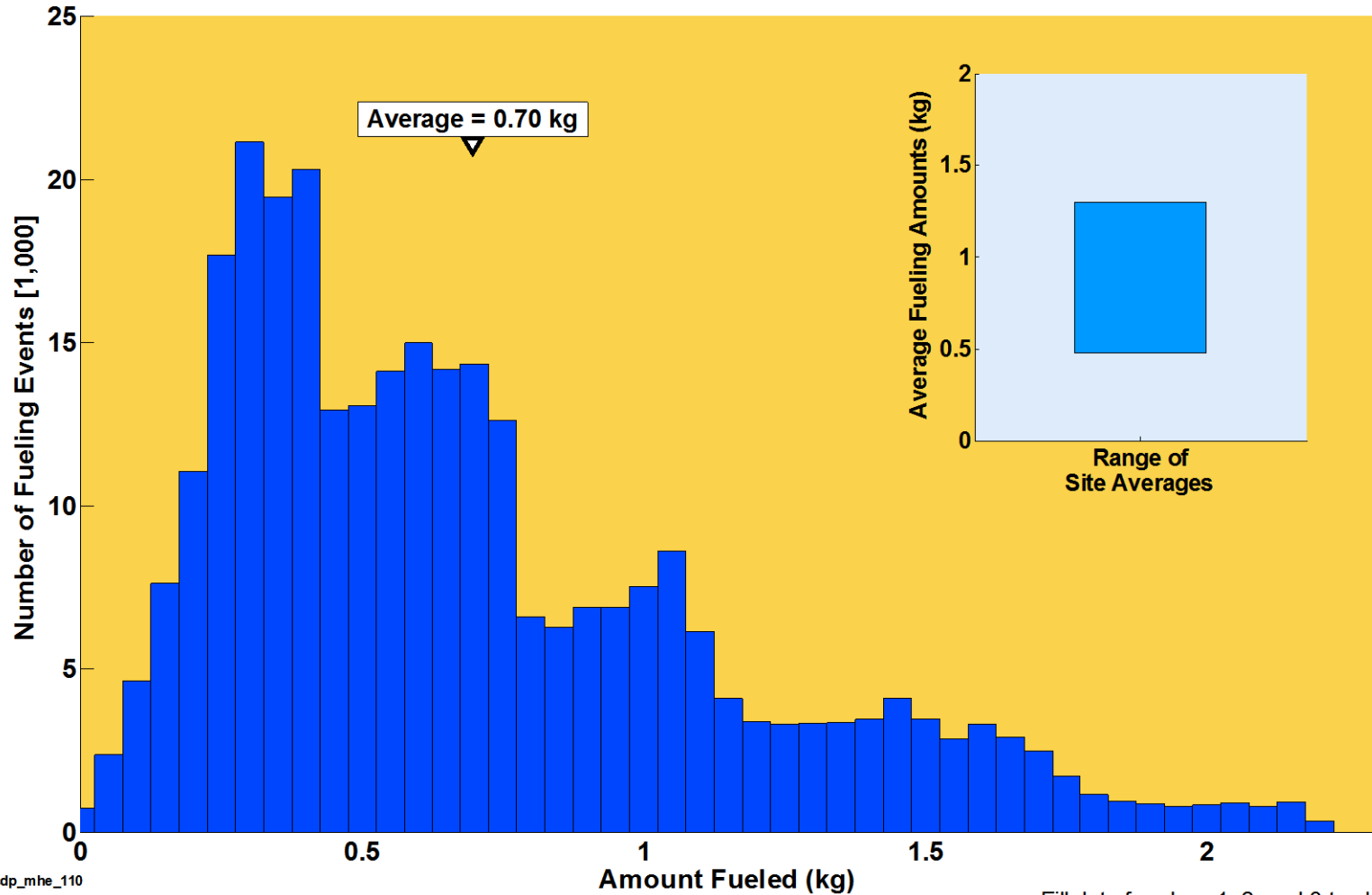
Created: Mar-31-15 4:43 PM | Data Range: 2009Q4-2014Q3

Fill data for class 1, 2, and 3 trucks

Histogram of Fueling Amounts

Histogram of Fueling Amounts Combined Fleet

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data

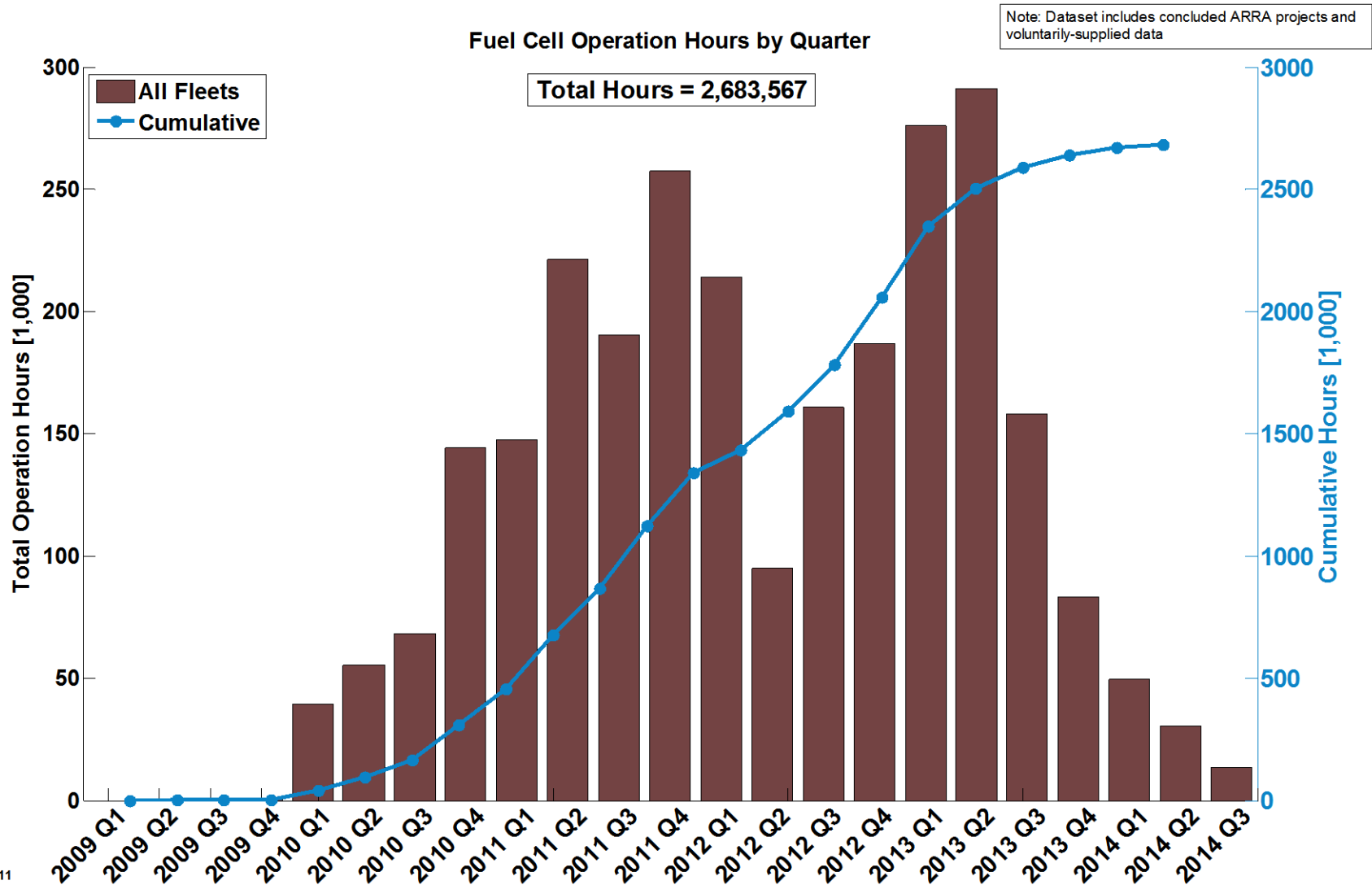


Fill data for class 1, 2, and 3 trucks



CDP-MHE-111

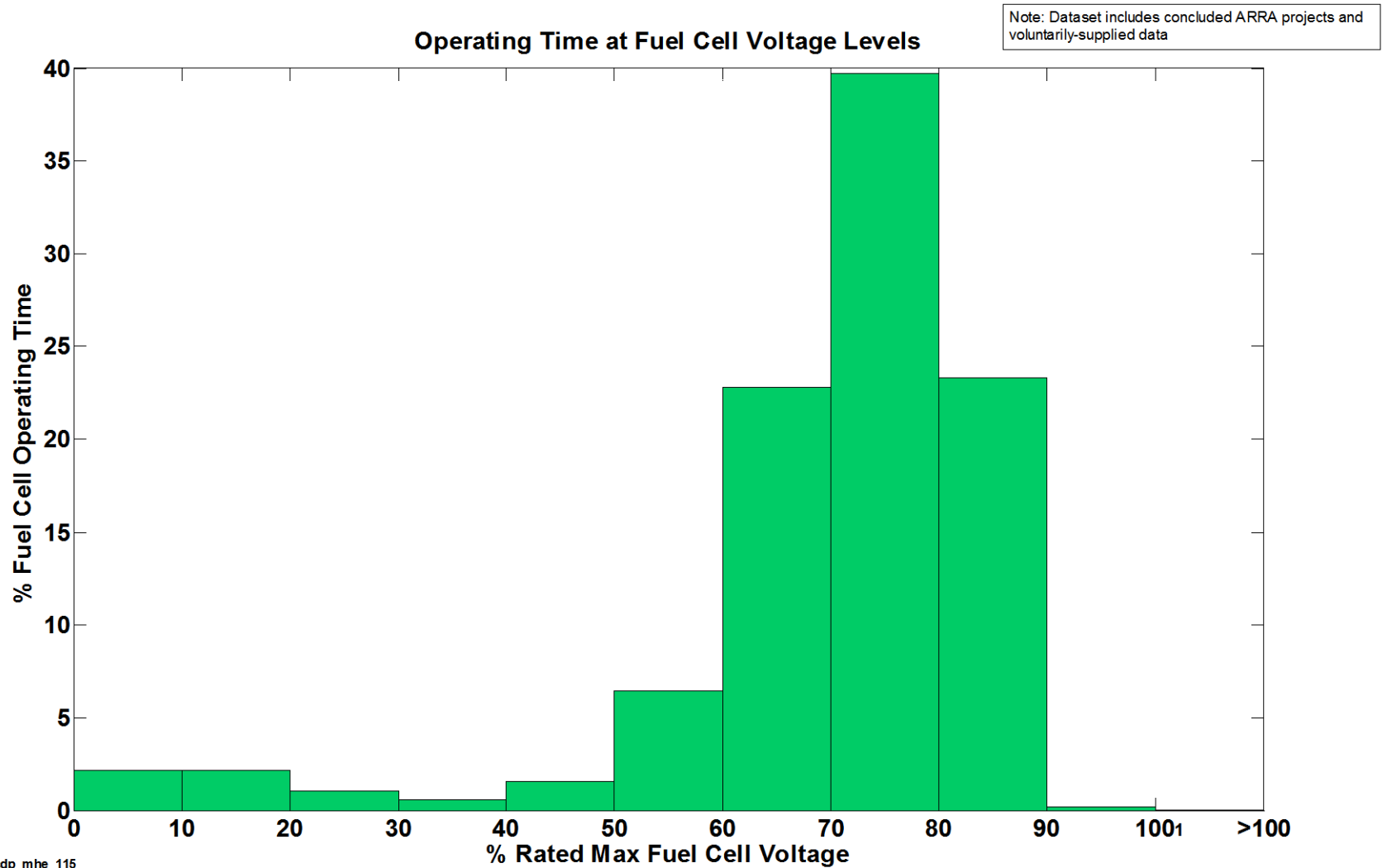
Fuel Cell Operation Hours by Quarter



NREL_cdp_mhe_111

Created: May-07-15 9:25 AM | Data Range: 2009Q4-2014Q3

Operating Time at Fuel Cell Voltage Levels

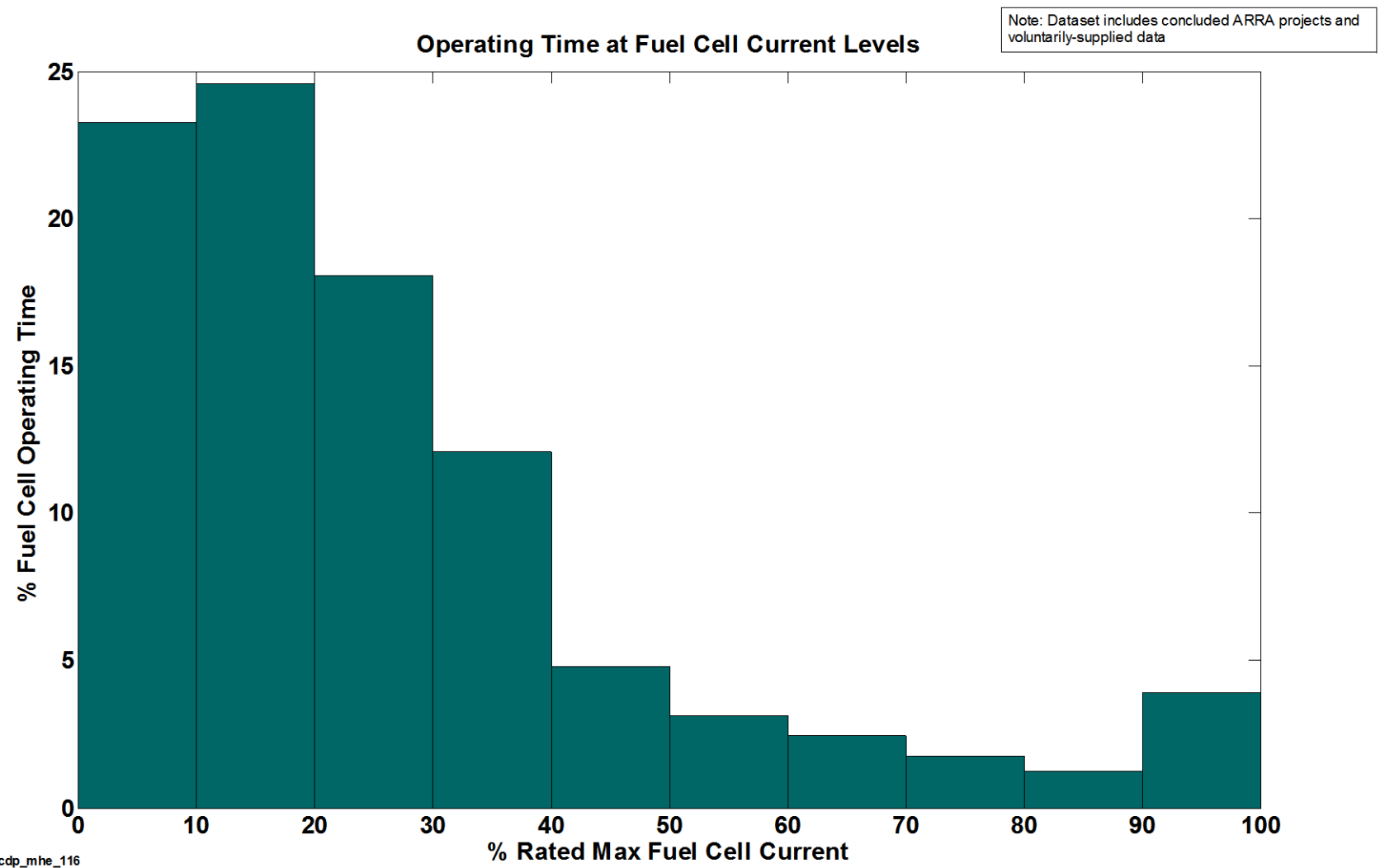


NREL.cdp_mhe_115

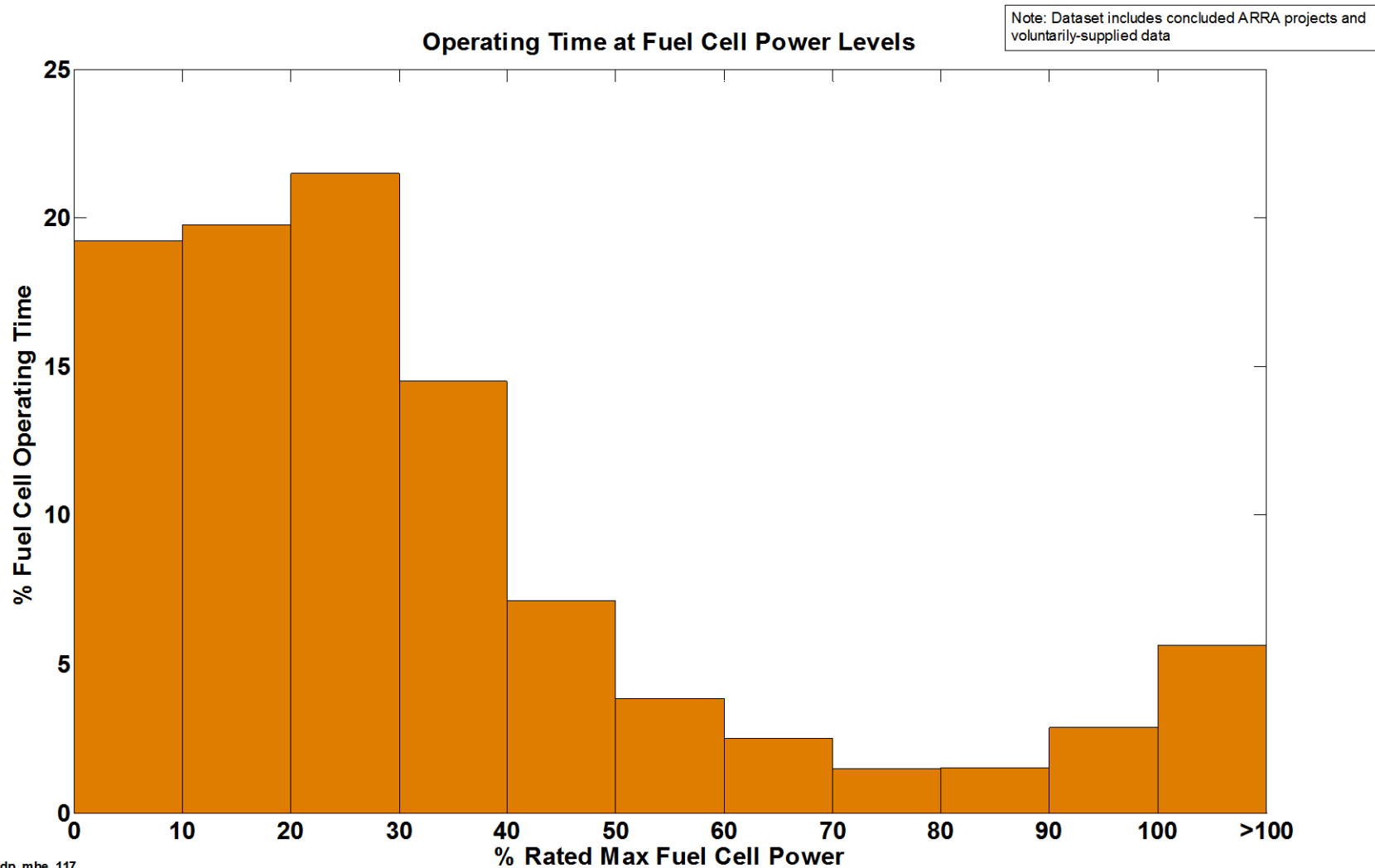
Created: Mar-31-15 5:04 PM | Data Range: 2009Q4-2014Q3

1) 100% max fuel cell voltage is approximately open-circuit voltage

Operating Time at Fuel Cell Current Levels

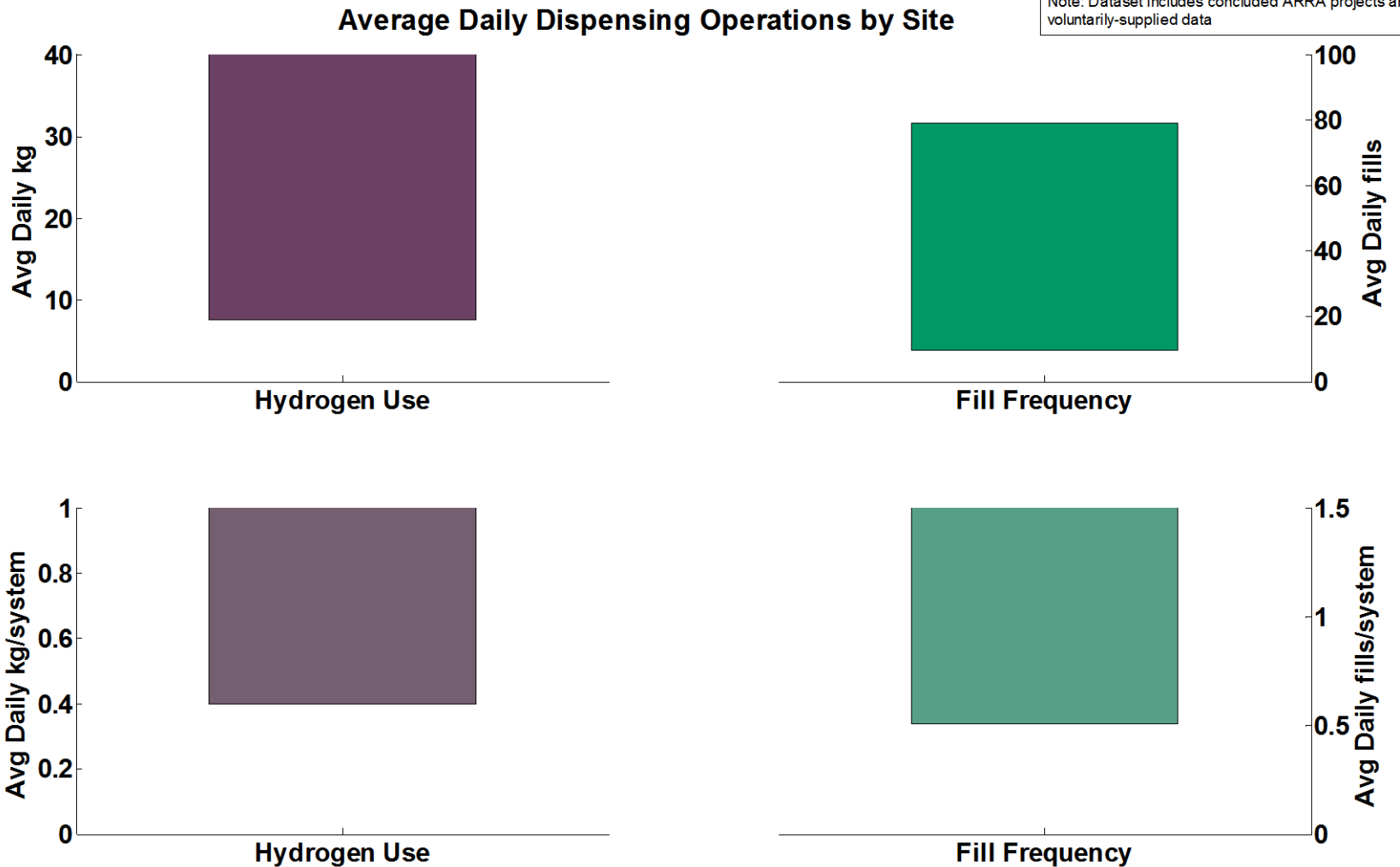


Operating Time at Fuel Cell Power Levels



Average Daily Dispensing Operations by Site

Note: Dataset includes concluded ARRA projects and voluntarily-supplied data



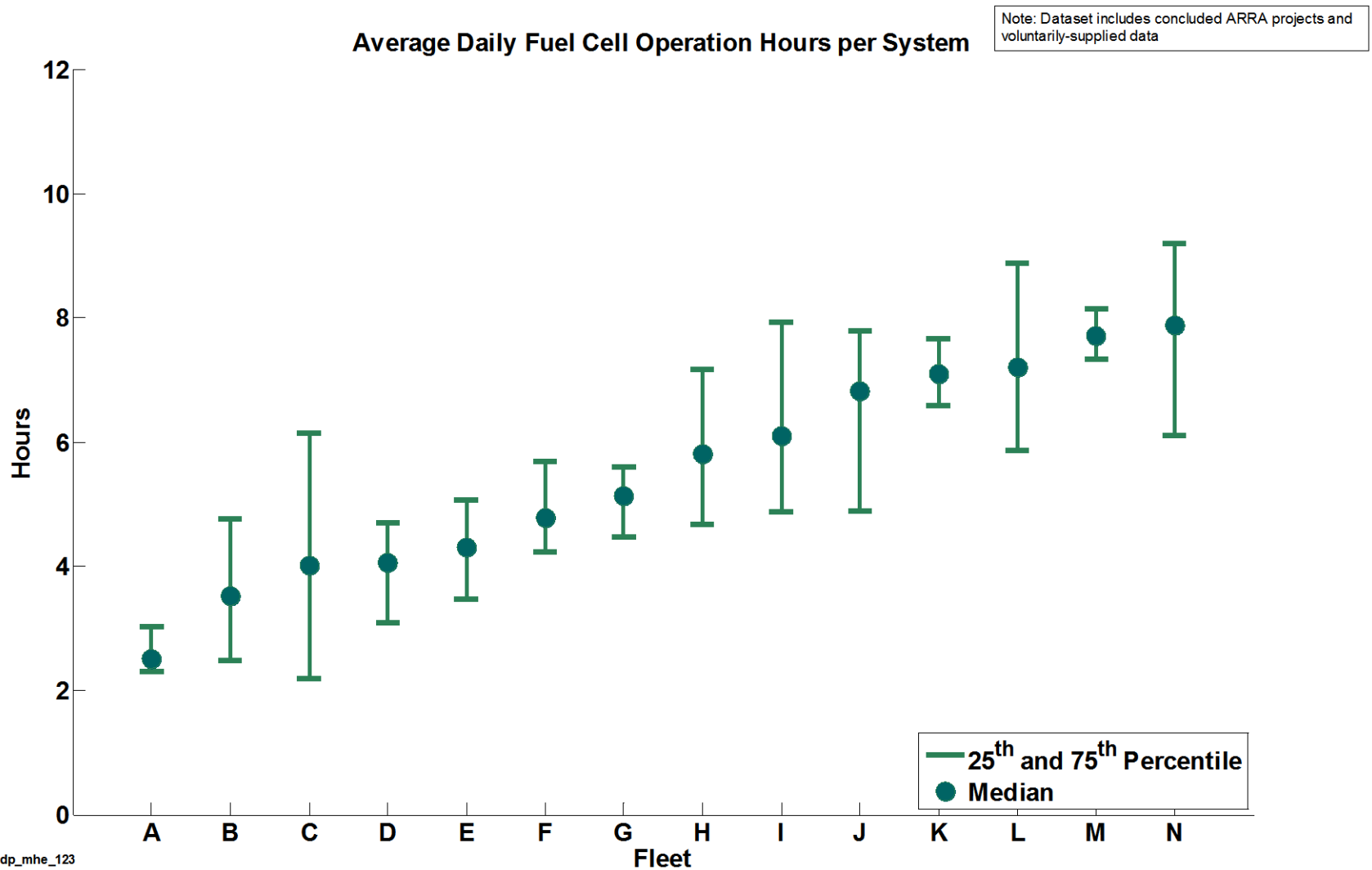
NREL cdp_mhe_122

Created: Mar-31-15 5:06 PM | Data Range: 2009Q4-2014Q3

Shaded areas represent the min and max site average hydrogen use and fill frequency

CDP-MHE-123

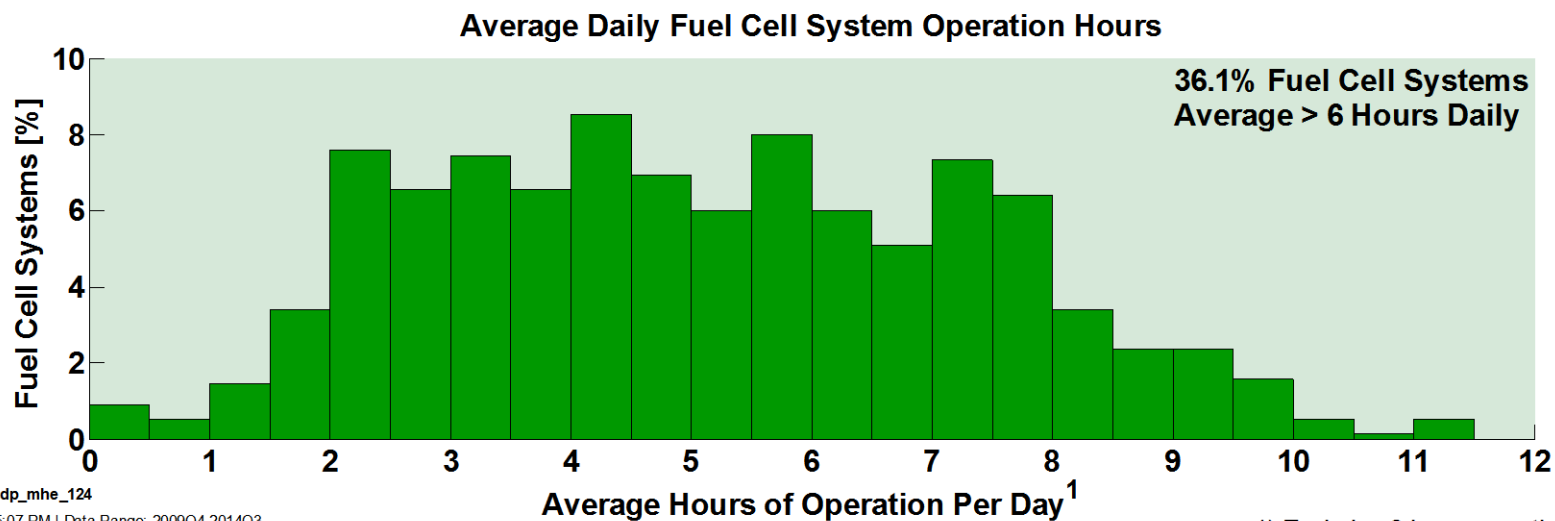
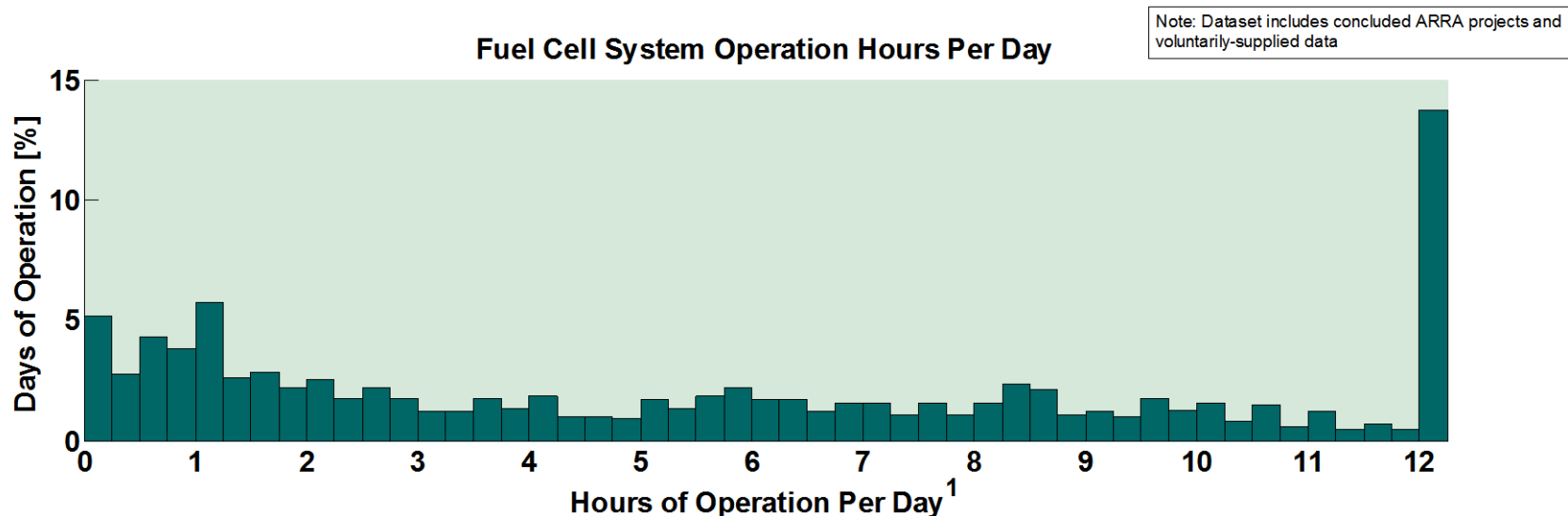
Average Daily Fuel Cell Operation Hours per Fleet



NREL cdp_mhe_123

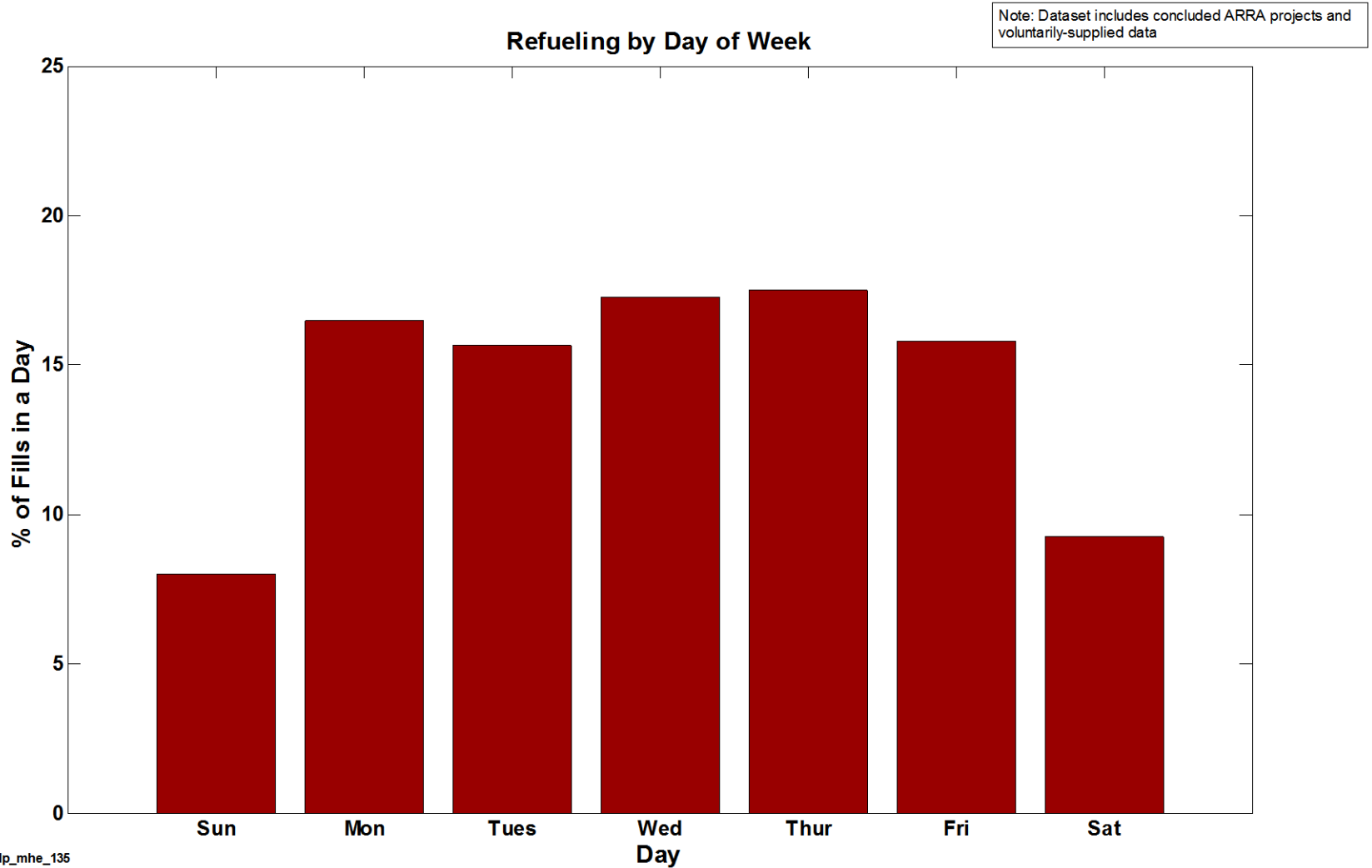
Created: Mar-31-15 5:06 PM | Data Range: 2009Q4-2014Q3

Average Daily Fuel Cell Operation Hours per System

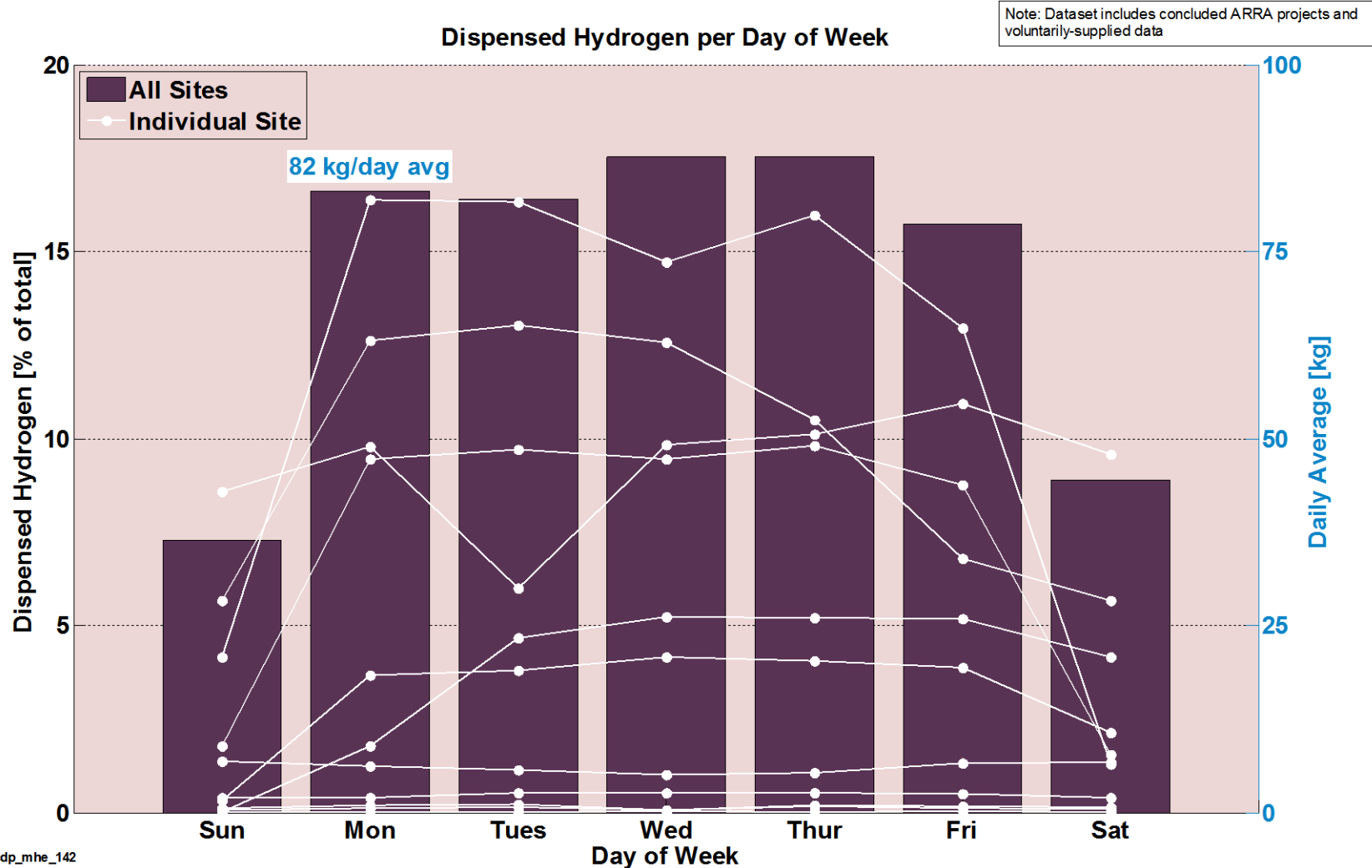


1) Excludes 0 hour operation days

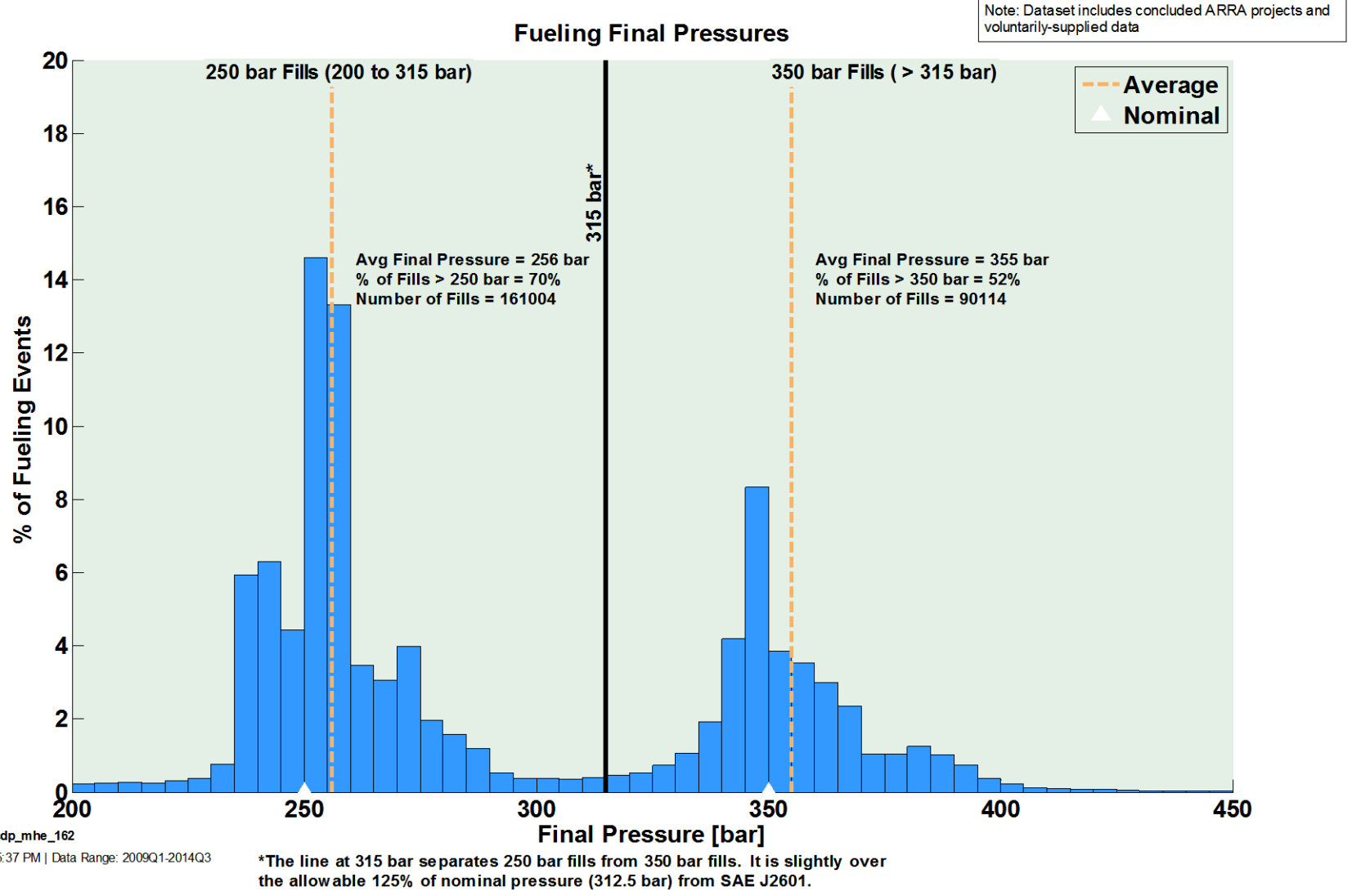
Refuel Events by Day of Week



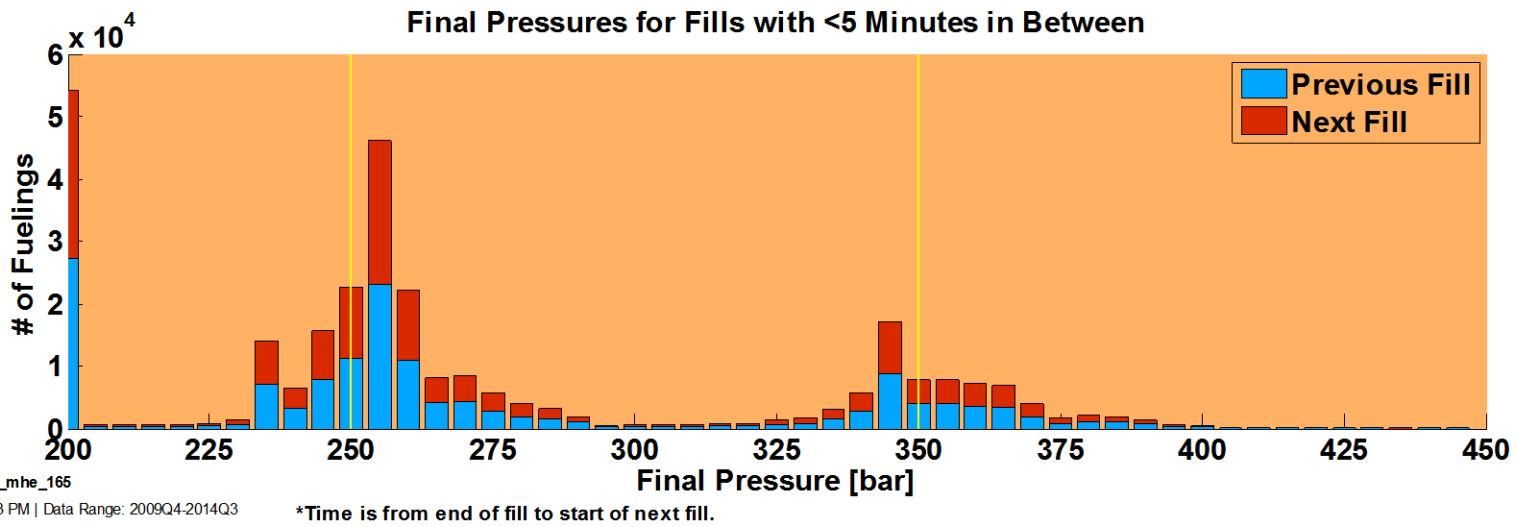
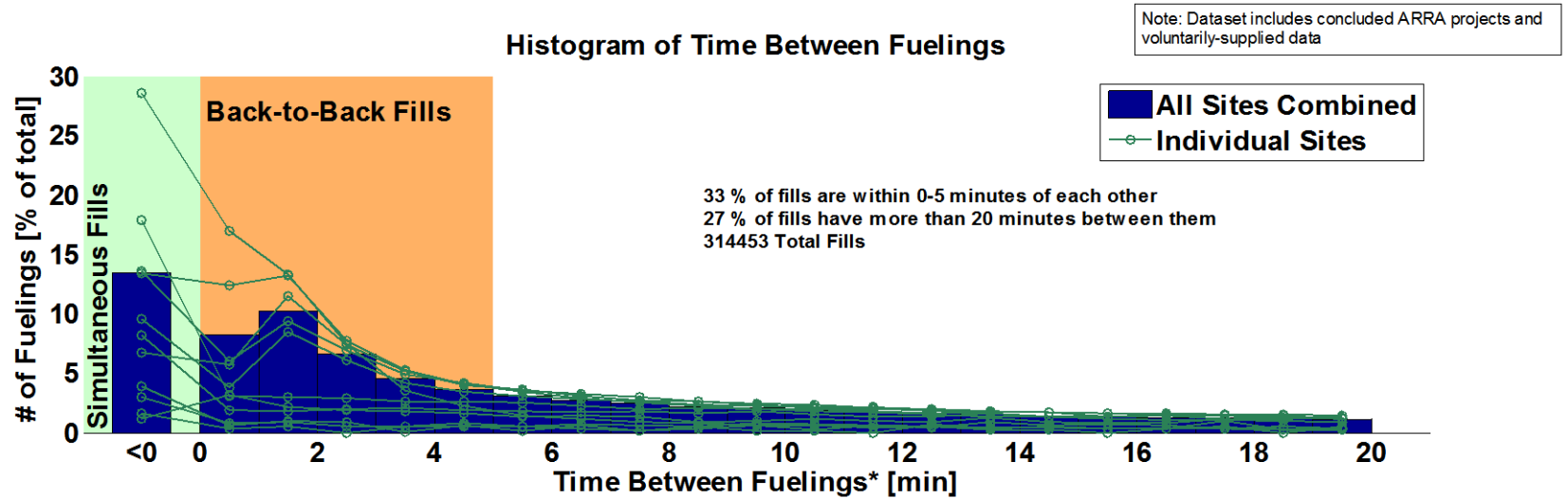
Amount of Hydrogen Dispensed by Day of Week



Final Pressure of Hydrogen Fills

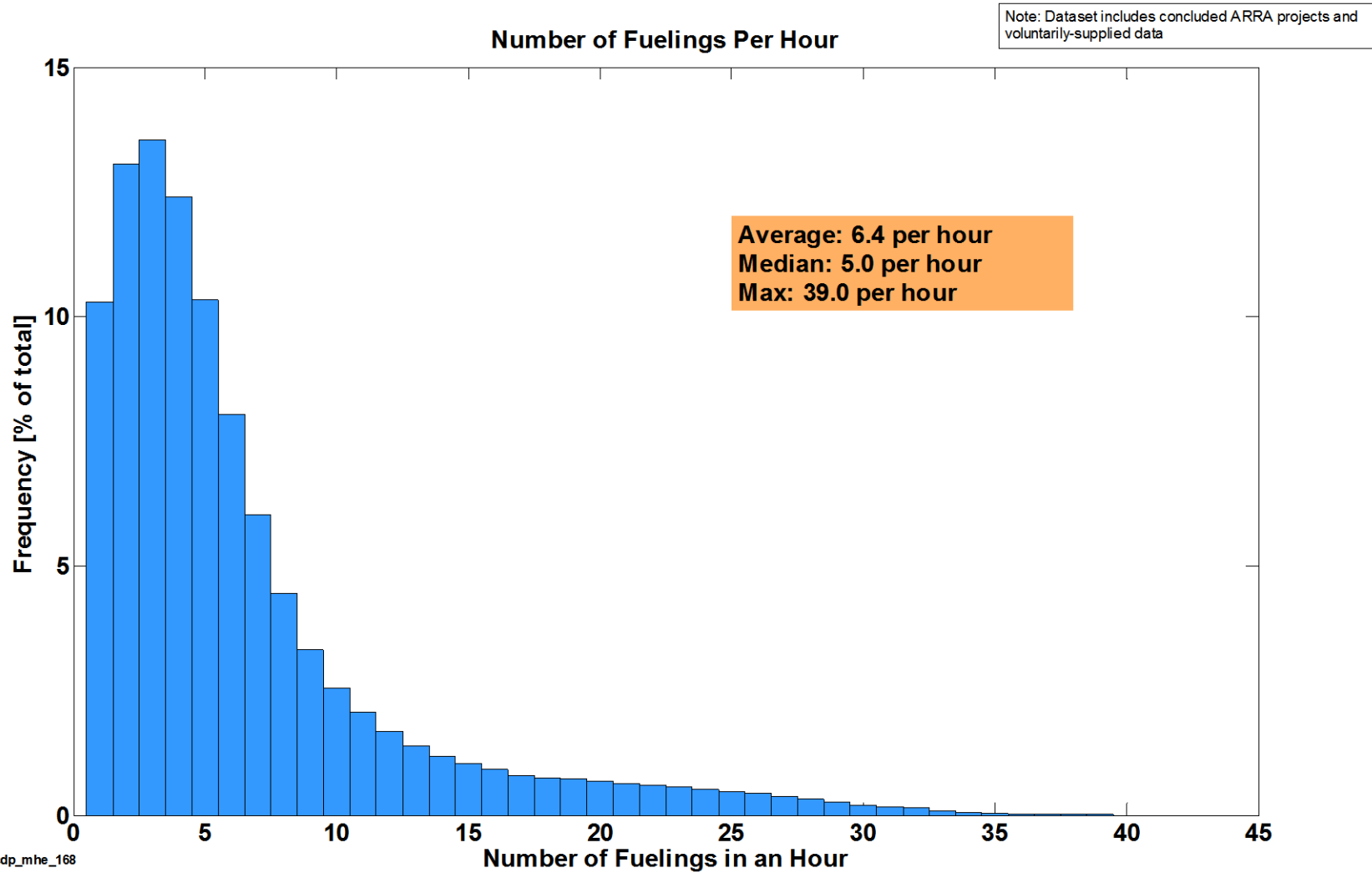


Details of Back-to-Back Fills

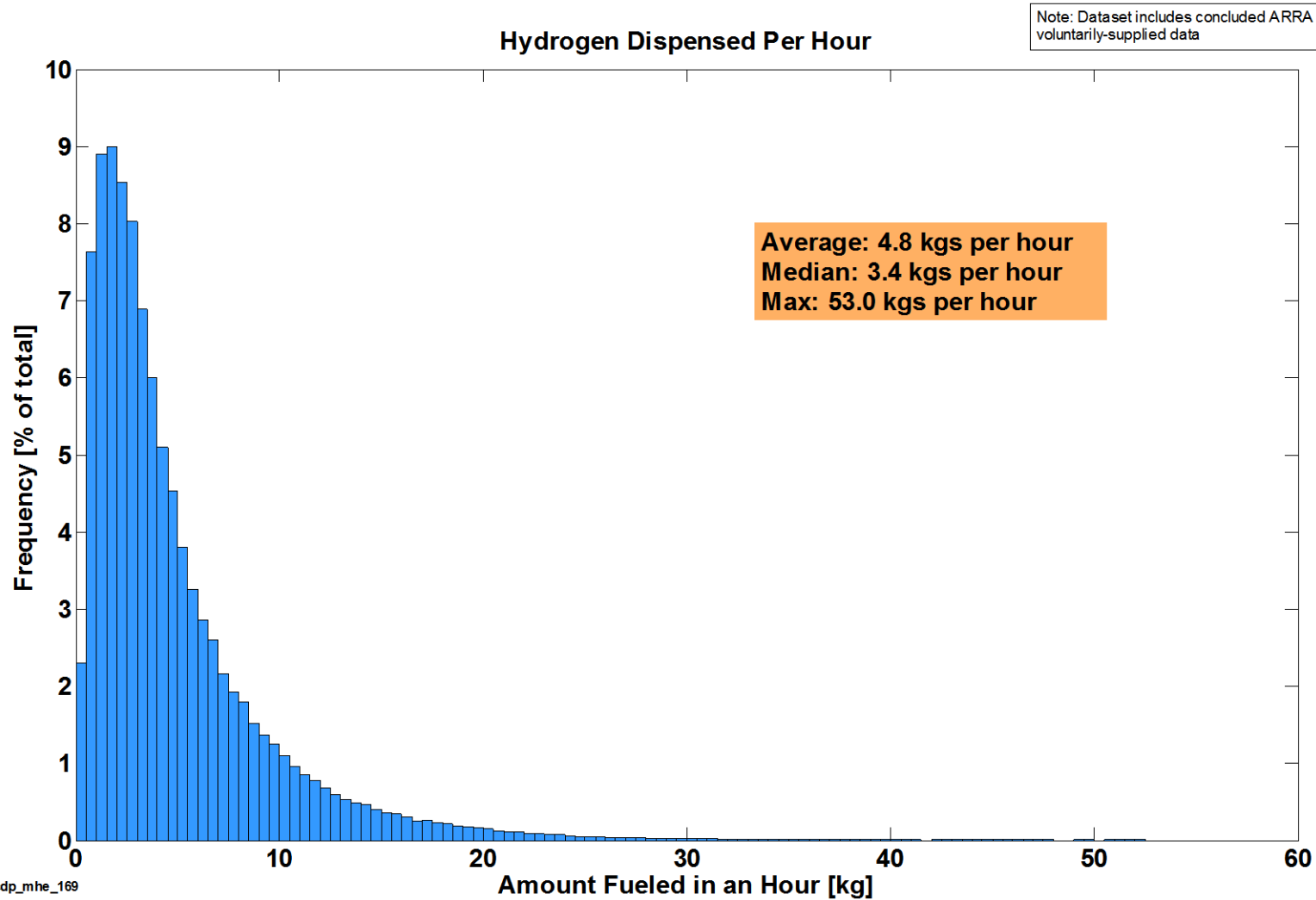


CDP-MHE-168

Fill Counts per Hours



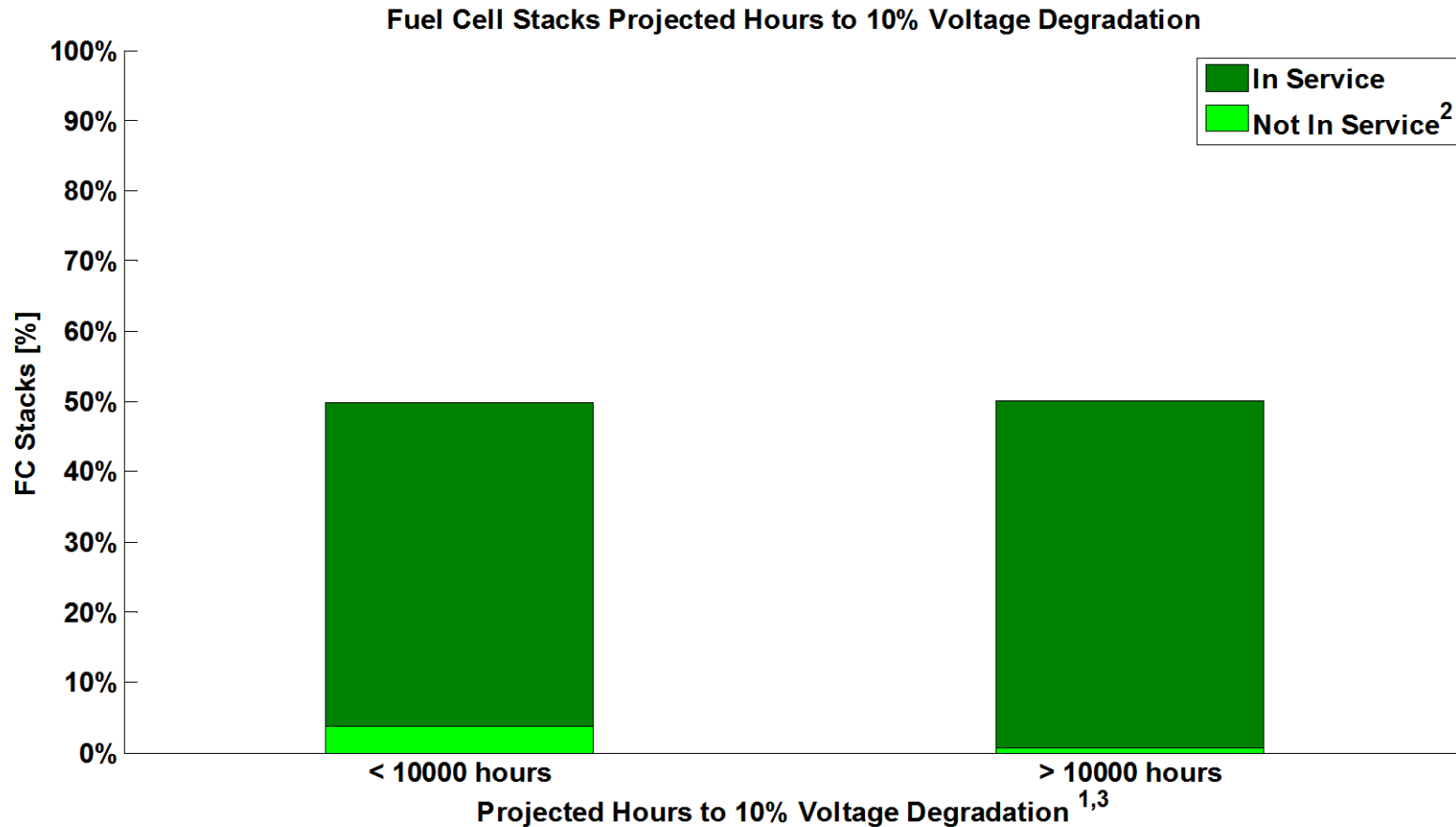
Fill Amount per Hour



NREL cdp_mhe_169

Created: Mar-31-15 6:40 PM | Data Range: 2009Q4-2014Q3

Projected Hours to 10% Voltage Degradation



1) Projection using field data, calculated at high stack current, from operation hour 0.

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.

