NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Stationary Fuel Cell System Composite Data Products

Data Through Quarter 3 of 2015

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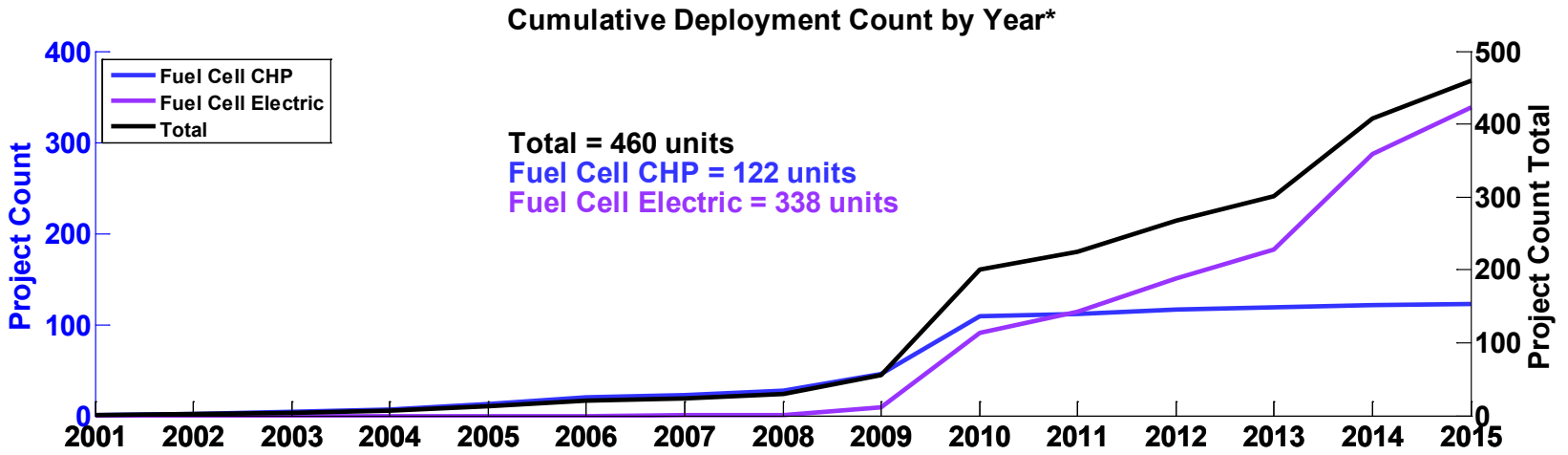
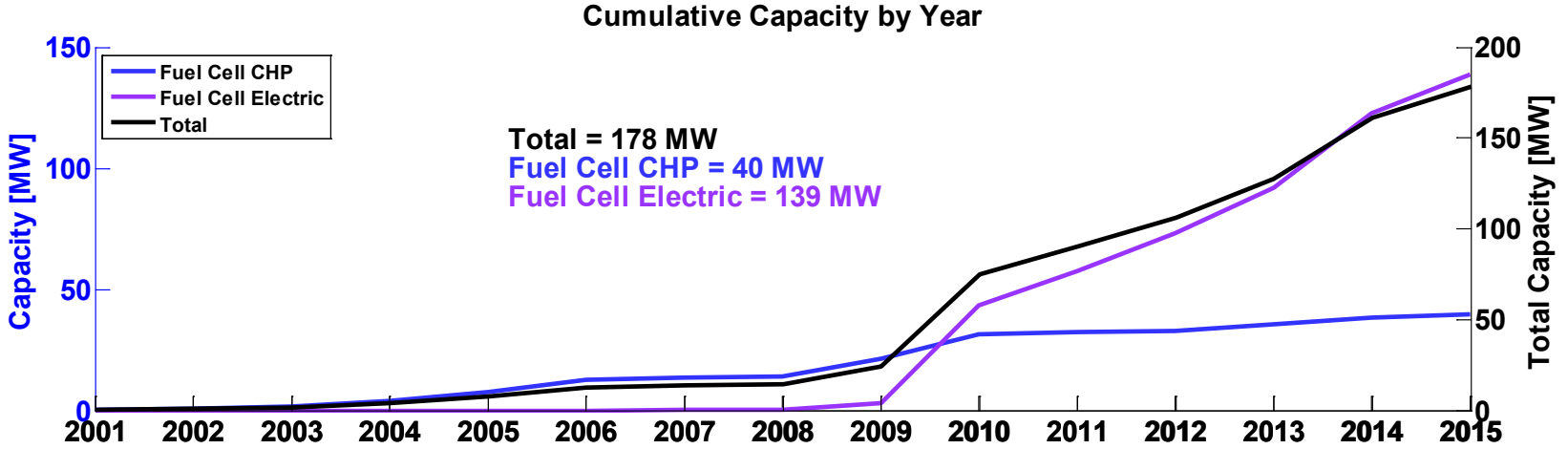
NREL/PR-5400-65555

CDP-STAT-01
Fuel Cell Stationary Systems Deployed by Year

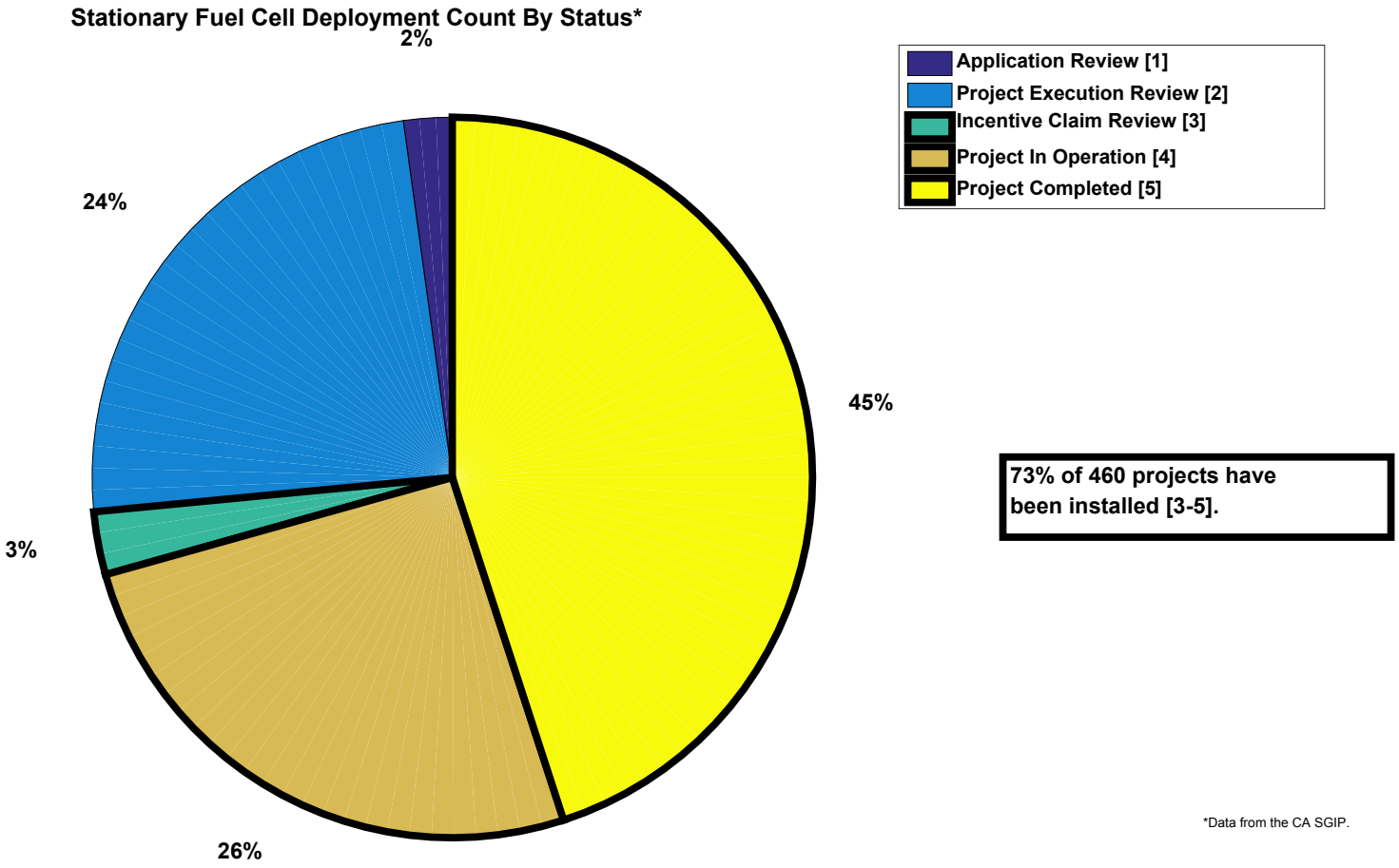




*Data from the CA SGIP.

NREL cdp_stat_01
Created: Oct-21-15 2:51 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-02
Stationary Fuel Cell System Count by Status



73% of 460 projects have been installed [3-5].

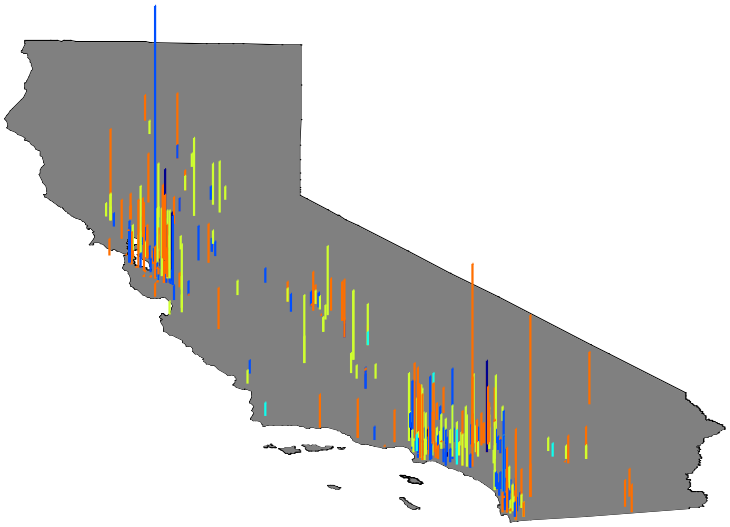
*Data from the CA SGIP.

Order of Project Phases: [1] Includes CA SGIP projects in Reservation Request Form (RRF) phases.
[2] Includes CA SGIP projects in Proof of Project Milestone (PPM) phases.
[3] Projects are in operation and pending confirmation of incentive claims, including CA SGIP Incentive Claim Form (ICF) phases.
[4] Includes projects that are receiving perfomance based incentives, includes CA SGIP Performance Based Incentives (PBI) In Progress.
[5] Includes installed projects with unknown operation status, includes CA SGIP Payment Completed and Payment Recalled status.

NREL cdp_stat_02
Created: Nov-17-15 2:22 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-03
California SGIP Deployment Map

CA Stationary Fuel Cell Installations [1] (2001 - 2015)

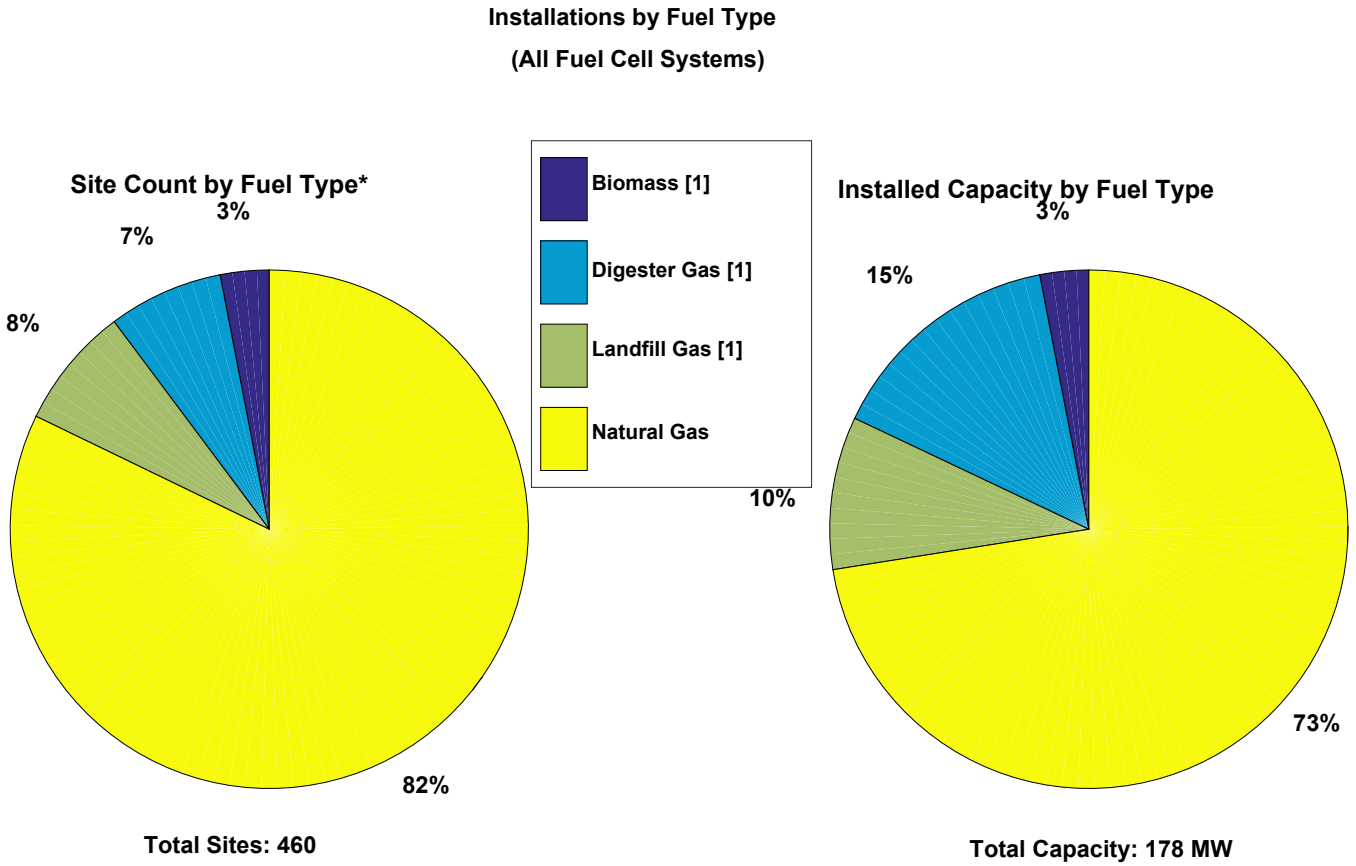


NREL cdp_stat_03
Created: Oct-21-15 2:52 PM | Data Range: 2001Q2-2015Q3

Order of Project Phases: [1] Includes CA SGIP projects in Reservation Request Form (RRF) phases.
[2] Includes CA SGIP projects in Proof of Project Milestone (PPM) phases.
[3] Projects are in operation and pending confirmation of incentive claims, including CA SGIP Incentive Claim Form (ICF) phases.
[4] Includes projects that are receiving perfomance based incentives, includes CA SGIP Performance Based Incentives (PBI) In Progress.
[5] Includes installed projects with unknown operation status, includes CA SGIP Payment Completed and Payment Recalled status.

*Data from the CA SGIP.

CDP-STAT-04
Stationary Fuel Cell System Count and Capacity by Fuel Type



[1] The renewable fuels exclude those defined as conventional in Section 2805 of the California Public Utilities Code and are categorized here as gas derived from biomass, digester gas, or landfill gas.

Definition of Included Status:

[2] Includes CA SGIP projects in Reservation Request Form (RRF) phases.

[3] Includes CA SGIP projects in Proof of Project Milestone (PPM) phases.

[4] Projects are in operation and pending confirmation of incentive claims, including CA SGIP Incentive Claim Form (ICF) phases.

[5] Includes projects that are receiving perfomance based incentives, includes CA SGIP Performance Based Incentives (PBI) In Progress.

[6] Includes installed projects with unknown operation status, includes CA SGIP Payment Completed and Payment Recalled status.

Includes Status Categories:

Application Review [2]

Project Execution Review [3]

Incentive Claim Review [4]

Project In Operation [5]

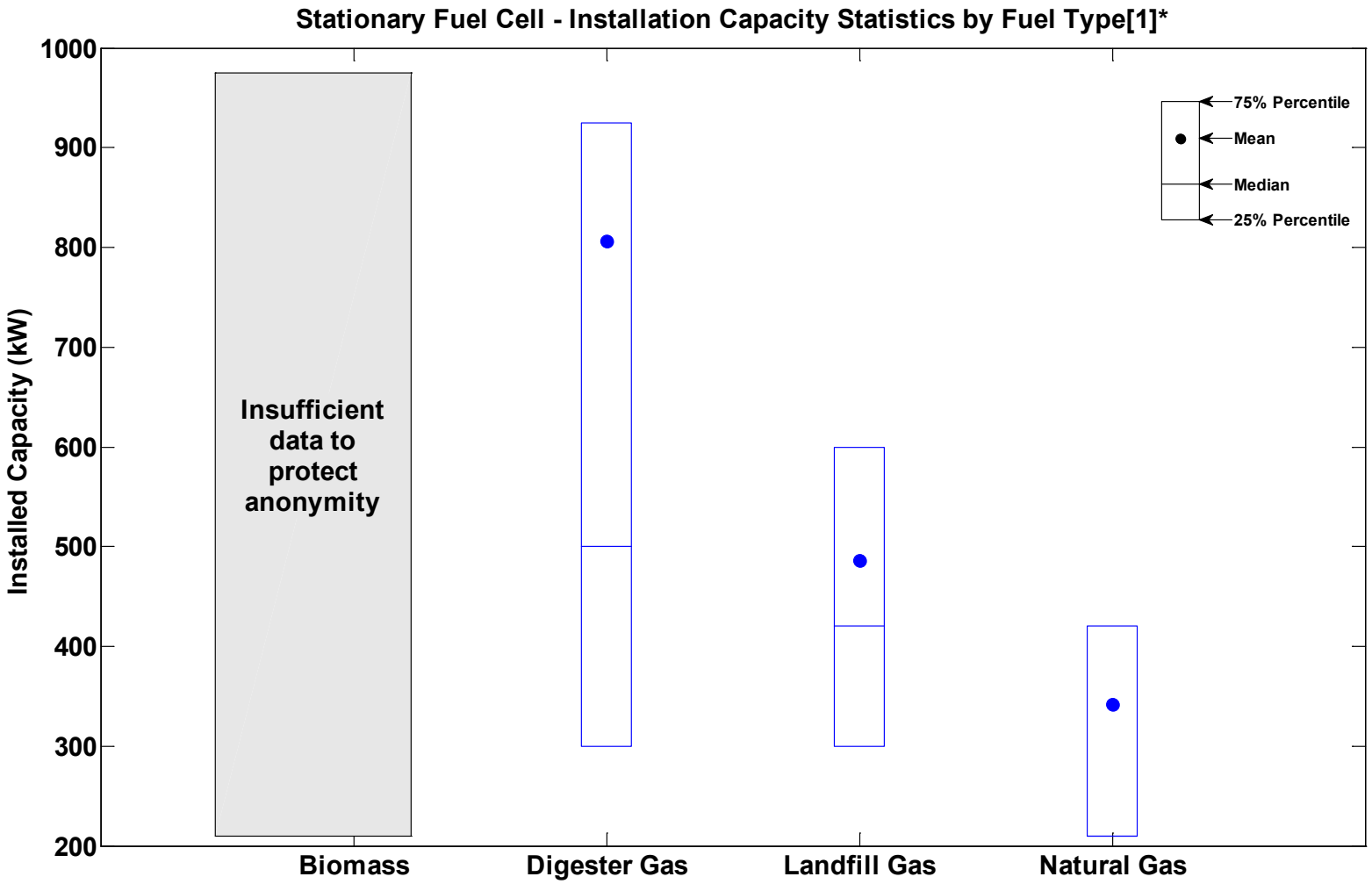
Project Completed [6]

*Data from the CA SGIP.

NREL cdp_stat_04

Created: Nov-05-15 2:46 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-05
Fuel Type Capacity

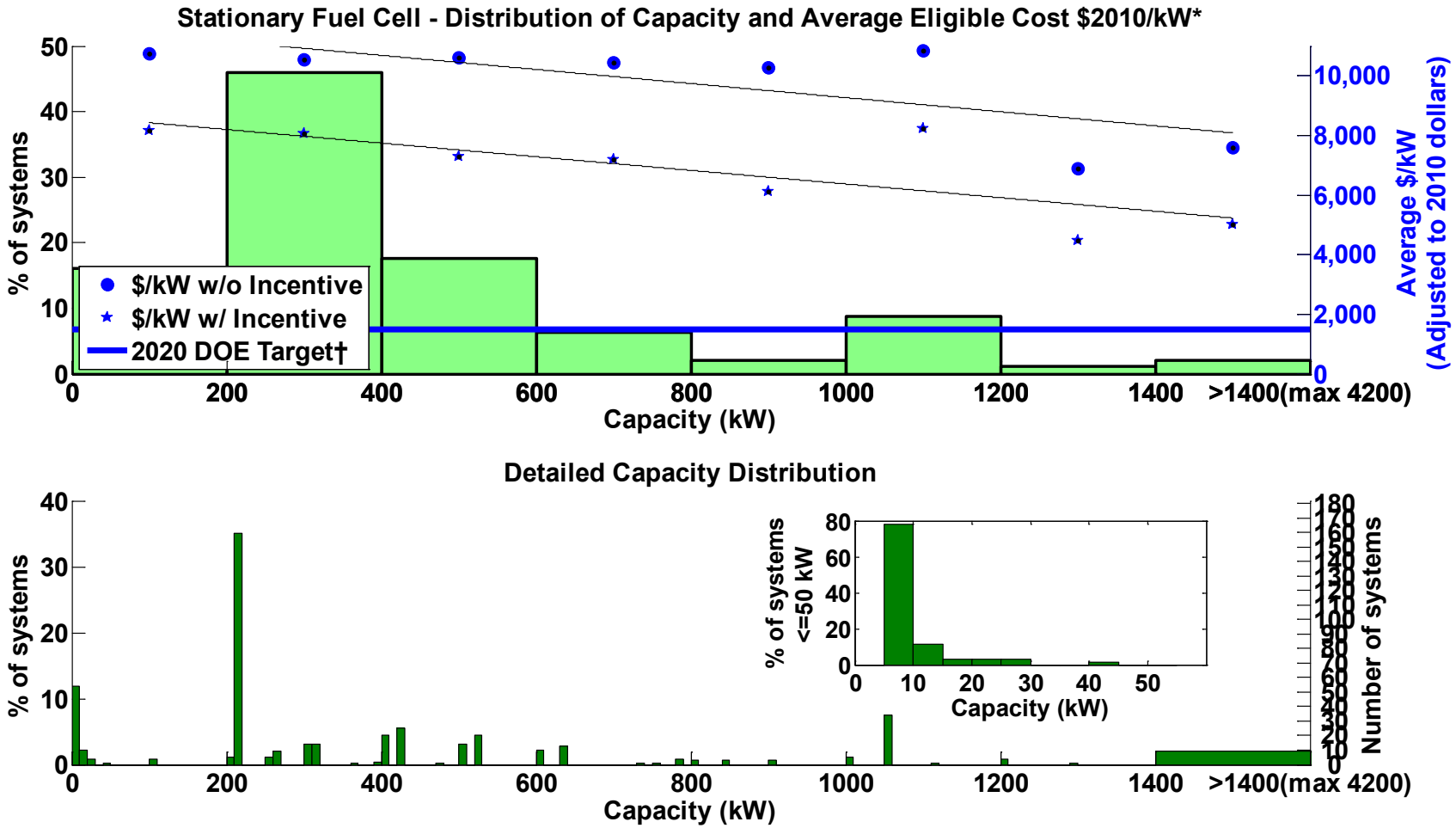


*Data from the CA SGIP.

NREL cdp_stat_05
Created: Oct-21-15 2:52 PM | Data Range: 2001Q2-2015Q3

[1] The renewable fuels exclude those defined as conventional in Section 2805 of the California Public Utilities Code and are categorized here as gas derived from biomass, digester gas, or landfill gas.

CDP-STAT-06
Fuel Cell Stationary Capacity and Average Prices



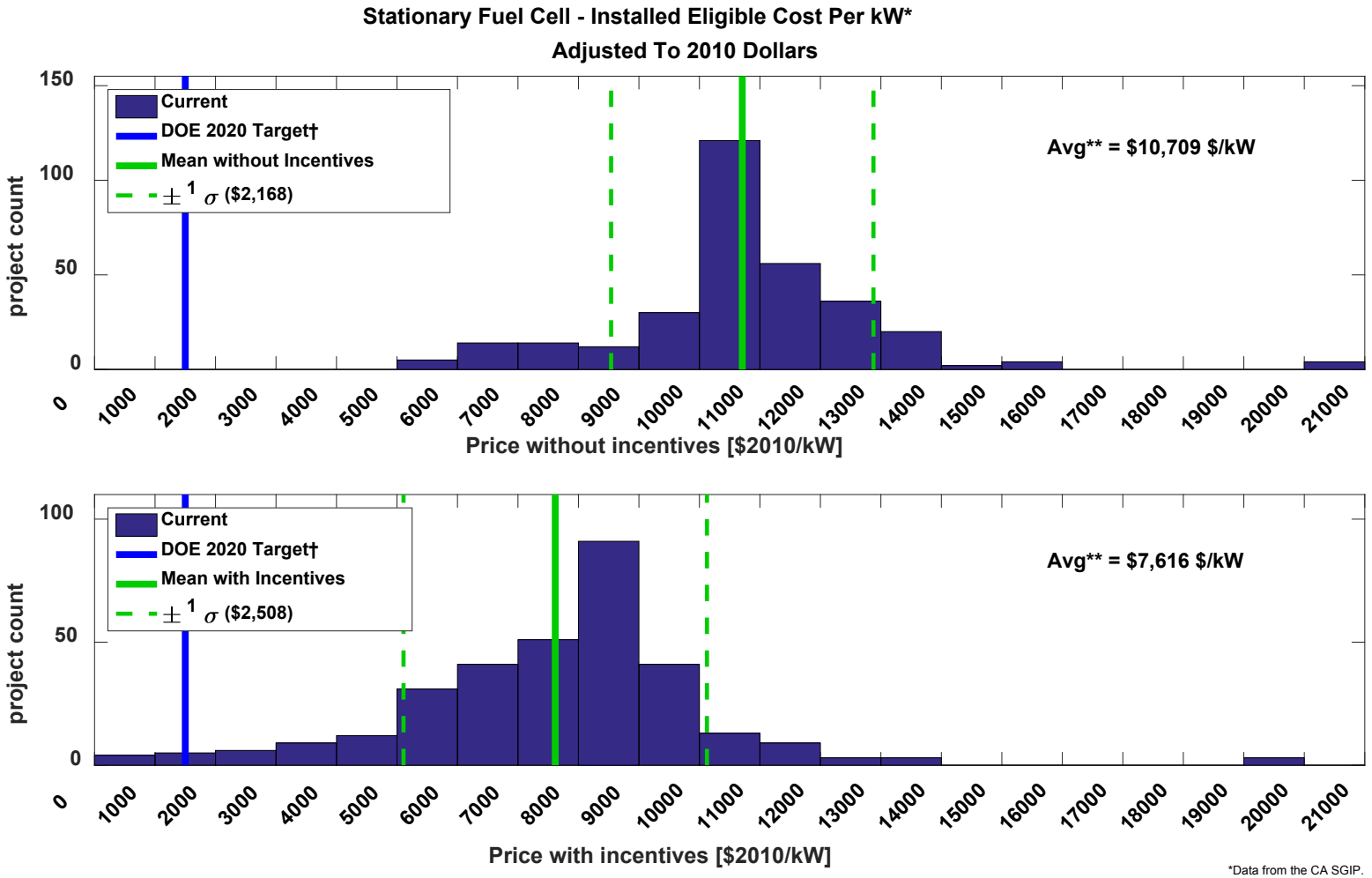
NREL cdp_stat_06
Created: Oct-21-15 2:53 PM | Data Range: 2001Q2-2015Q3

Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.
†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

CDP-STAT-07

Distribution of Stationary Fuel Cell Install Price with and without Incentives



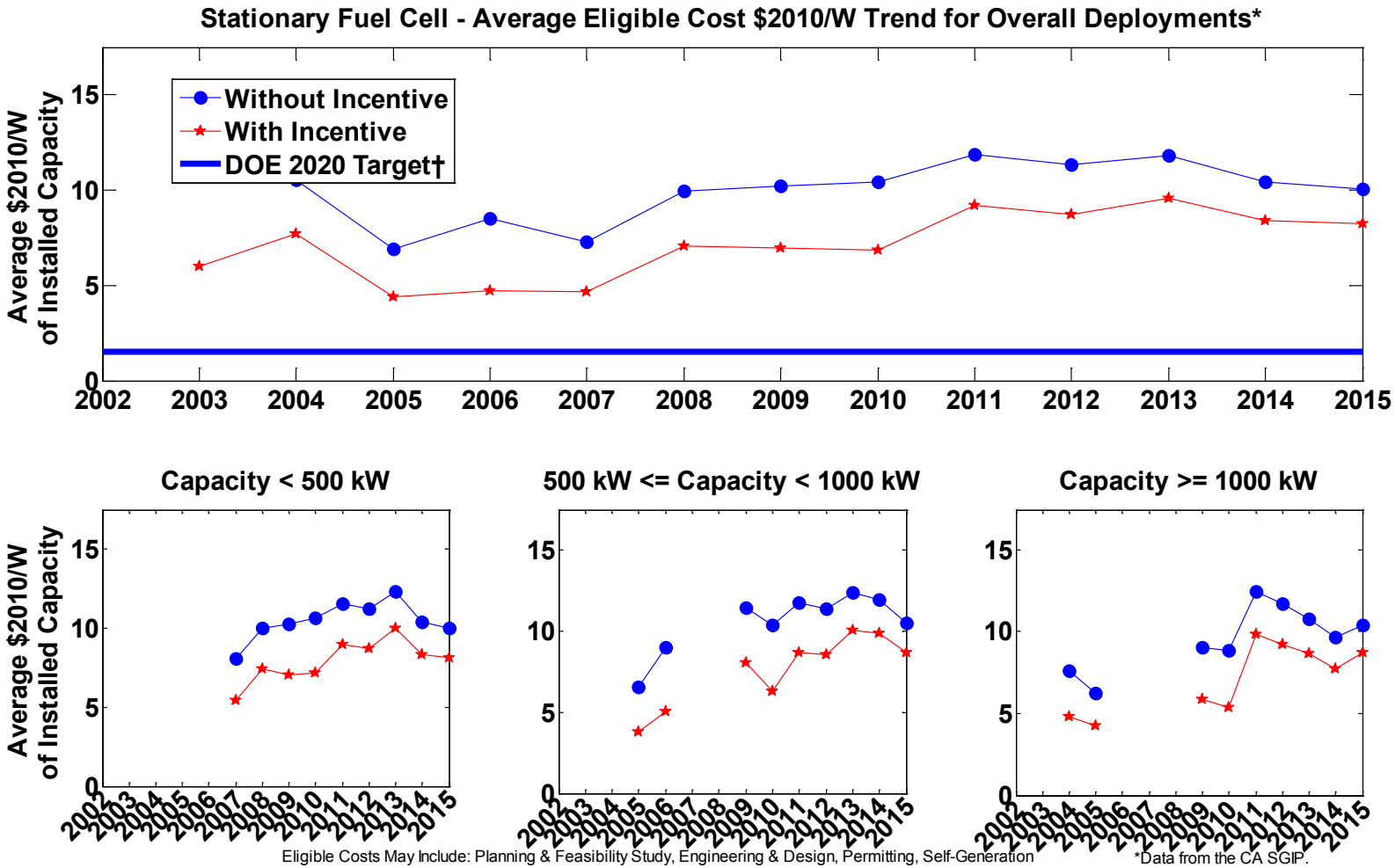
Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.
**Data bins with less than 2 projects filtered.
†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

NREL cdp_stat_07
Created: Nov-05-15 3:01 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-08

Stationary Fuel Cell Install Price Over Time with and without Incentives



Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.

Note: Data points are omitted where only one system would be represented in a given year.

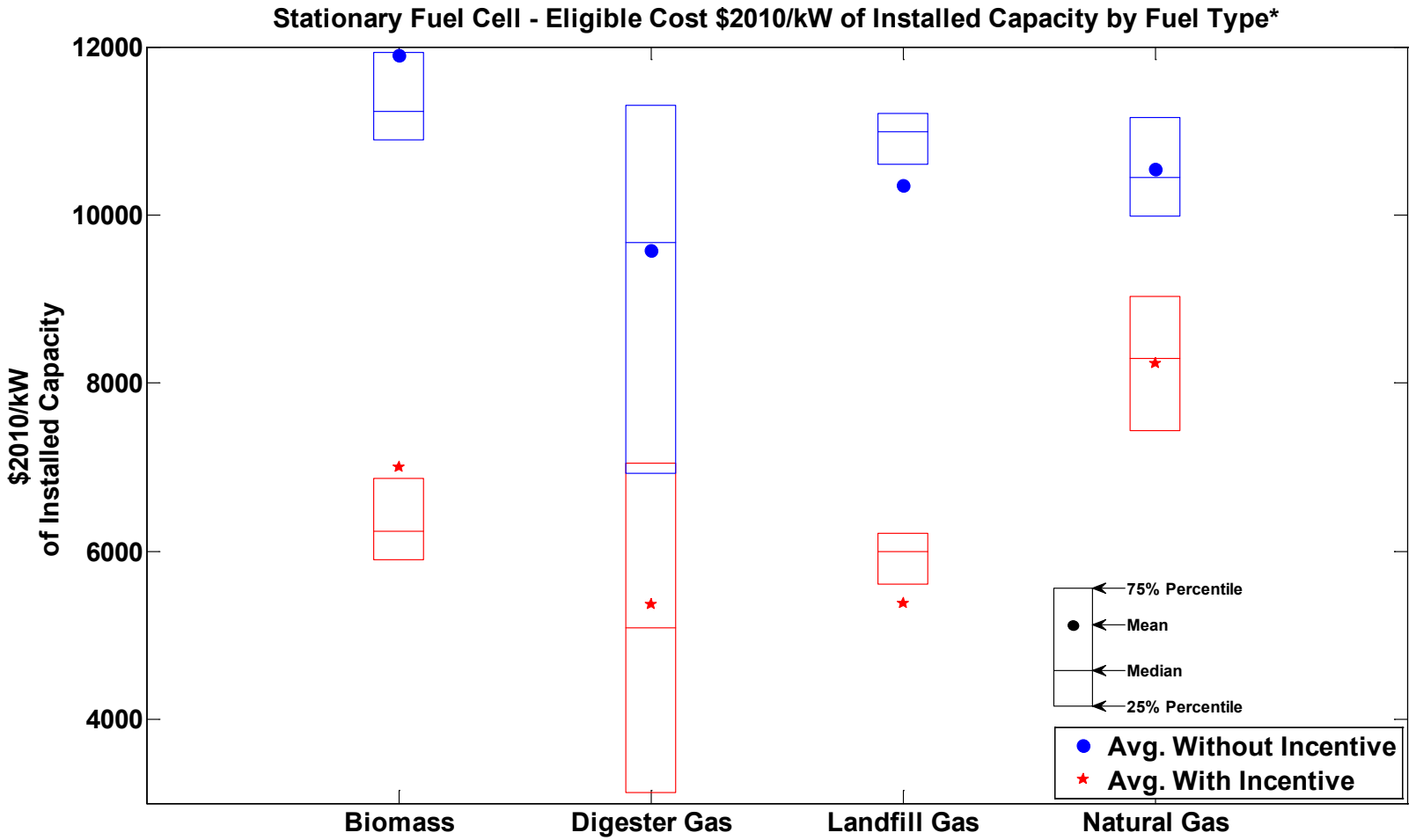
†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

NREL cdp_stat_08

Created: Oct-21-15 2:54 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-09

Stationary Fuel Cell Install Price by Fuel Type with and without Incentives



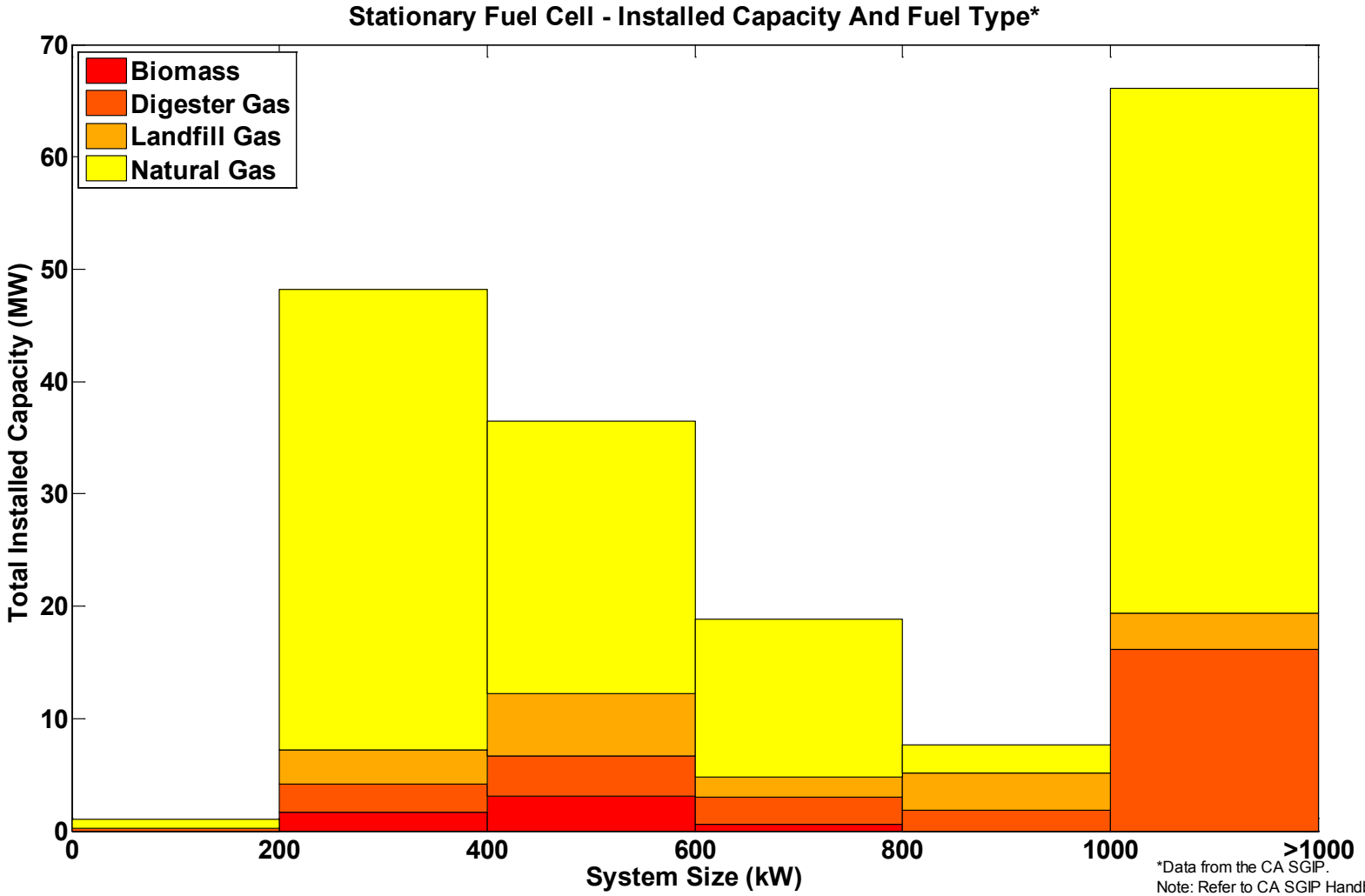
NREL cdp_stat_09
Created: Oct-21-15 2:55 PM | Data Range: 2001Q2-2015Q3

Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.

Note: Refer to CA SGIP Handbook for on-site vs directed digester gas (biogas) qualifications.

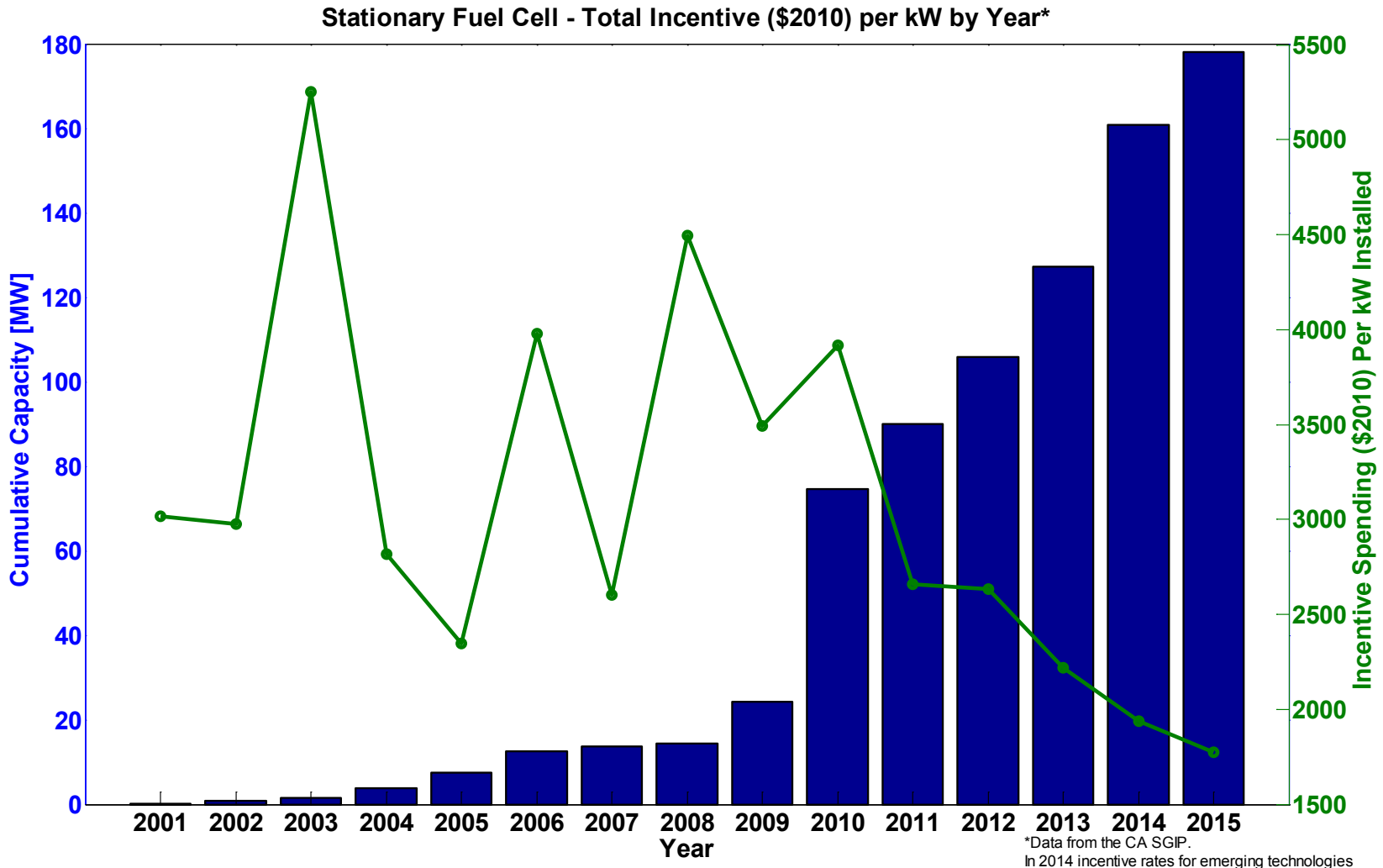
CDP-STAT-10
Installed Capacity and Fuel Type



NREL cdp_stat_10
Created: Oct-21-15 2:56 PM | Data Range: 2001Q2-2015Q3

*Data from the CA SGIP.
Note: Refer to CA SGIP Handbook for on-site vs directed digester gas (biogas) qualifications.

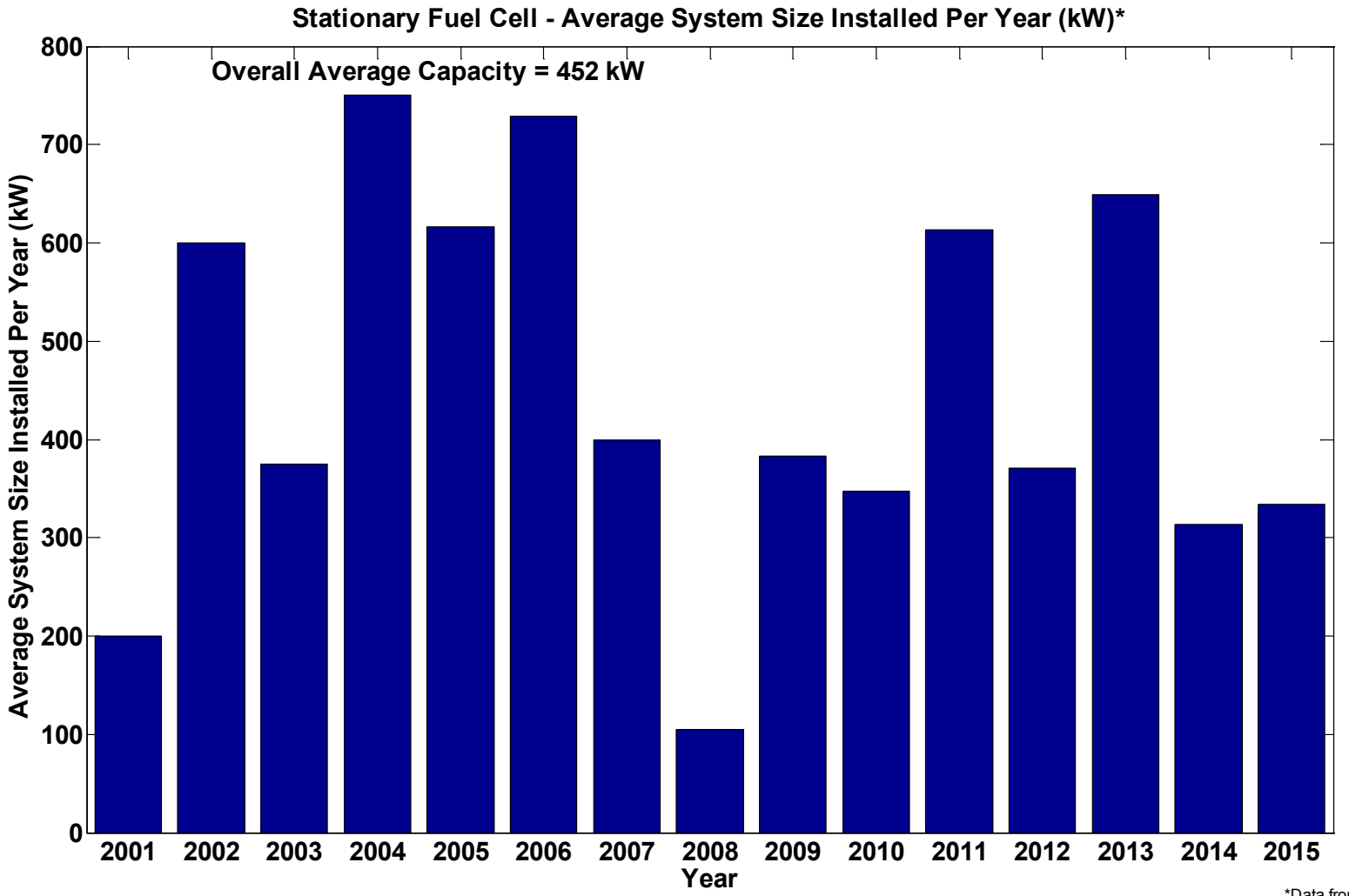
CDP-STAT-11
Total Incentive Spending ($2010) per kW by Year



NREL cdp_stat_11
Created: Oct-21-15 2:56 PM | Data Range: 2001Q2-2015Q3

*Data from the CA SGIP.
In 2014 incentive rates for emerging technologies (including fuel cells) and biogas will decline 10% and all other technologies 5% annually. (2014 SGIP Handbook)

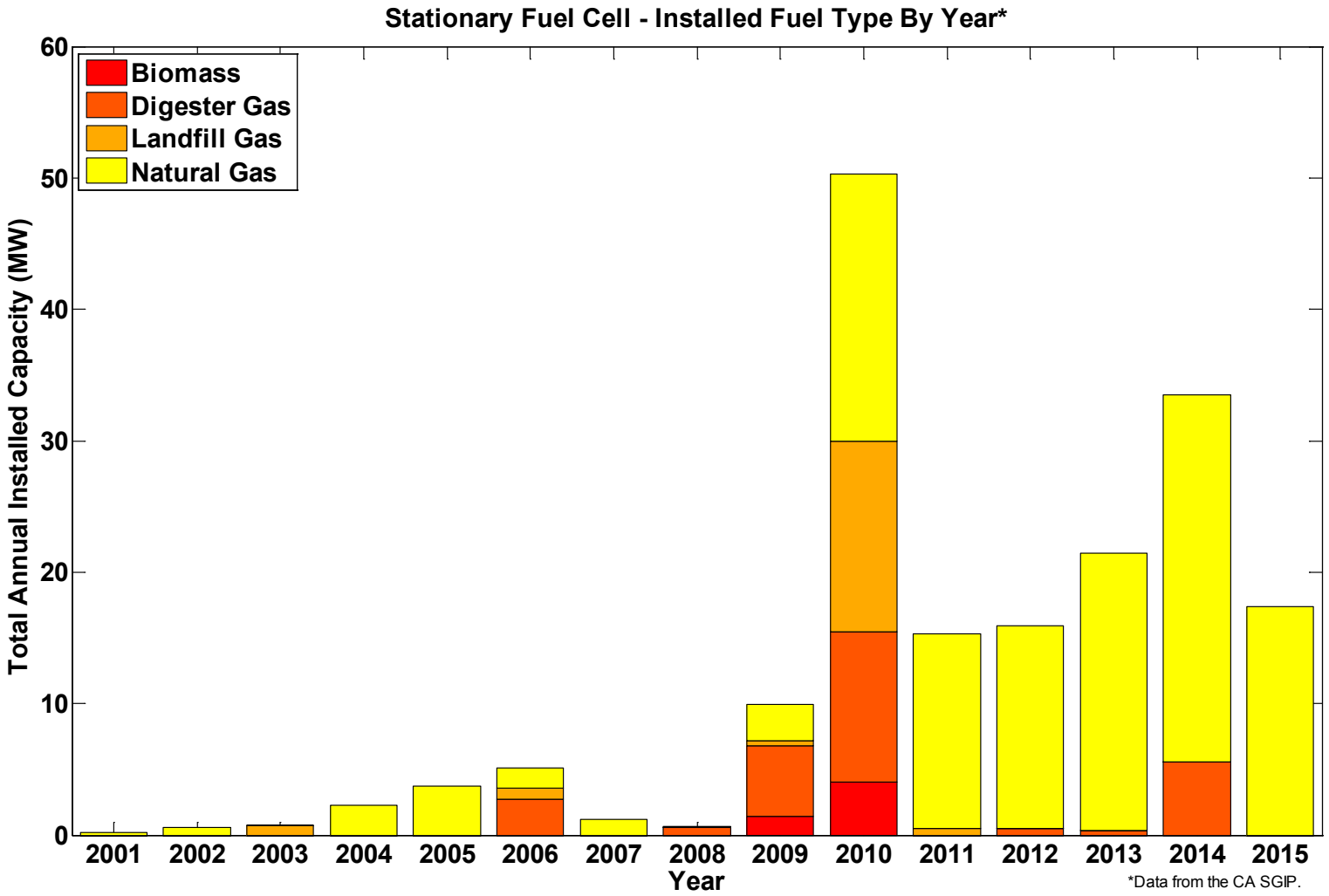
CDP-STAT-12
Average System Size Installed per Year (kW)



NREL cdp_stat_12
Created: Oct-21-15 2:56 PM | Data Range: 2001Q2-2015Q3

*Data from the CA SGIP.

CDP-STAT-13
Installed Annual Capacity by Fuel Type

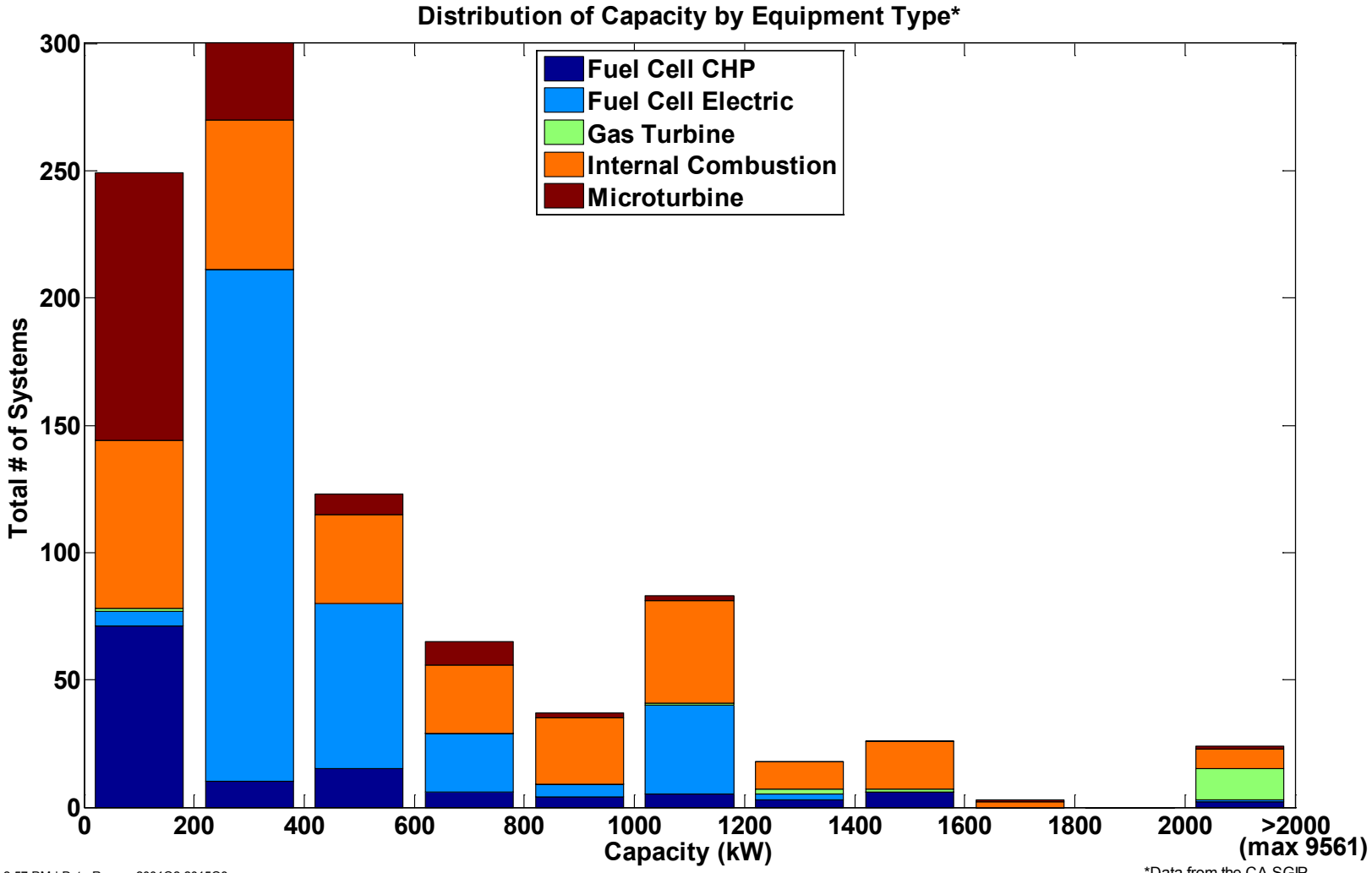


NREL cdp_stat_13
Created: Oct-21-15 2:57 PM | Data Range: 2001Q2-2015Q3

*Data from the CA SGIP.

Note: Refer to CA SGIP Handbook for on-site vs directed digester gas (biogas) qualifications.

CDP-STAT-14
Distribution of Capacity by Equipment Type

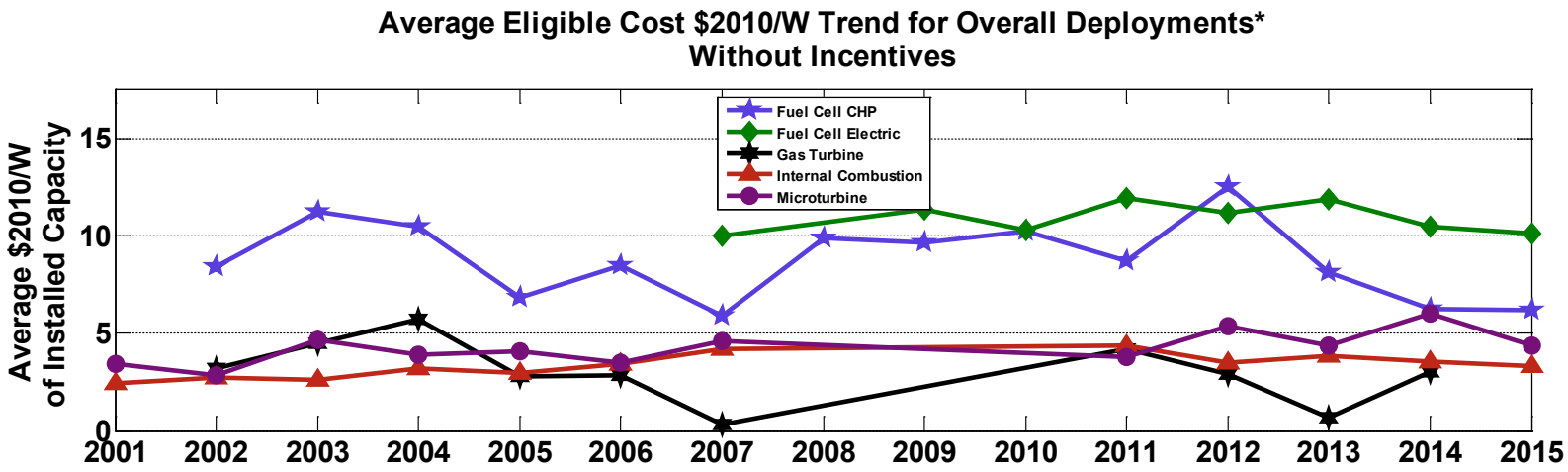


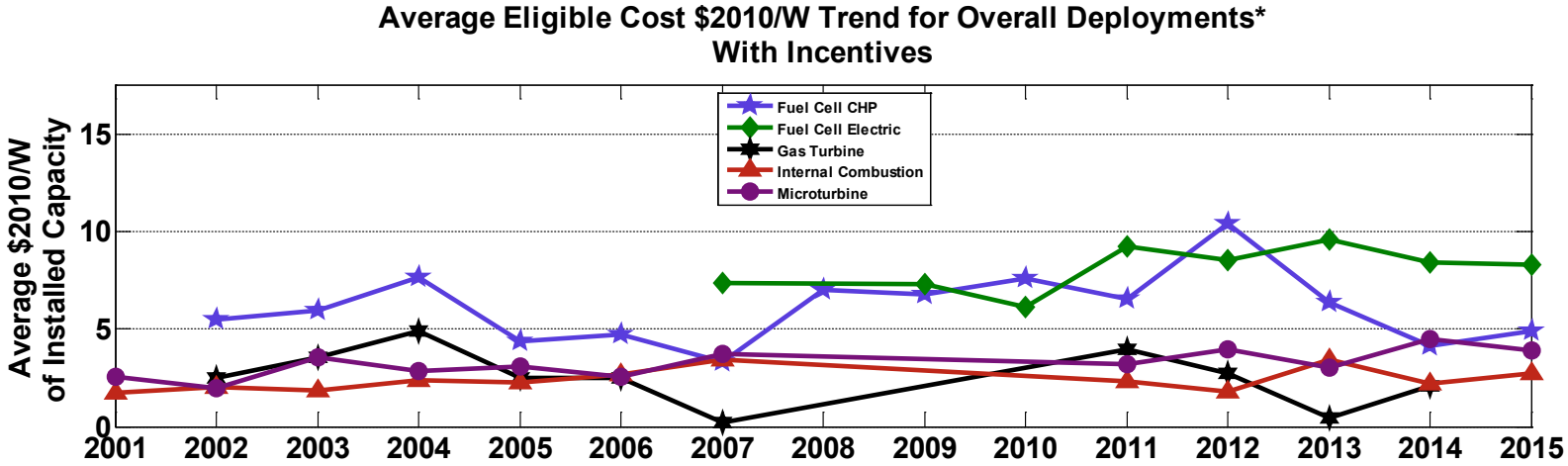
NREL cdp_stat_14
Created: Oct-21-15 2:57 PM | Data Range: 2001Q2-2015Q3

*Data from the CA SGIP.

CDP-STAT-15

Average Eligible Cost by Equipment Type, including Other Distributed Generation



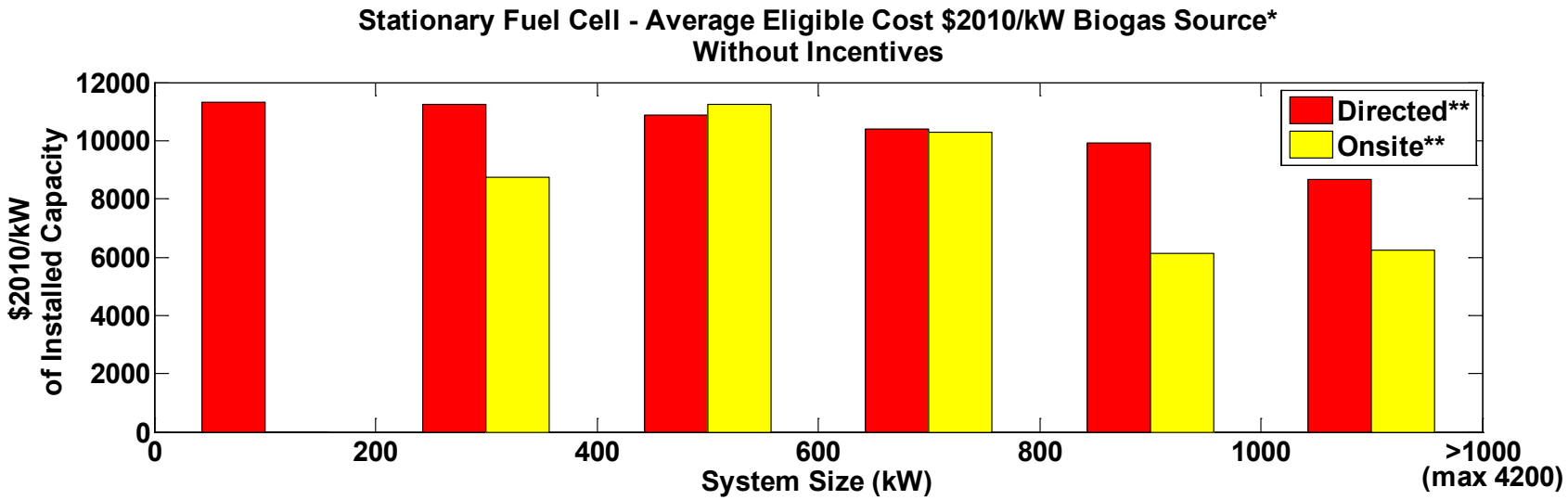


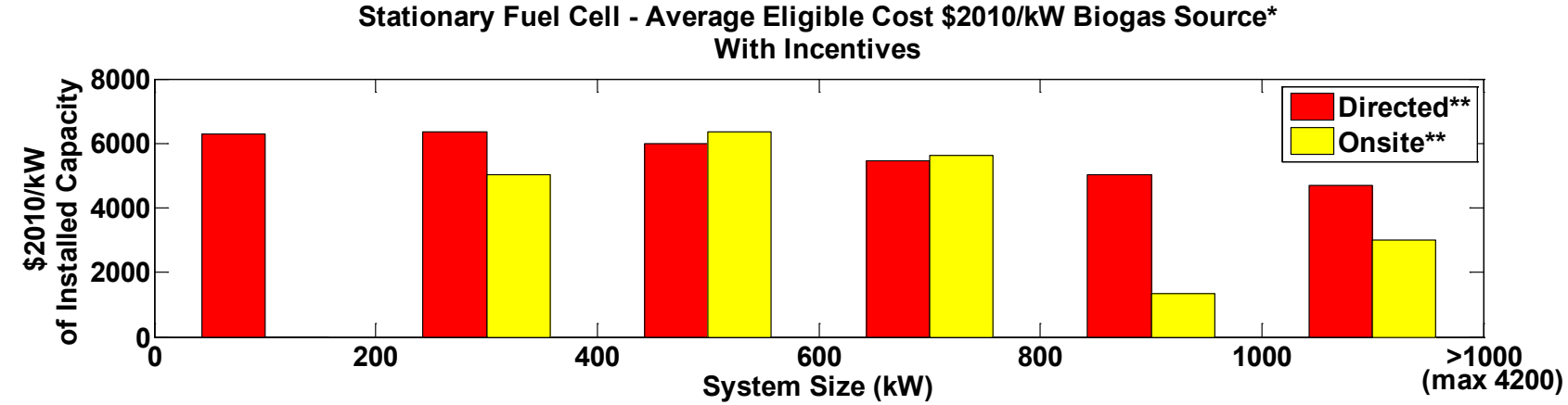
NREL cdp_stat_15
Created: Oct-21-15 2:57 PM | Data Range: 2001Q2-2015Q3

Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.

CDP-STAT-16
Average Eligible Cost for Biogas Sources





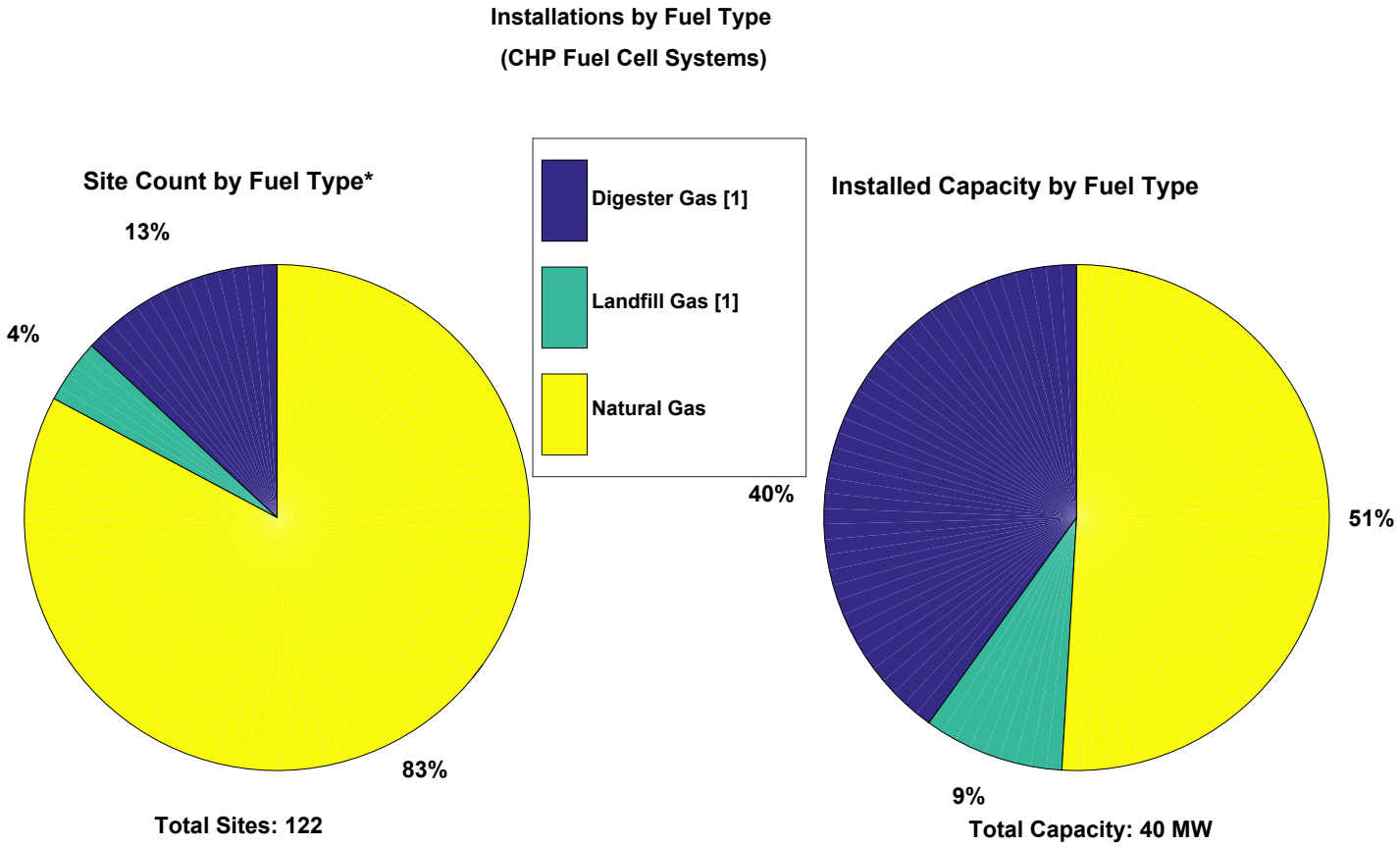
Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

NREL cdp_stat_16
Created: Oct-21-15 2:57 PM | Data Range: 2001Q2-2015Q3

*Data from the CA SGIP.

** Refer to CA SGIP Handbook for on-site vs directed digester gas (biogas) qualifications.

CDP-STAT-20
Installations By Fuel Type (CHP Fuel Cells)



[1] The renewable fuels exclude those defined as conventional in Section 2805 of the California Public Utilities Code and are categorized here as gas derived from biomass, digester gas, or landfill gas.

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[6] Includes installed projects with unknown operation status, includes CA SGIP Payment Completed and Payment Recalled status.

Includes Status Categories:

Application Review [2]

Project Execution Review [3]

Incentive Claim Review [4]

Project In Operation [5]

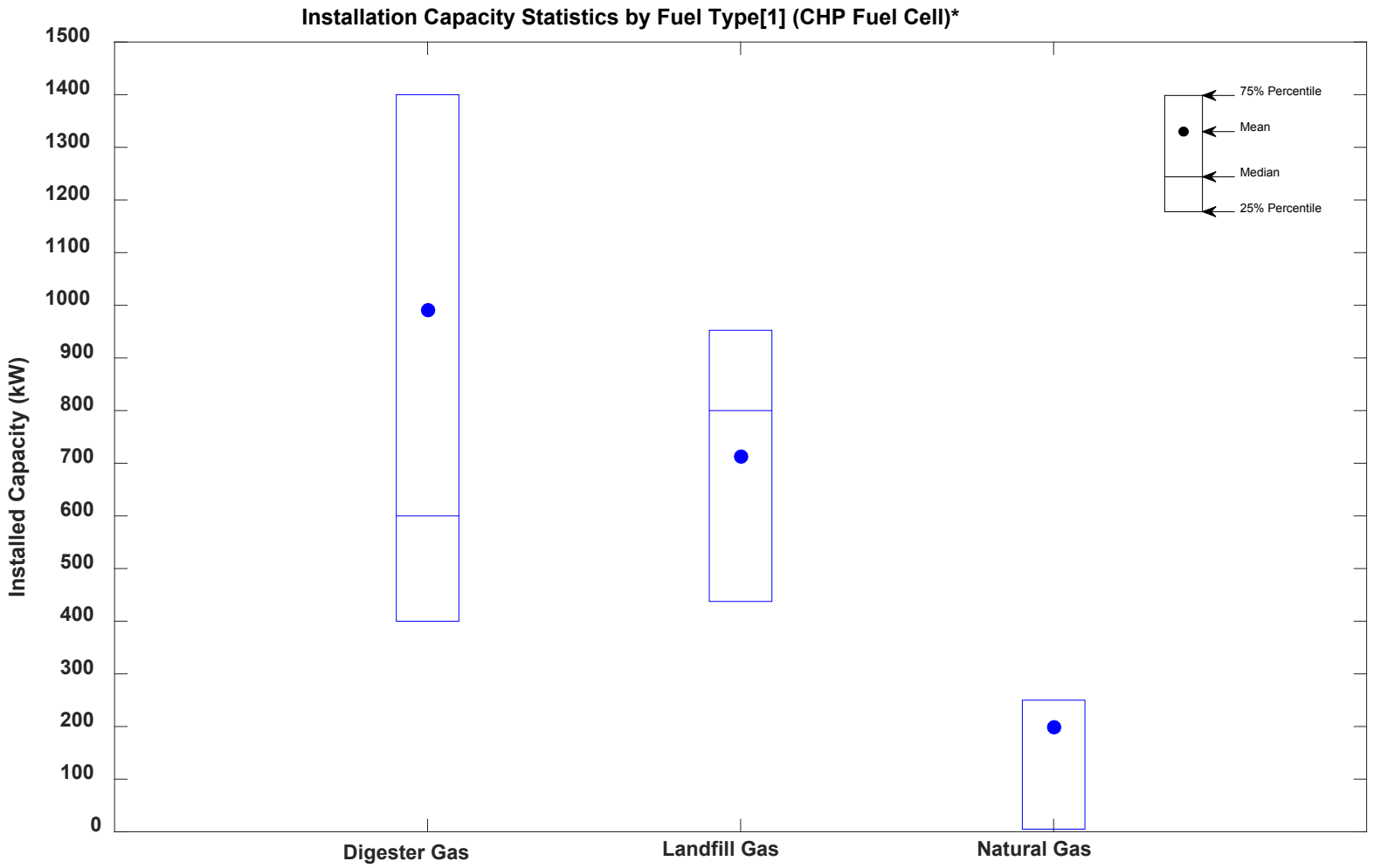
Project Completed [6]

*Data from the CA SGIP.

NREL cdp_stat_20

Created: Nov-05-15 2:46 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-21
Installation Capacity by Fuel Type (CHP Fuel Cells)



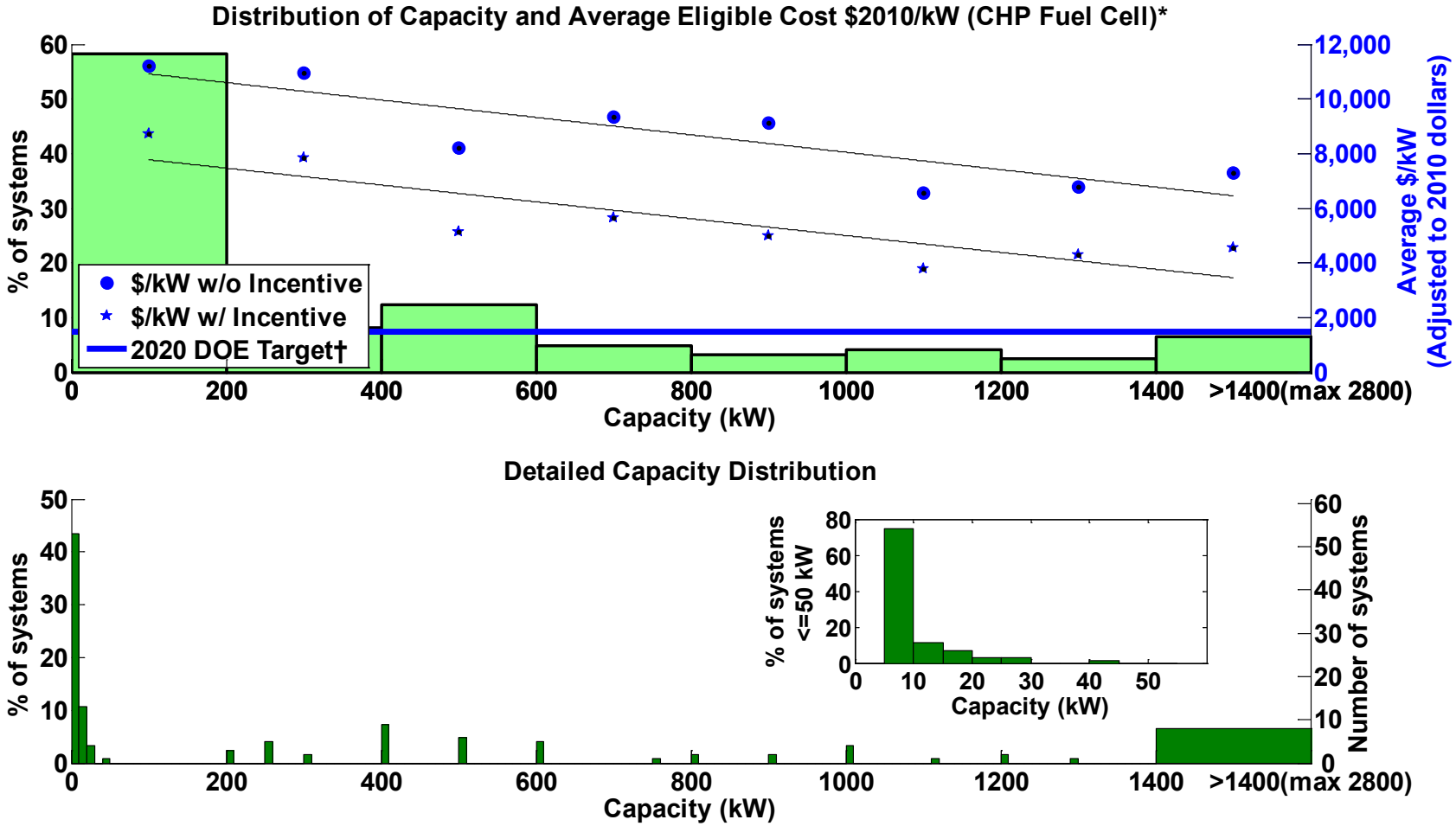
*Data from the CA SGIP.

NREL cdp_stat_21

Created: Nov-05-15 2:22 PM | Data Range: 2001Q2-2015Q3

[1] The renewable fuels exclude those defined as conventional in Section 2805 of the California Public Utilities Code and are categorized here as gas derived from biomass, digester gas, or landfill gas.

CDP-STAT-22
Distribution of Capacity and Eligible Cost (CHP Fuel Cells)



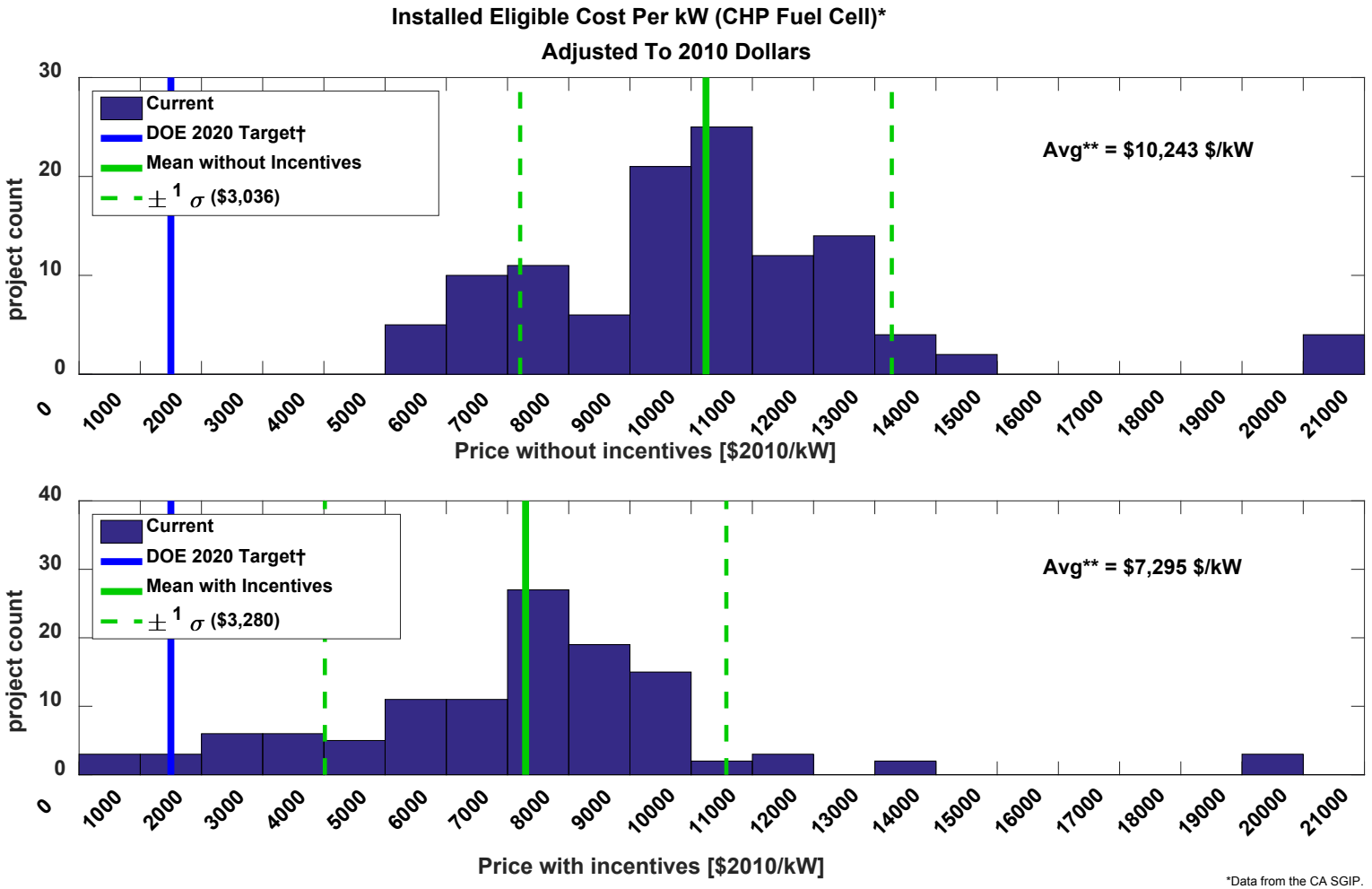
Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.
†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

NREL cdp_stat_22
Created: Oct-21-15 2:58 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-23

Distribution of Eligible Cost with and without Incentives (CHP Fuel Cells)



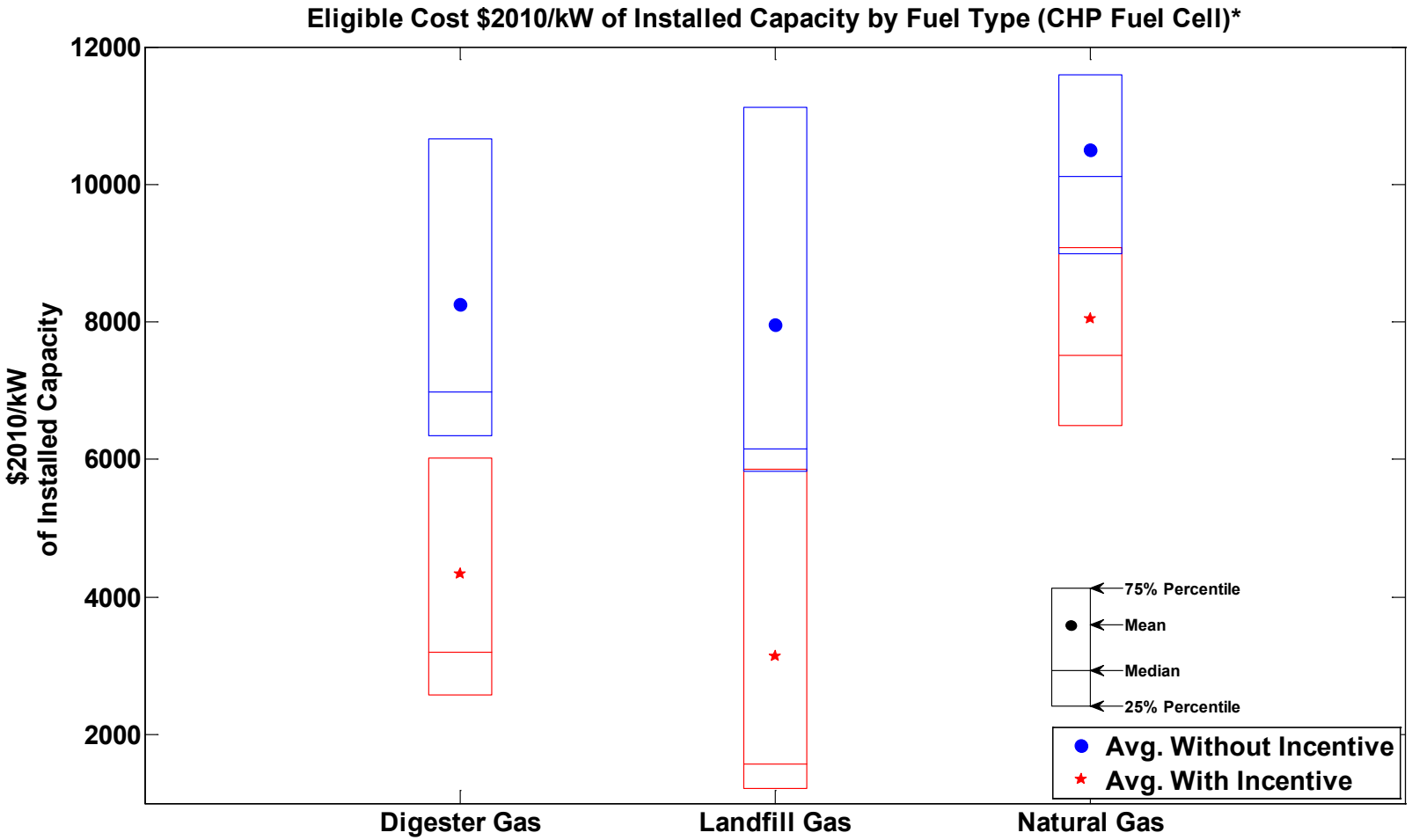
Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.
**Data bins with less than 2 projects filtered.
†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

NREL cdp_stat_23
Created: Nov-05-15 3:02 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-24

Eligible Cost By Fuel Type with and without Incentives (CHP Fuel Cells)



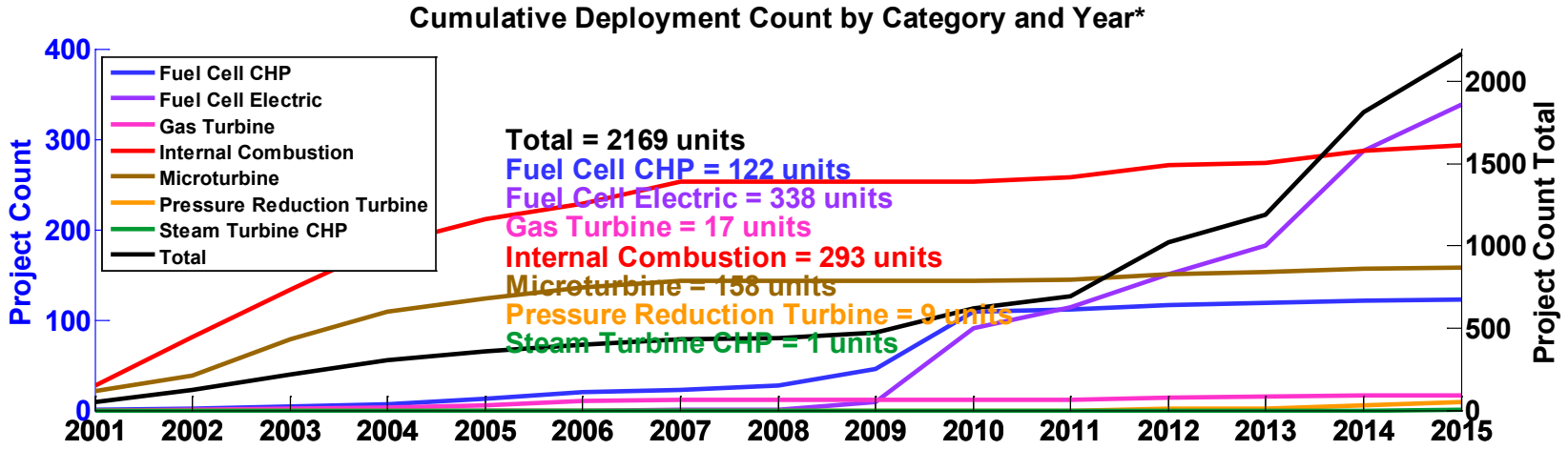
Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

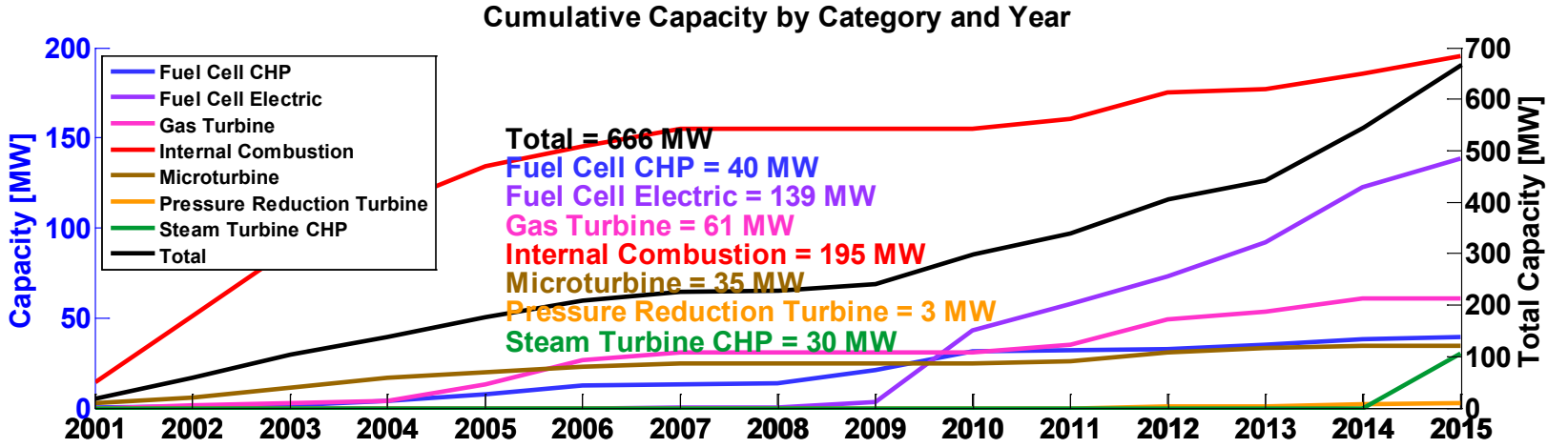
*Data from the CA SGIP.

Note: Refer to CA SGIP Handbook for on-site vs directed digester gas (biogas) qualifications.

NREL cdp_stat_24
Created: Oct-21-15 2:59 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-25
Cumulative Deployment Count by Category and Year

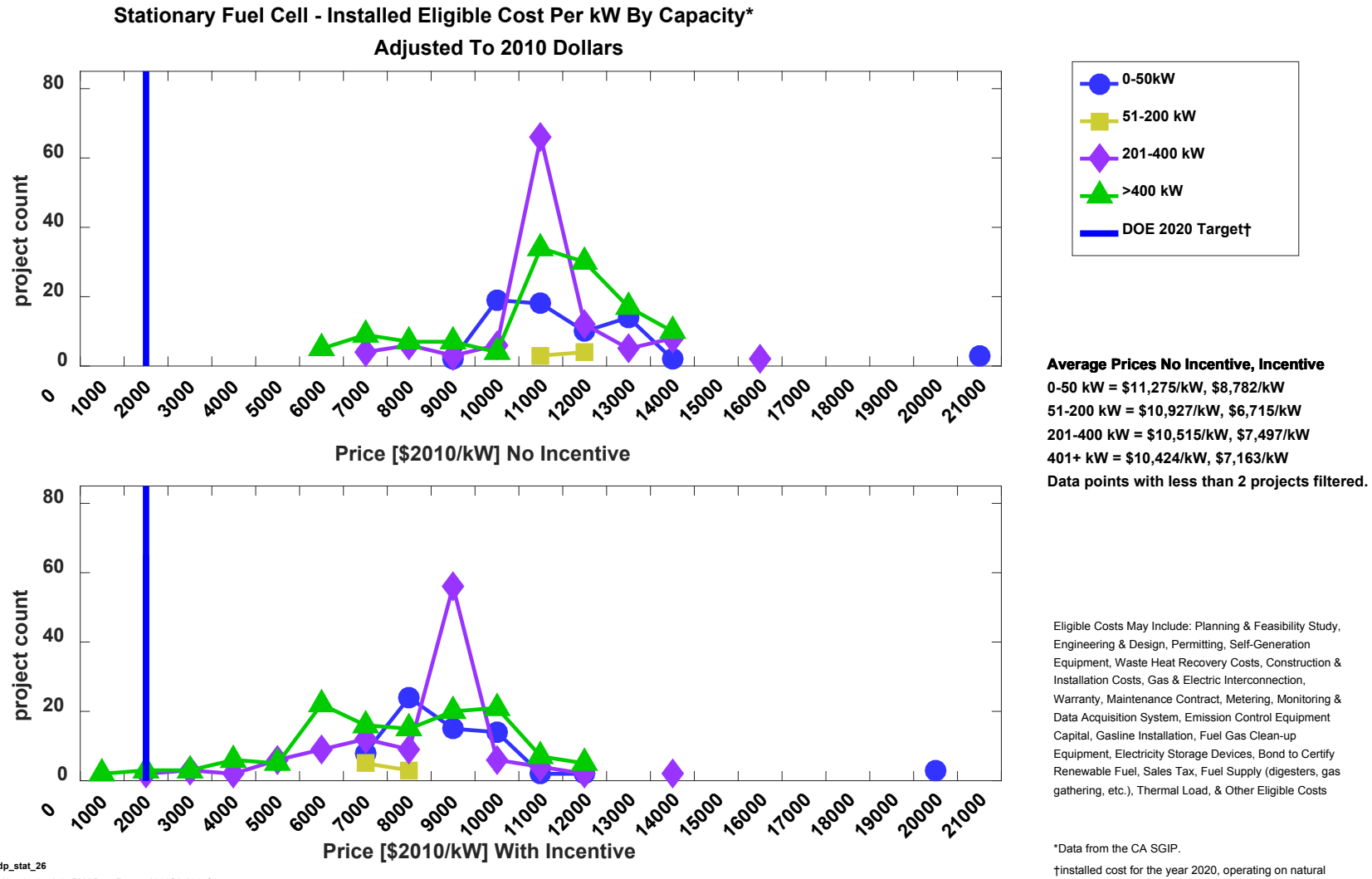




*Data from the CA SGIP.

NREL cdp_stat_25
Created: Oct-21-15 2:59 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-26
Installed Eligible Cost per kW By Capacity



Average Prices No Incentive, Incentive
0-50 kW = $11,275/kW, $8,782/kW
51-200 kW = $10,927/kW, $6,715/kW
201-400 kW = $10,515/kW, $7,497/kW
401+ kW = $10,424/kW, $7,163/kW
Data points with less than 2 projects filtered.

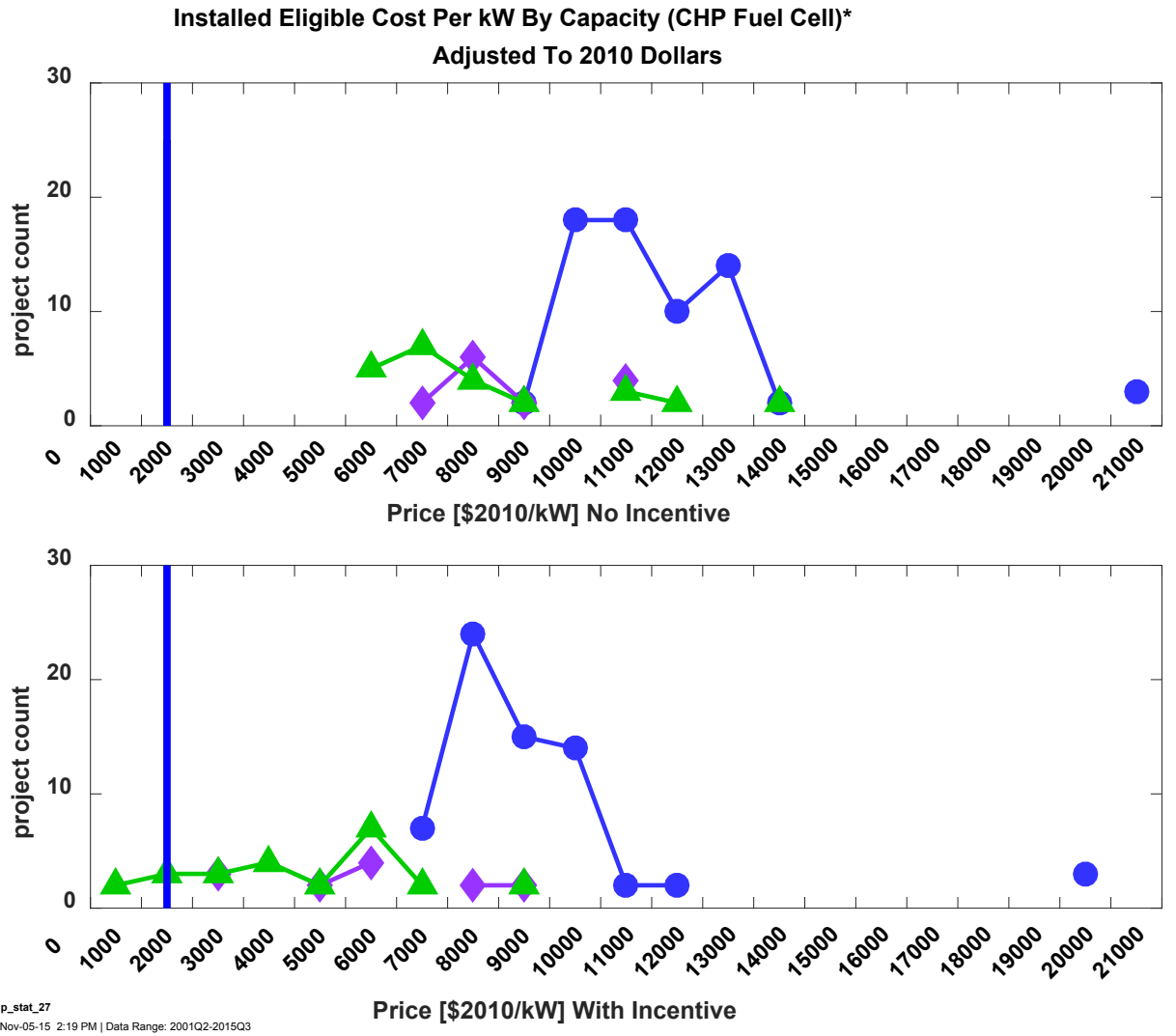
Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

*Data from the CA SGIP.

†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

NREL cdp_stat_26
Created: Nov-05-15 2:17 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-27
Installed Eligible Cost per kW By Capacity (CHP Fuel Cell)



Average Prices No Incentive, Incentive
0-50 kW = $11,303/kW, $8,809/kW
51-200 kW = $NaN/kW, $NaN/kW
201-400 kW = $8,414/kW, $5,581/kW
401+ kW = $8,043/kW, $4,197/kW
Data points with less than 2 projects filtered.

Eligible Costs May Include: Planning & Feasibility Study, Engineering & Design, Permitting, Self-Generation Equipment, Waste Heat Recovery Costs, Construction & Installation Costs, Gas & Electric Interconnection, Warranty, Maintenance Contract, Metering, Monitoring & Data Acquisition System, Emission Control Equipment Capital, Gasline Installation, Fuel Gas Clean-up Equipment, Electricity Storage Devices, Bond to Certify Renewable Fuel, Sales Tax, Fuel Supply (digesters, gas gathering, etc.), Thermal Load, & Other Eligible Costs

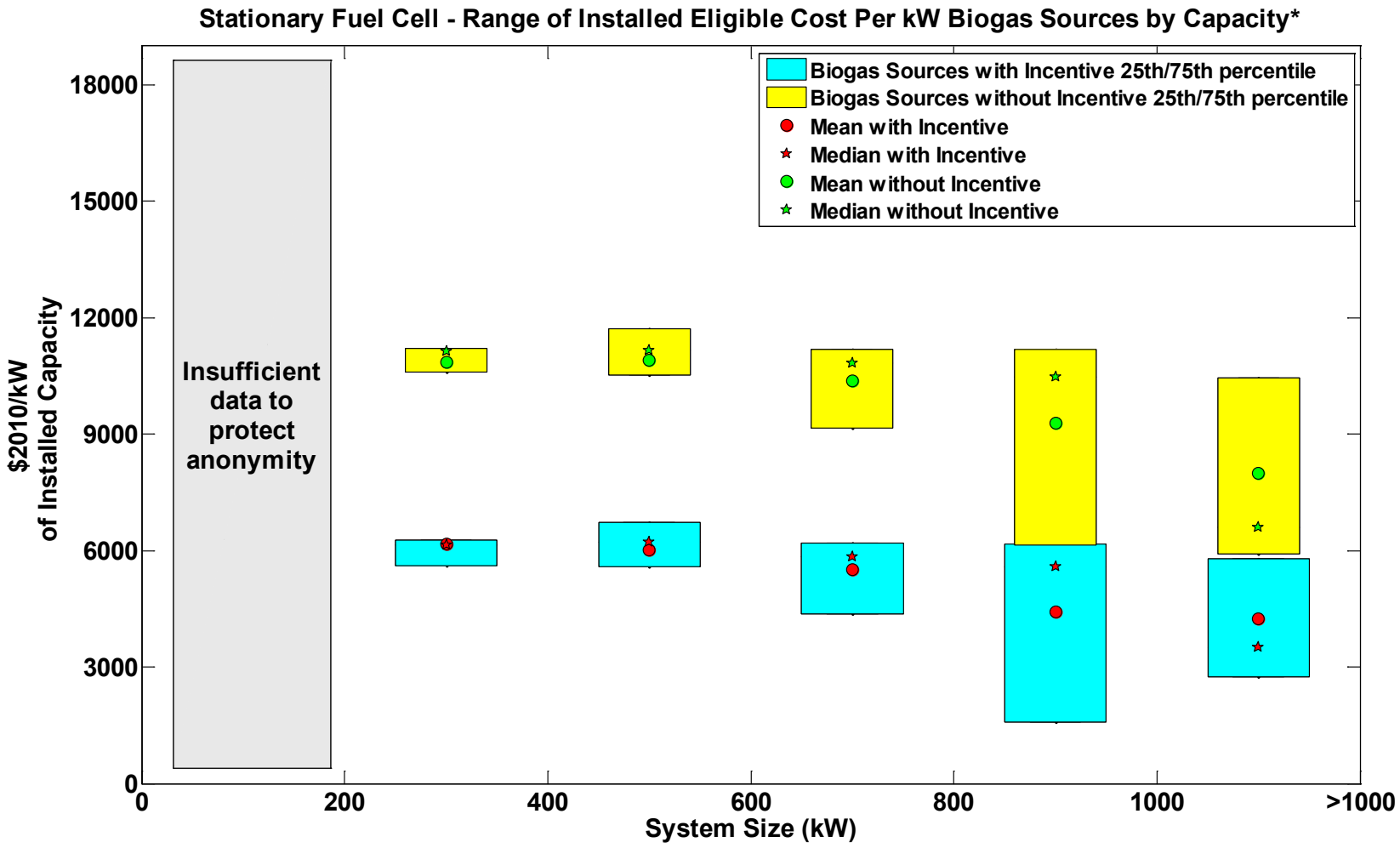
*Data from the CA SGIP.

†installed cost for the year 2020, operating on natural gas. May not include all costs reported in CA SGIP.

NREL cdp_stat_27
Created: Nov-05-15 2:19 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-28

Range of Installed Eligible Cost per kW Biogas Sources by Capacity



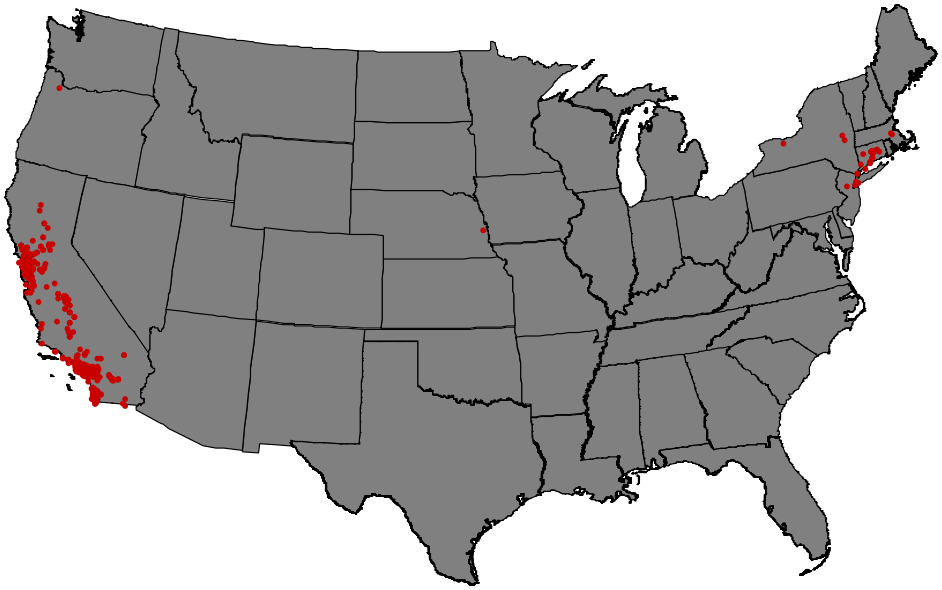
*Data from the CA SGIP.

NREL cdp_stat_28
Created: Oct-21-15 3:01 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-29
U.S. Deployment Map of Stationary Fuel Cells

USA Stationary Fuel Cell Installations (2001 - 2015)

Includes CA SGIP data as well as sites supplying voluntary data.

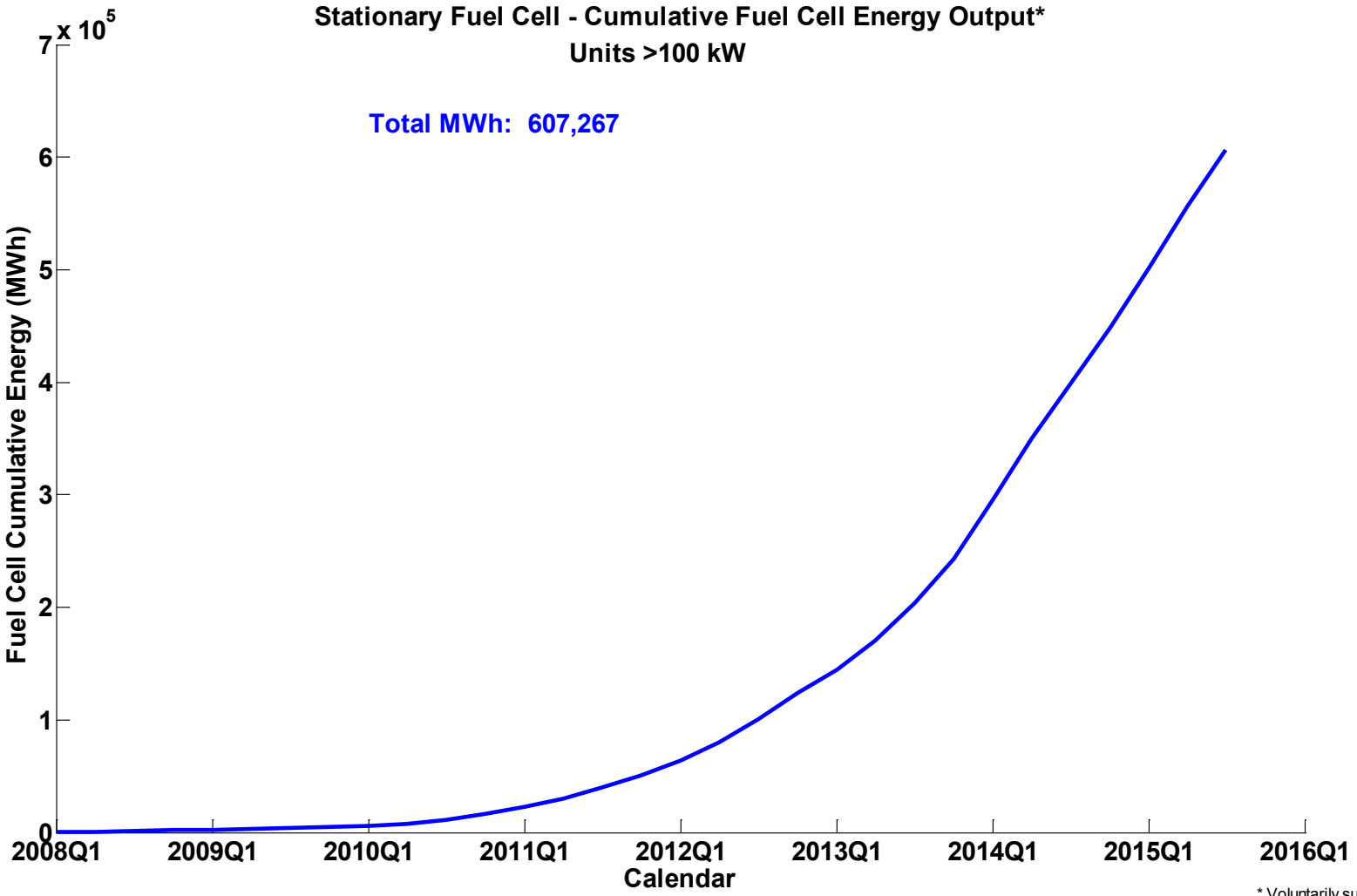


Total Count of Sites in Continental US: 501

NREL cdp_stat_29
Created: Oct-21-15 3:01 PM | Data Range: 2001Q2-2015Q3

CDP-STAT-30

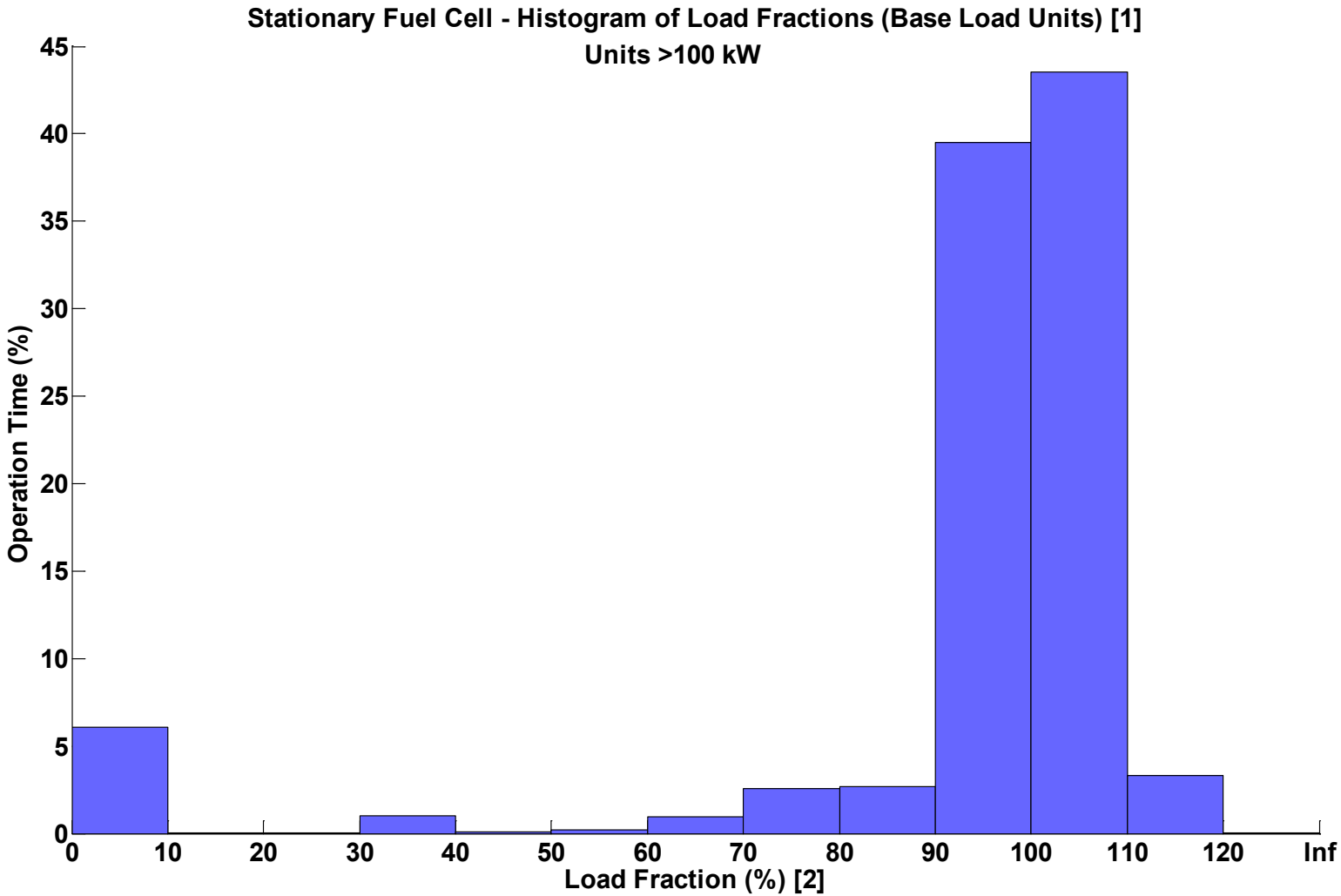
Cumulative Fuel Cell Output of Voluntarily Supplied Data for Units >100 kW



NREL cdp_stat_30
Created: Oct-21-15 3:02 PM | Data Range: 2001Q2-2015Q3

* Voluntarily supplied data for units > 100 kW

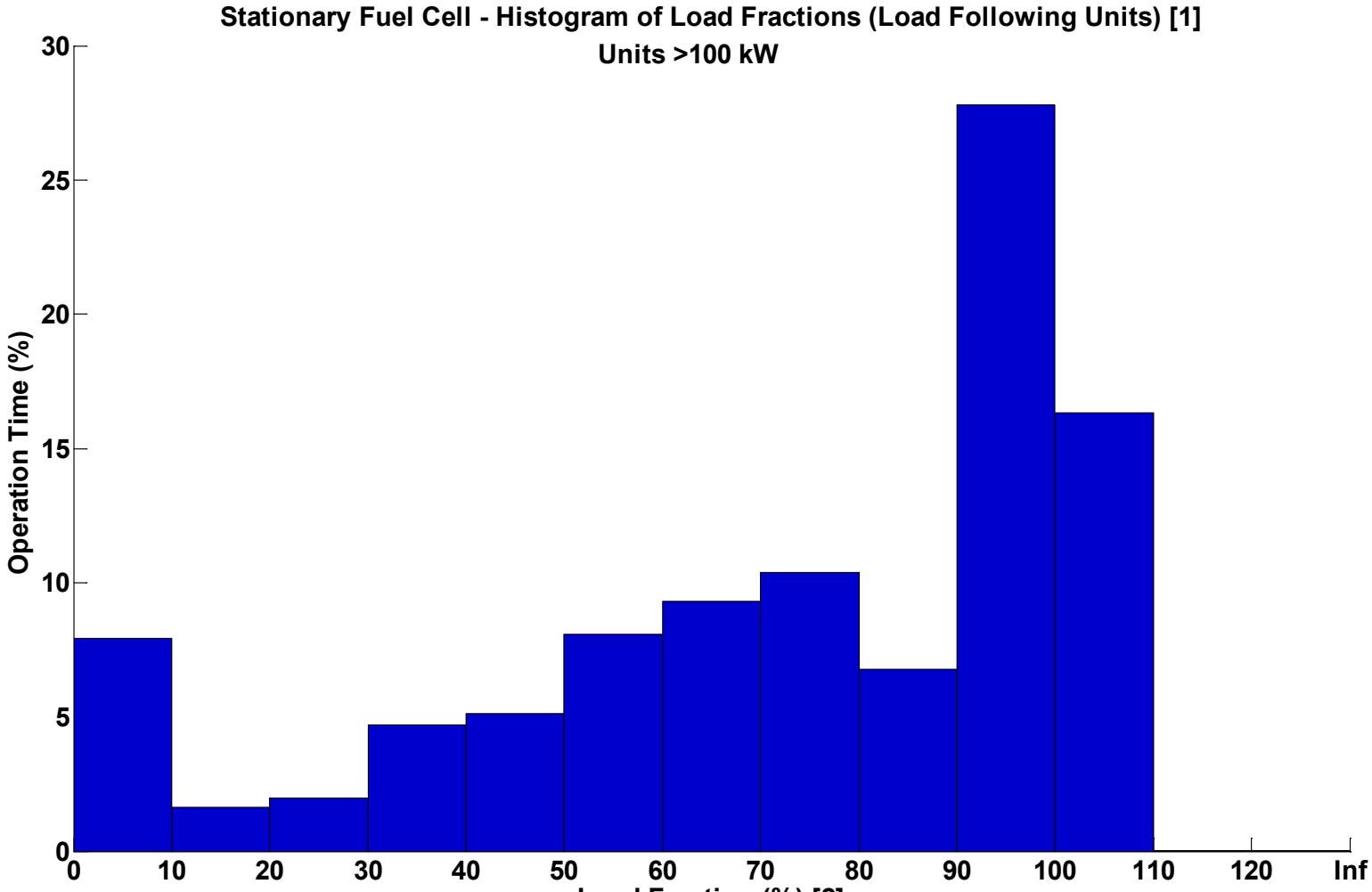
CDP-STAT-31
Histogram of Load Fractions for Base Load Units >100 kW



NREL cdp_stat_31
Created: Oct-21-15 3:02 PM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW, fuel cells running as building base load generation
[2] Load fraction is the ratio of electrical output per rated capacity of the fuel cell unit.

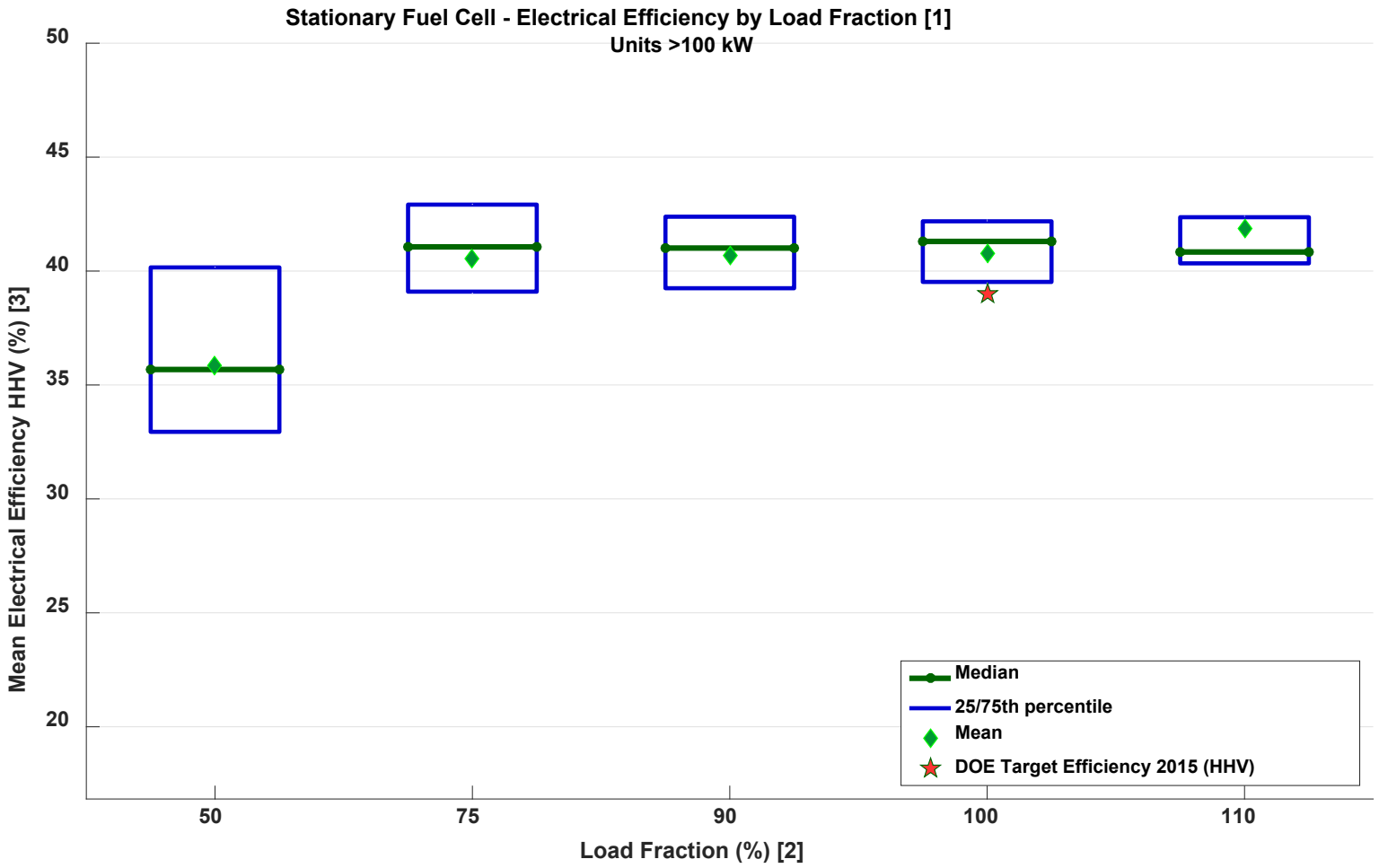
CDP-STAT-32
Histogram of Load Fractions for Load Following Units >100 kW



NREL cdp_stat_32
Created: Oct-21-15 3:02 PM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW, fuel cells running as building load following generation
[2] Load fraction is the ratio of electrical output per rated capacity of the fuel cell unit.

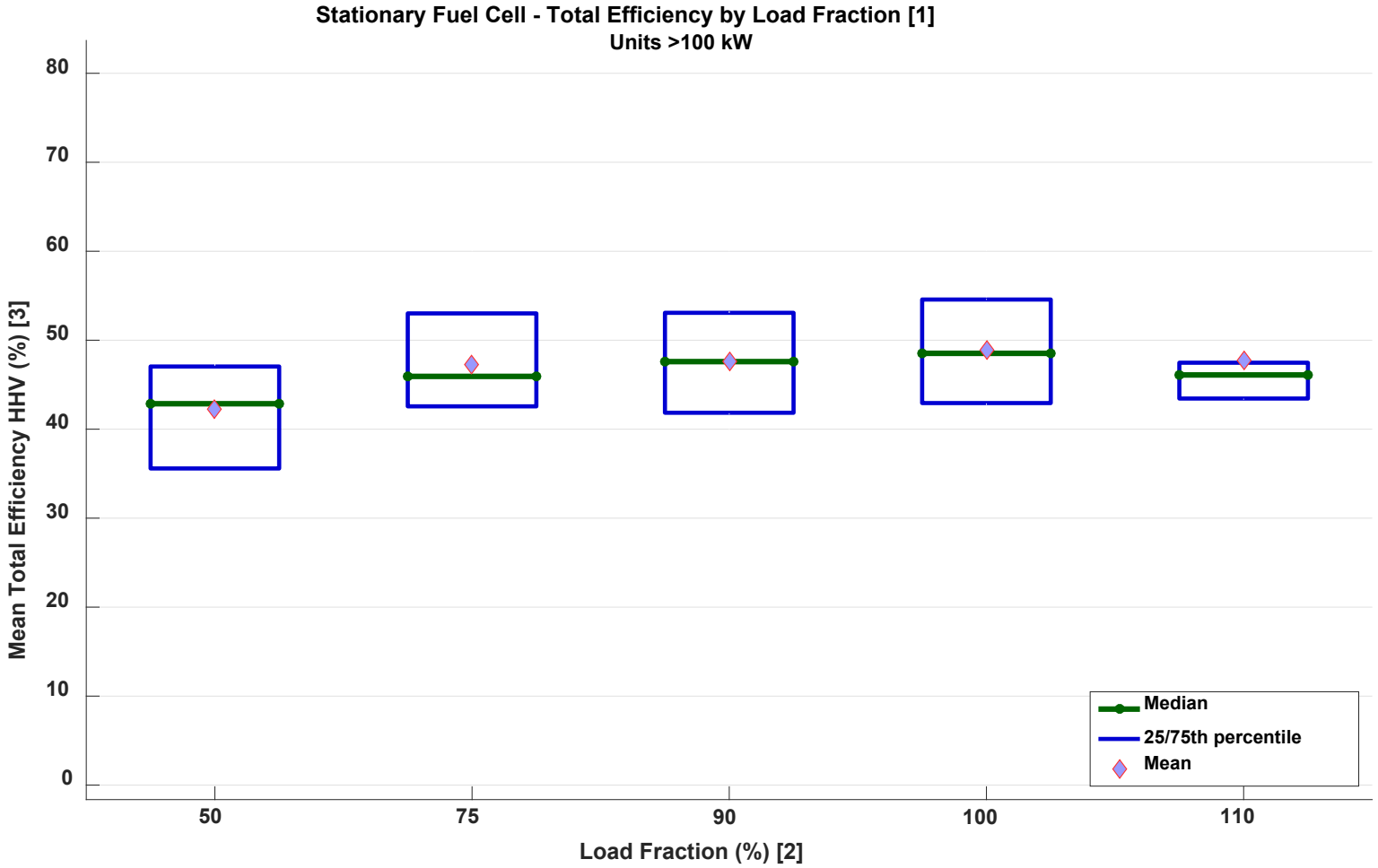
CDP-STAT-33
Electrical Efficiency by Load Fraction for Units >100 kW



NREL cdp_stat_33
Created: Nov-19-15 7:53 AM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW
[2] Load fraction is the ratio of electrical output per rated capacity of the fuel cell unit. Efficiency data points for each load fraction are +/- 2% of the target load fraction.
[3] Mean efficiencies by unit are calculated as the percentage of electrical power output to higher heating value of fuel input. The natural gas higher heating value used is 48.956 MJ/kg and the lower heating value used is 44.294 MJ/kg.

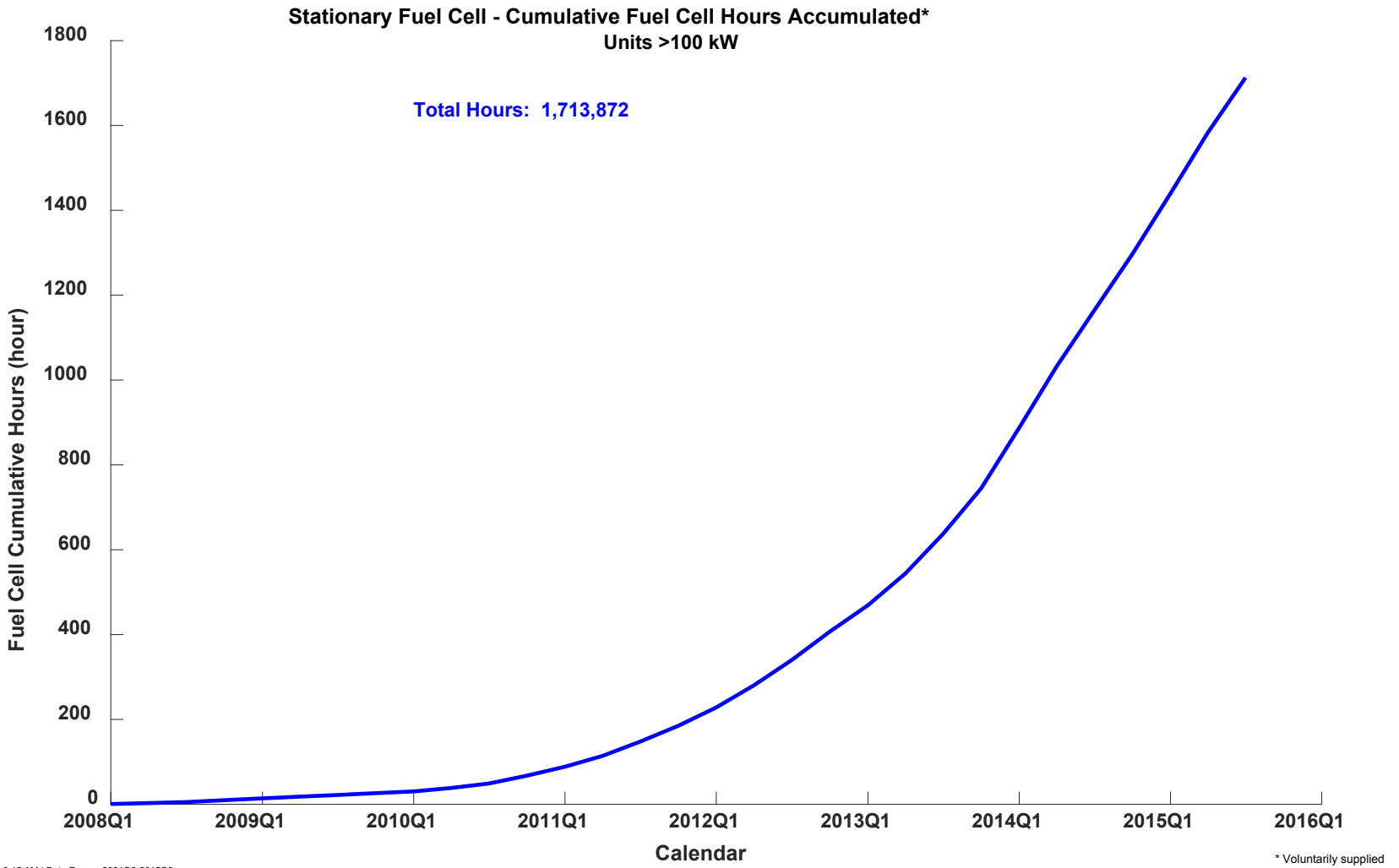
CDP-STAT-34
Total Efficiency by Load Fraction for Units >100 kW



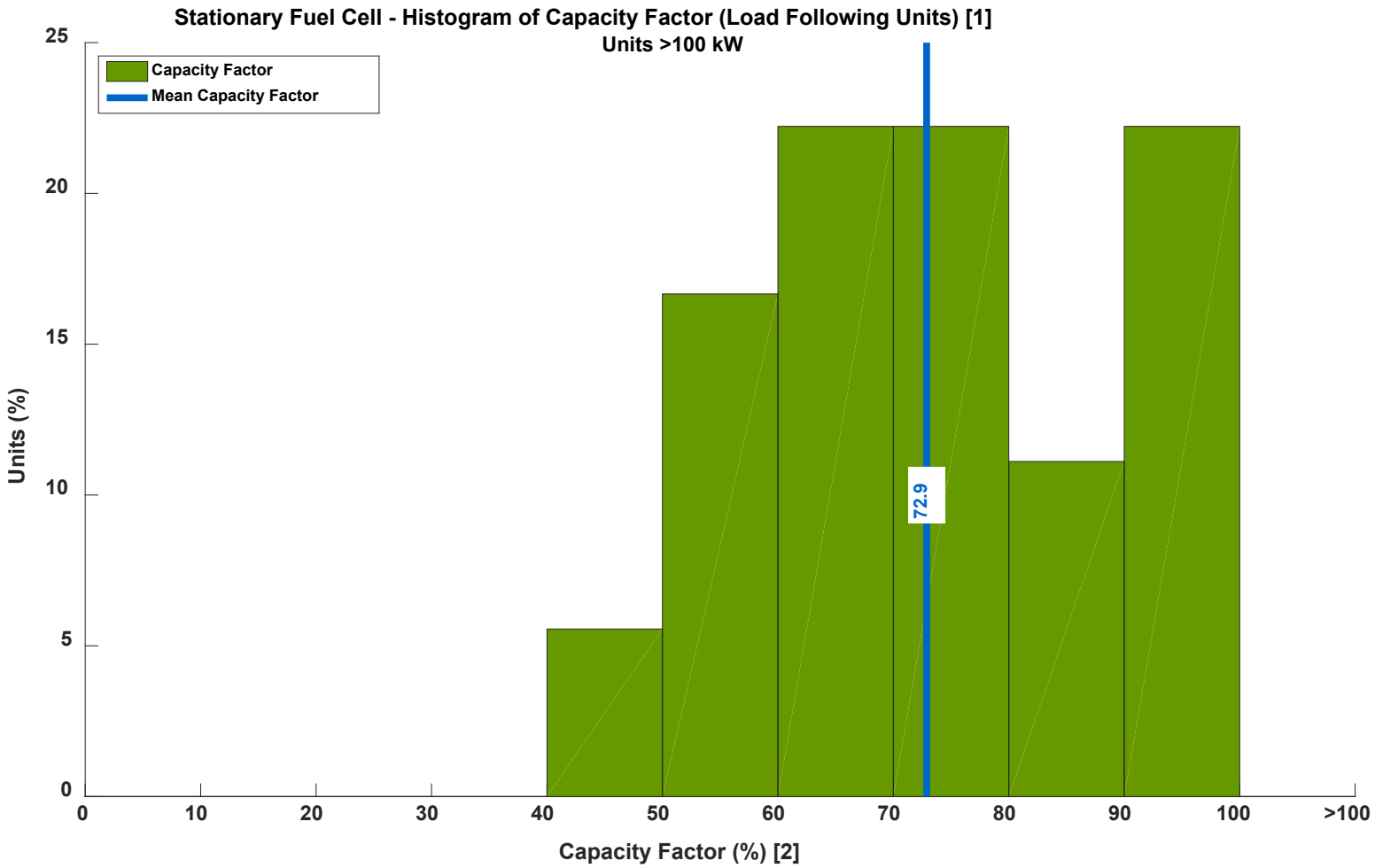
NREL cdp_stat_34
Created: Nov-23-15 9:15 AM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW
[2] Load fraction is the ratio of electrical output per rated capacity of the fuel cell unit. Efficiency data points for each load fraction are +/- 2% of the target load fraction.
[3] Mean total efficiencies by unit are calculated as the percentage of electrical plus heat outputs to higher heating value of fuel input. The natural gas higher heating value used is 48.956 MJ/kg and the lower heating value used is 44.294 MJ/kg.

CDP-STAT-35
Cumulative Fuel Cell Hours Accumulated for Units >100 kW



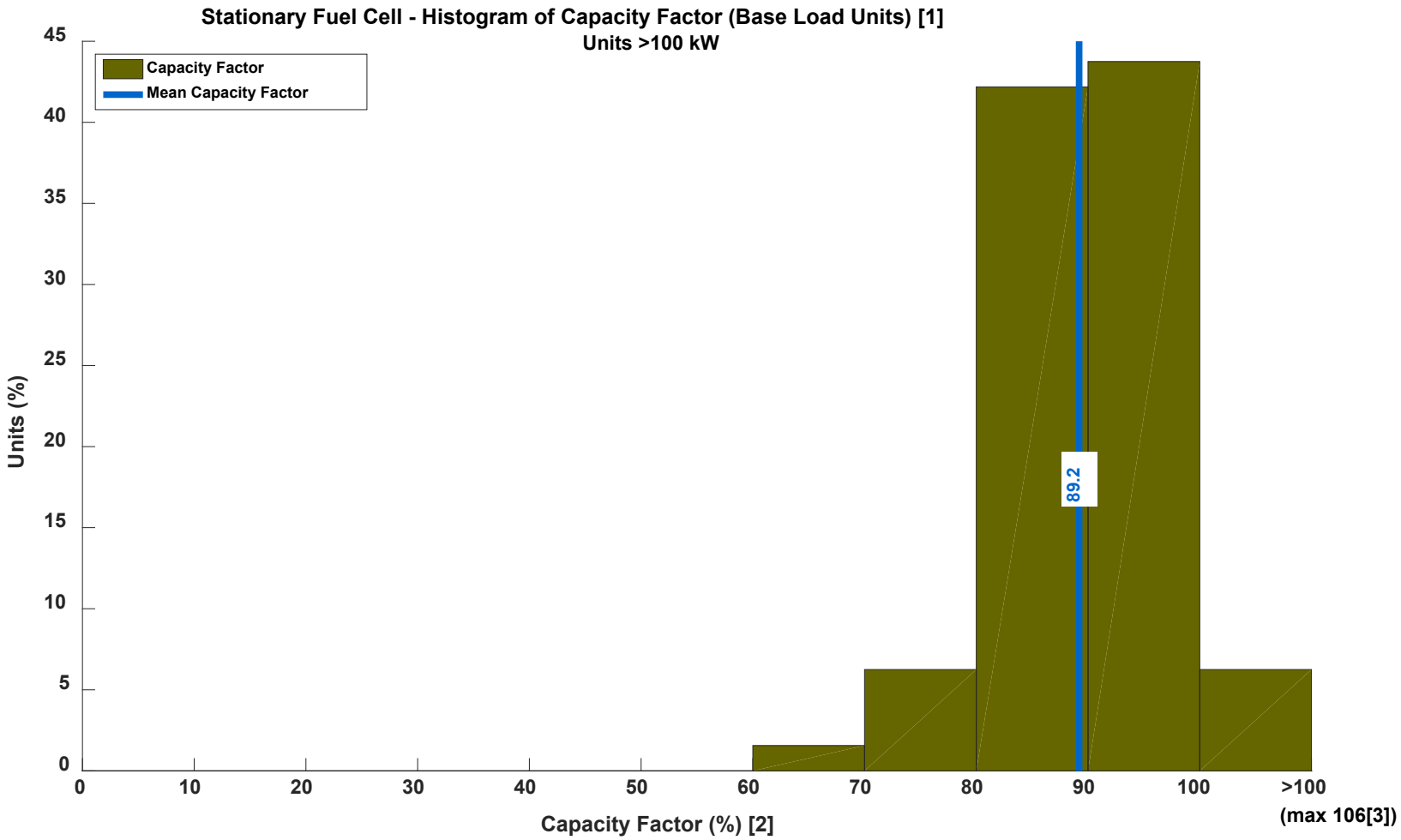
CDP-STAT-36
Histogram of Capacity Factor for Load Following Units >100 kW



NREL cdp_stat_36
Created: Nov-23-15 9:34 AM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW, fuel cells running as building load following generation
[2] Capacity Factor is defined as the ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period.

CDP-STAT-37
Histogram of Capacity Factor for Base Load Units >100 kW



NREL cdp_stat_37

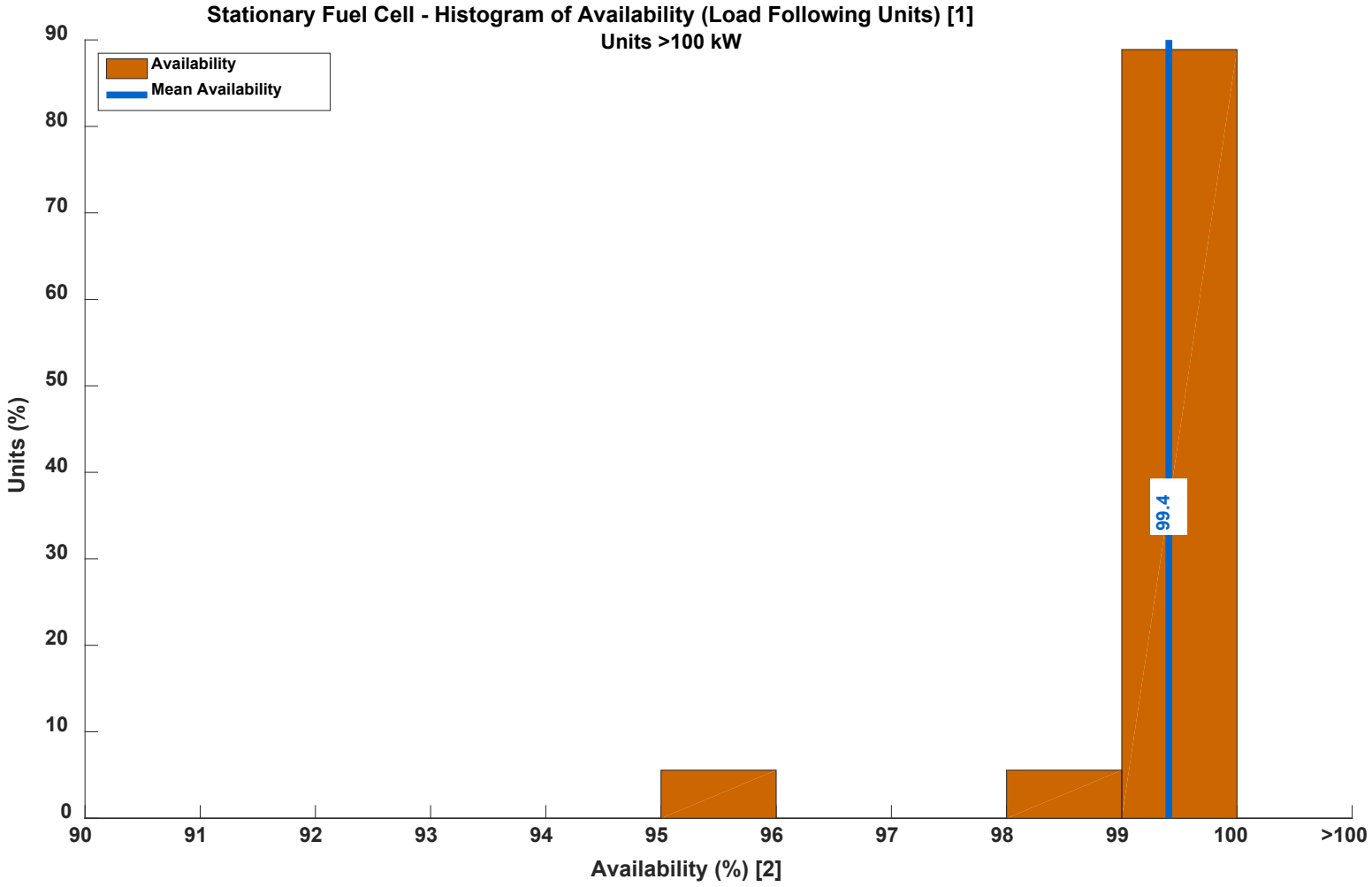
Created: Nov-23-15 9:34 AM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW, fuel cells running as building base load generation

[2] Capacity Factor is defined as the ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period.

[3] Capacity Factor over 100% is possible when a unit operates above rated capacity.

CDP-STAT-38
Histogram of Availability for Load Following Units >100 kW



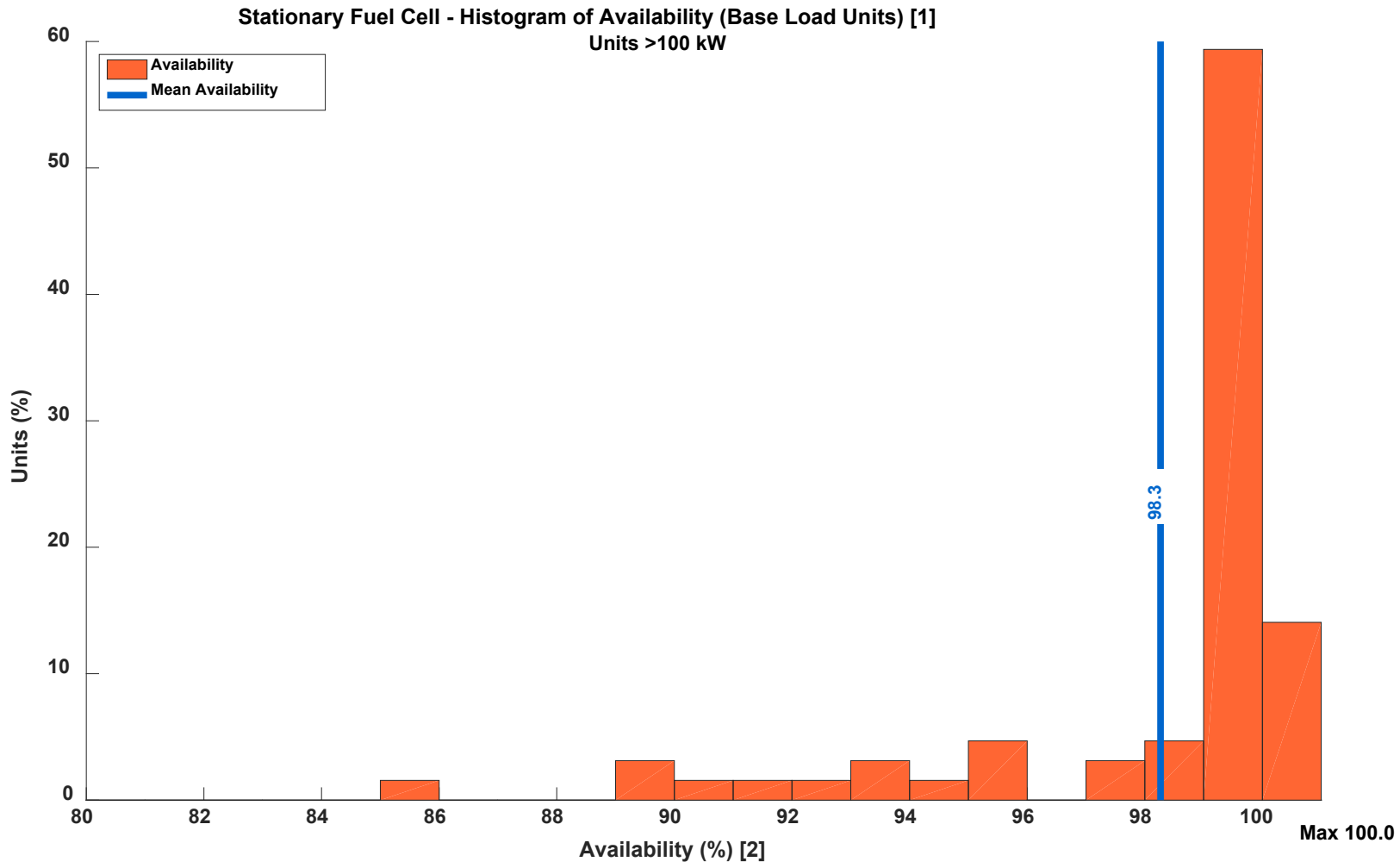
NREL cdp_stat_38

Created: Dec-03-15 10:19 AM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW, fuel cells running as building load following generation

[2] Downtime may include scheduled maintenance decreasing calculated availability.

CDP-STAT-39
Histogram of Availability for Base Load Units >100 kW



NREL cdp_stat_39

Created: Dec-03-15 10:22 AM | Data Range: 2001Q2-2015Q3

[1] Voluntarily supplied data for units > 100 kW, fuel cells running as building base load generation

[2] Downtime may include scheduled maintenance decreasing calculated availability.