Creating A Greener Energy Future For the Commonwealth

Massachusetts Department of Energy Resources

Massachusetts Alternative Portfolio Standard for Combined Heat & Power (CHP)

An Effective Program for Clean, Efficient Energy:

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Overview of MA Portfolio Standard Programs
Renewable Energy Portfolio Standard (RPS)
Alternative Energy Portfolio Standard (APS)

Policy Purpose

- Creates obligation of all retail electricity suppliers to acquire Renewable Energy Certificates (RECs) and Alternate Energy Credits (AECs) equal to a set percentage (Minimum Standard) of load served. Purchase of RECs and AECs from qualified generators provides additional revenue.
- Strategy is to "green up" the ISO-NE grid. Generation from throughout New England and adjacent control areas are eligible (except for solar and CHP).

RPS/APS Standards

- **Renewable Energy Portfolio Standard – RPS Class I**
  - New (post-1997) renewable energy generation – original program (began 2002)
  - RPS Solar Carve Out – begins in 2010 to grow solar PV sector to 400 MW

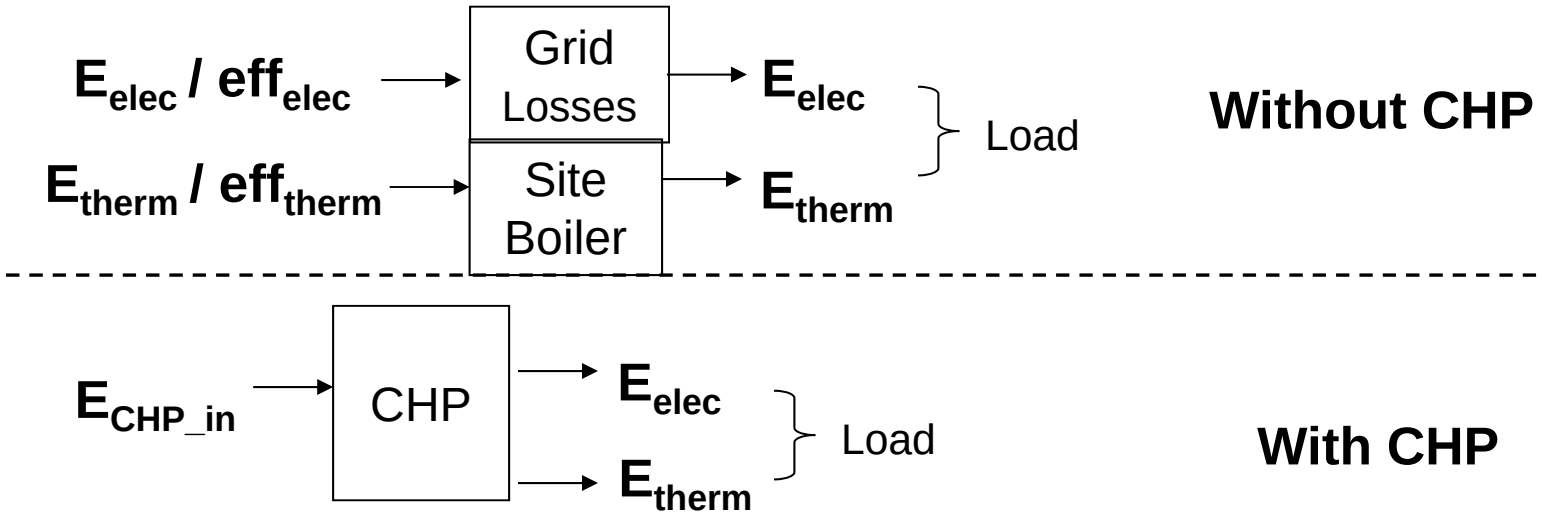
- **Renewable Energy Portfolio Standard – RPS Class II**
  - Supports MA share of existing (pre-1998) RE generation
  - Subclass supports existing Waste-to-Energy Plants in MA and dedicates at least 50% of revenues to recycling programs

- **Alternative Energy Portfolio Standard (APS)**
  - Supports non-RE technologies (flywheels, gasification, CHP)
  - CHP of key importance – provides credits for efficiency gains in electric and thermal production

Alternative Energy Portfolio Standard

- Established under Green Communities Act 2008. Provides for RPS-type program for alternative (non-renewable) technologies.
- Program compliance obligation began in 2009.
- Eligible technologies include flywheels, CHP, gasification with carbon capture/sequestration, paper derived fuels.
- Key technology of interest is CHP. Provides credit for electric generation and useful thermal load.
- Qualified units produce Alternative Energy Credits (AECs).
- Alternative Compliance Payment (ACP) Rate is $21/MWh (2012) and increases with CPI.

AECs for CHP Account for Efficiency Gains



Alternative Energy Credits (AECs) calculated as energy savings of CHP compared with grid power and separate thermal unit, to meet the same load

$$AECs = \underbrace{E_{elec}/0.33 + E_{therm}/0.80}_{\text{non-CHP Source Fuel}} - \underbrace{E_{CHP\_in}}_{\text{CHP Fuel}}$$

All units in MWH

CHP Benefits

Facility / End-User

- Cost Savings from avoided utility electric charges, including avoided demand charges for large users.
- Greater control over facility energy costs
- Increased reliability: CHP can be designed to supply power, heat and cooling during a grid outage.

Grid Operator

- Load and demand reduction on existing grid.

Rate-payers:

- CHP generated electricity avoids energy, capacity and other significant grid-related costs which are drivers for the retail cost of grid supplied power.

Climate Change and Societal

- Source GHG reduction (typically 17% for natural gas CHP)
- Enhanced competitiveness for MA energy intensive industries by reducing cost of energy.

MA Alternative Portfolio Standard – Minimum Standard and Cumulative CHP Demand

Year	APS Minimum Standard	Est. MW of Installed CHP
2009	1.00%	
2010	1.50%	64
2011	2.00%	92
2012	2.50%	121
2013	3.00%	148
2014	3.50%	177
2015	3.75%	205
2016	4.00%	215
2017	4.25%	226
2018	4.50%	237
2019	4.75%	249
2020	5.00%	261

Estimate based upon APS being met only by CHP

Approximately 27 MW of new CHP installations required each year through 2014, and half this amount in years following.

Guidelines for APS Eligible CHP Systems

- New systems: Have to have started operation after Jan. 1, 2008.
- Pre-2008 Systems: Program supports incremental CHP
  - Provides incentive for existing electric-only power plants to add useful thermal load, or for thermal-only plants to add electrical generation.
  - Also Provides incentive for modifications to meet incremental thermal and/or electrical loads
    - EXAMPLE: 2009 Addition of a heat driven chiller to a 2005 CHP system to supply a new process cooling load.

Guidelines for APS Eligible CHP Systems

- Metering of fuel, kWh and BTUs heat supplied to a useful load by revenue grade meters is required as the basis for determination of the AECs generated per quarter
  - Reduced metering requirements for systems < 200kW
- Meter reading and computation of the AECS are by an independent verifier.
- CHP Projects must serve thermal load in MA

CHP Units may also qualify for Utility EE Funding

- Per Green Communities Act, CHP projects passing a cost-effectiveness screen are eligible for support (up to $750/kW) from the electric utility energy efficiency programs.

Guidelines for RPS Eligible CHP Systems

- CHP systems using woody biomass fuel can also qualify for the RPS and generate Class I RECs.
- Location: within the ISO-NE Control Area or within an adjacent Control Area.
- RECs per MWH output are a based on overall efficiency
  - For efficiencies between 40 and 50%; ¼ REC per MWH
  - For efficiencies between 50 and 60%; ½ REC per MWH
  - For efficiencies of 60% or greater; 1 full REC per MWH
- Meet required wood source documentation (see regulations as posted on the MA DOER website)

CHP and RPS

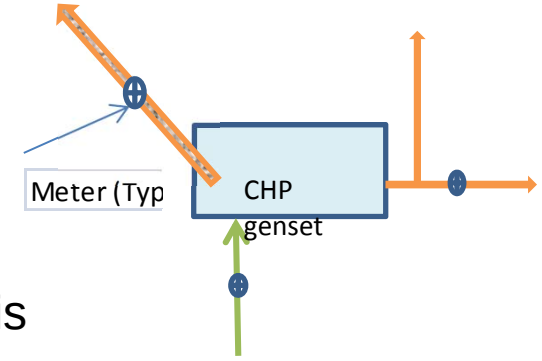
- If a CHP system has a DOER-approved Statement of Qualification for both the APS and RPS, it can earn both AECs and RECs.

APS Benefit – Example

Unit Electric Generating Capacity		Unit Useful Heat Generating Capacity		Electric Generation EFF	Fuel to CHP (mWh)	
kW	MWh/yr	MMBTU/yr	MWh/yr		MMBTU/yr	MWh/yr
500	3500	17918	5250	0.30	39818	11667

AECs/hr	$/hr Maximum	Equivalent Full Load Run hrs/year	AECs/yr	Maximum Annual Value for AECs ($/year)
0.79	$ 15.72	7000	5502	$ 115,539.77

Useful Heat as a % of Total Heat Output	CHP Overall Efficiency @Full Load	Value per AEC	Annual Value for AECs ($/year)
45%	0.75	$ 20.00	$ 110,037.88



Remarks:
Ratio of AECs to MWh electric generated is 1.6:1. So, for every kWh generated 2.7 cents is earned. As O&M costs typcally range from 2 to 4 cents per kWh, this benefit will cover a substantial portion of these costs.

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Examples of Projected APS Benefit by Size and Application

- Based on the system inputs and $20 /AEC as used in the previous example

Size (kW)	APS $/yr	Common End User	Typical System Types
10	$1,900.00	Residential, Small Commercial	IC Genset with heat recovery
250	$47,330.00	Small Industrial, institutional, health care, commercial, mixed use and district energy.	IC genset with heat recovery; IC genset + HRSG; Microturbine; Small CGT + HRSG; absorption chiller option Power boiler with steam turbine
500	$94,659.09		
1,000	$189,318.18		
5,000	$946,590.91	Mid-sized to large Industrial, institutional, health care, commercial, mixed use and district energy.	IC genset + HRSG CGT + HRSG; CGT based combied cycle Power boiler with steam turbine Absortpion Chiller Option
10,000	$1,893,181.82		
15,000	$2,839,772.73		

EE/APS Project Support – Case Study 1

UMass Medical Center Campus

Project Description

New 7.5 MW combustion gas turbine and HRSG integrated with existing 9 MW power boiler steam turbines.

Total gross generating capacity is 16.5 MW.

Campus Loads

Electric, Steam (Heating , Chilled water with steam and electric motor driven compressors)

Projected Performance

Most of incremental energy will be electrical which will allow the Campus to operate with virtually no requirement for supplemental grid power.

No incremental heating load and related steam production.

Largest benefit is the increase in overall efficiency of the new 16.5 MW system, which is 86% compared with the previous 9 MW system efficiency of 71%.

EE/APS Project Support – Case Study 1

UMass Medical Center Campus

Projected Performance (per annum)

Total Net Electricity:	123,566 MWh
Incremental Net Electricity:	85,404 MWh
Total Steam:	823,339 MMBTU
Incremental Steam:	None
Incremental Net Fuel Use:	-33,785 MMBTU
Incremental Net GHG Emission Reduction:	18,571 TPY (19%)

Incentives

EE MassSave

Award $5.6 million

Alternative Portfolio Standard

Projected annual AECs = 135,488

Value at present market value of $20/AEC = $ 2,709,768 per annum

Value per incremental kWh = 3.7 cents

EE/APS Project Support – Case Study 1
Simonds International

Project Description

Saw Blade manufacturer; Fitchburg, MA; ~160 employees

New 1.8 MW (3 x 600 kW) natural gas fired diesel gensets, with 400 ton absorption chiller.

Plant Loads

Electric motors and drives; Space heating and DHW; Chilled water for space and process cooling.

EE/APS Project Support – Case Study 1
Simonds International

Projected Performance (per annum)

Electric Generation:	15,019 MWh
Useful Thermal Energy:	63,735 MMBTU
Fuel Use:	135,550 MMBTU
Net GHG Emission Reduction:	2,956 TPY (27%)

Incentives

EE MassSave

Award $470,000

Alternative Portfolio Standard

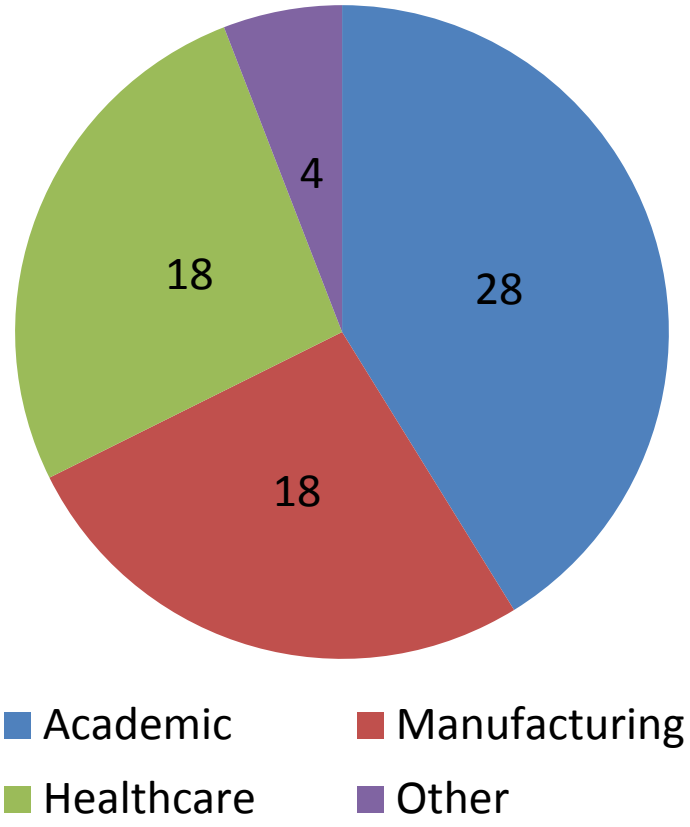
Projected annual AECs = 29,768

Value at present market value of $20/AEC = $ 595,360 per annum

Value per incremental kWh = 4 cents

Capacity (MW) of Operating APS CHP by End Use (Approved and Under Review)

Total Capacity = 67 MW



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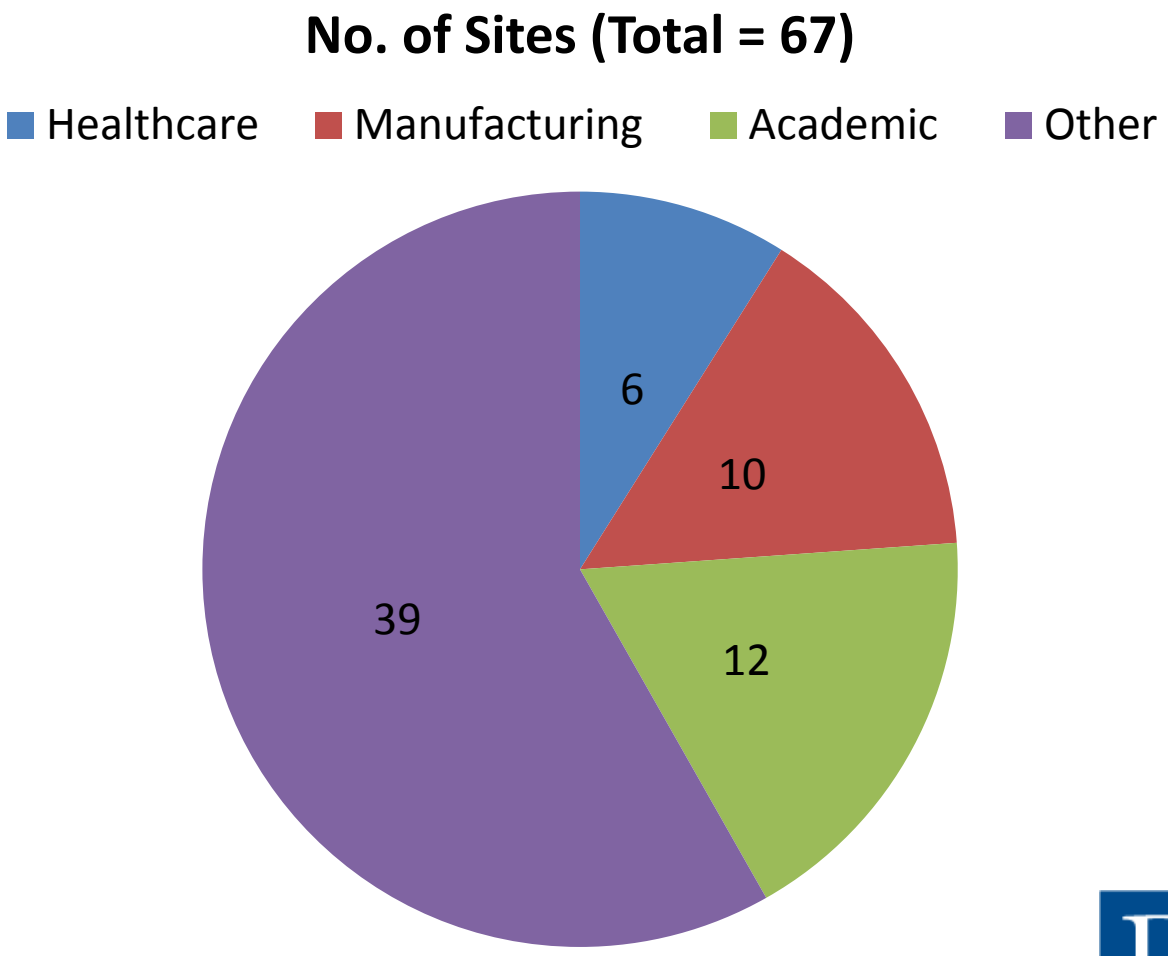
Numbers of Operating APS Systems by End Use



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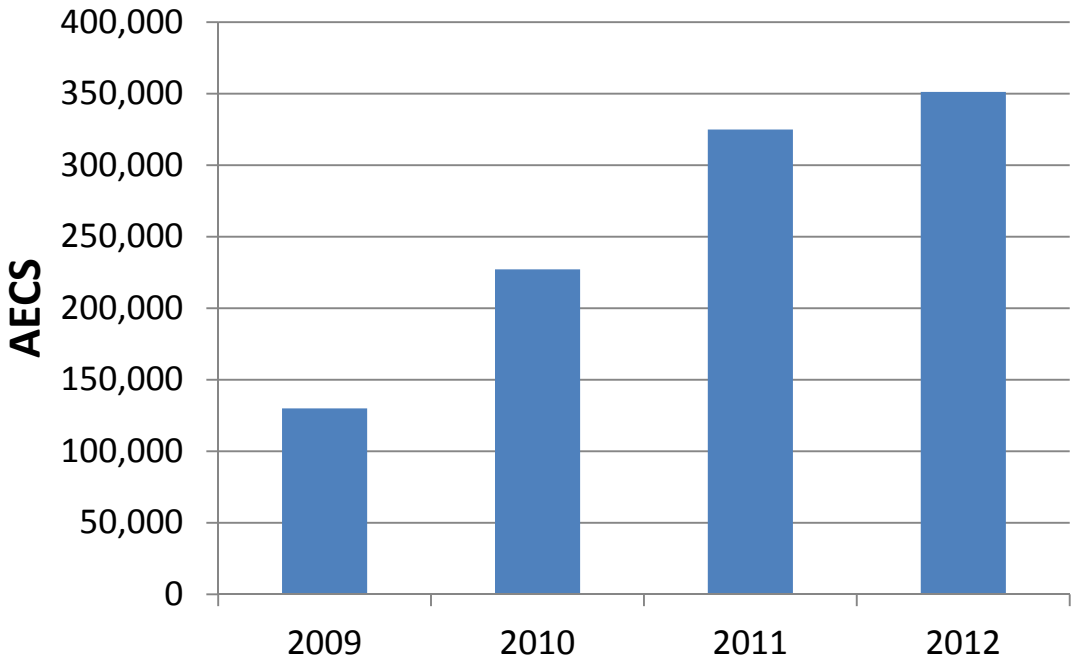
Performance (2009-12)

- Net Source Fuel Savings,
  - 1,033,152 MWH (3,525,1215 MMBTU)
    - Equivalent to 462,960 fifty-five gallon barrels of heating oil.
- Approx. Net Source CO2 Source Emission Reduction
  - 121,600 (short tons)
    - Equivalent to displacing the source GHG generated per year by 17 million square feet of new office buildings.
    - Equivalent to the removal of 23,000 cars from Mass roads for one year.

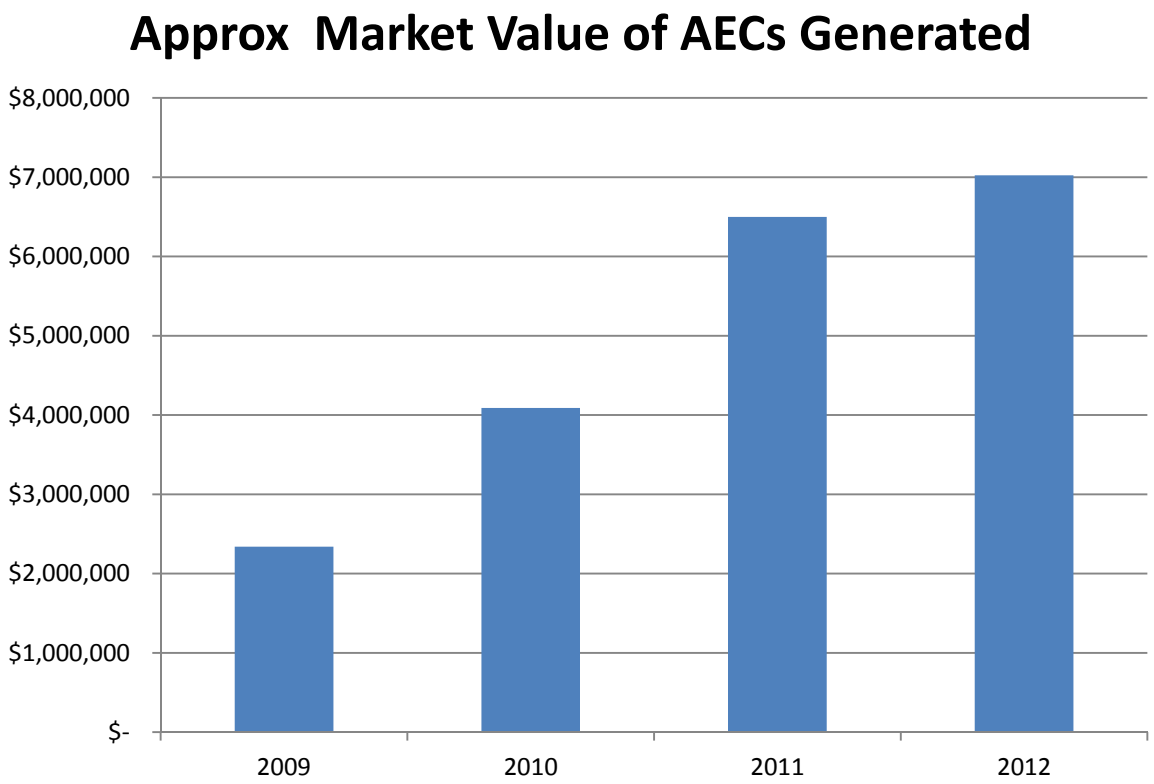
Performance

- APS CHP AECs Generation to date



- Cumulative Total (2009 – present): 1,033,152

Performance



- Approx Cumulative Value: $ 19,950,000

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Performance Tool

Data from APS meters represents a potentially valuable resource for evaluating GHG performance.

DOER is well along with the development of an excel based tool which will:

- Compare actual .vs. projected performance metrics (e.g. efficiency or reduction of source GHG) either by quarter or by year
- Allow for the evaluation of any of these metrics for any single or aggregated system data based on a user-selected query (e.g. size, end use, type, or location)
- Automatically generate graphic and tabulated display of results.

Input data same as for AECs formula so can be populated by the owner's IV as a part of the computation of the quarterly AECs.

Performance Tool – Input Form

III. Projected CHP Performance Results

Month	Fuel Consumption (MWh)			Alternate Energy Credits		
	Baseline	Current	Incremental	Baseline	Current	Incremental
Jan	Not Applicable	27492.92	Not Applicable	Not Applicable	9304.65	Not Applicable
Feb	Not Applicable	27458.56	Not Applicable	Not Applicable	10731.95	Not Applicable
Mar	Not Applicable	27470.19	Not Applicable	Not Applicable	10359.63	Not Applicable
Apr	Not Applicable	26332.99	Not Applicable	Not Applicable	9948.45	Not Applicable
May	Not Applicable	27457.95	Not Applicable	Not Applicable	9434.71	Not Applicable
June	Not Applicable	31382.79	Not Applicable	Not Applicable	10213.31	Not Applicable
July	Not Applicable	31014.99	Not Applicable	Not Applicable	11859.89	Not Applicable
Aug	Not Applicable	34170.12	Not Applicable	Not Applicable	11418.07	Not Applicable
Sept	Not Applicable	33886.43	Not Applicable	Not Applicable	10035.18	Not Applicable
Oct	Not Applicable	31057.92	Not Applicable	Not Applicable	13171.78	Not Applicable
Nov	Not Applicable	33599.09	Not Applicable	Not Applicable	14202.01	Not Applicable
Dec	Not Applicable	34103.76	Not Applicable	Not Applicable	6920.33	Not Applicable
Year	Not Applicable	365427.71	Not Applicable	Not Applicable	127599.96	Not Applicable

IV. Actual CHP Performance Results

Month	Fuel Consumption (MWh)			Alternate Energy Credits		
	Baseline	Current	Incremental	Baseline	Current	Incremental
Jan	Not Applicable	20556.31	Not Applicable	Not Applicable	9565.20	Not Applicable
Feb	Not Applicable	22384.64	Not Applicable	Not Applicable	10856.06	Not Applicable
Mar	Not Applicable	30534.25	Not Applicable	Not Applicable	13977.69	Not Applicable
Apr	Not Applicable	34099.08	Not Applicable	Not Applicable	16985.75	Not Applicable
May	Not Applicable	28354.04	Not Applicable	Not Applicable	14491.67	Not Applicable
June	Not Applicable	29023.67	Not Applicable	Not Applicable	14381.53	Not Applicable
July	Not Applicable	26484.44	Not Applicable	Not Applicable	13769.75	Not Applicable
Aug	Not Applicable	24151.74	Not Applicable	Not Applicable	11313.97	Not Applicable
Sept	Not Applicable	27825.35	Not Applicable	Not Applicable	14027.28	Not Applicable
Oct	Not Applicable	24158.11	Not Applicable	Not Applicable	8400.26	Not Applicable
Nov	Not Applicable	32560.92	Not Applicable	Not Applicable	14031.23	Not Applicable
Dec	Not Applicable	34606.51	Not Applicable	Not Applicable	15223.85	Not Applicable
Year	Not Applicable	334739.06	Not Applicable	Not Applicable	157024.24	Not Applicable

Performance Tool – Principal Result Summary

V. Summary of Projected CHP Performance Results

Quarter	Full Load Equivalent Operating Hours	Net Electrical Output (MWh)	Useful Thermal Output (MMBTU)	Fuel Consumption (MWh)
Q1	1282.22	19778.17	144394.62	82421.67
Q2	1325.03	20438.56	144261.15	85173.72
Q3	1541.23	23773.52	164762.47	99071.55
Q4	1536.40	23698.95	167209.39	98760.77
Year	5684.88	87689.20	620627.63	365427.71

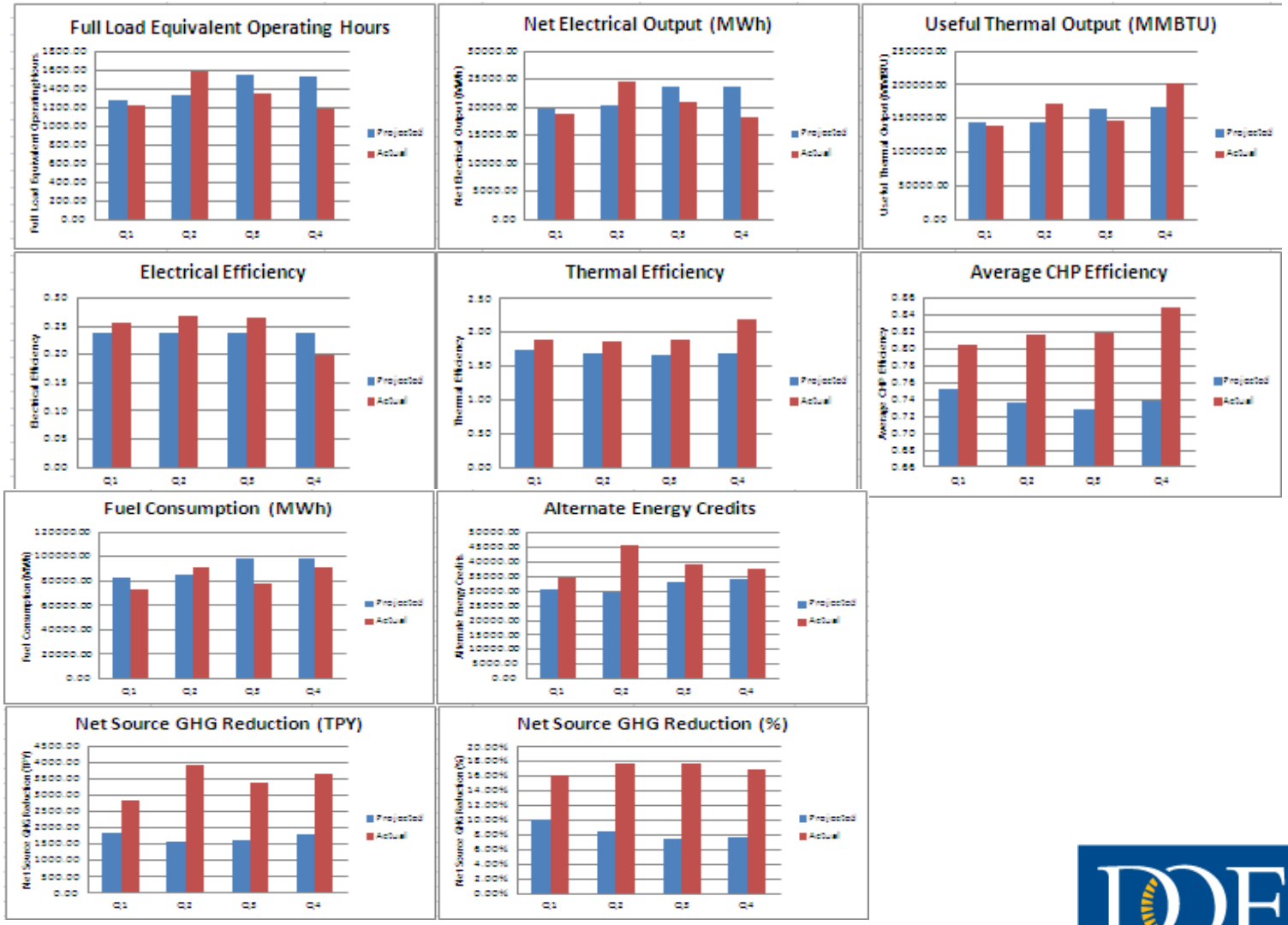
VI. Summary of Actual CHP Performance Results

Quarter	Full Load Equivalent Operating Hours	Net Electrical Output (MWh)	Useful Thermal Output (MMBTU)	Fuel Consumption (MWh)
Q1	1222.57	18858.21	138507.93	73475.21
Q2	1590.65	24535.80	171973.79	91476.79
Q3	1354.40	20891.60	148164.21	78461.53
Q4	1182.42	18238.88	201262.02	91325.54
Year	5350.05	82524.48	659907.94	334739.06

VII. Actual Performance as a Fraction of Projected Performance

Quarter	Full Load Equivalent Operating Hours	Net Electrical Output (MWh)	Useful Thermal Output (MMBTU)	Fuel Consumption (MWh)
Q1	0.95	0.95	0.96	0.89
Q2	1.20	1.20	1.19	1.07
Q3	0.88	0.88	0.90	0.79
Q4	0.77	0.77	1.20	0.92
Year	0.94	0.94	1.06	0.92

Performance Tool – Example of Graphical Output for a Single System



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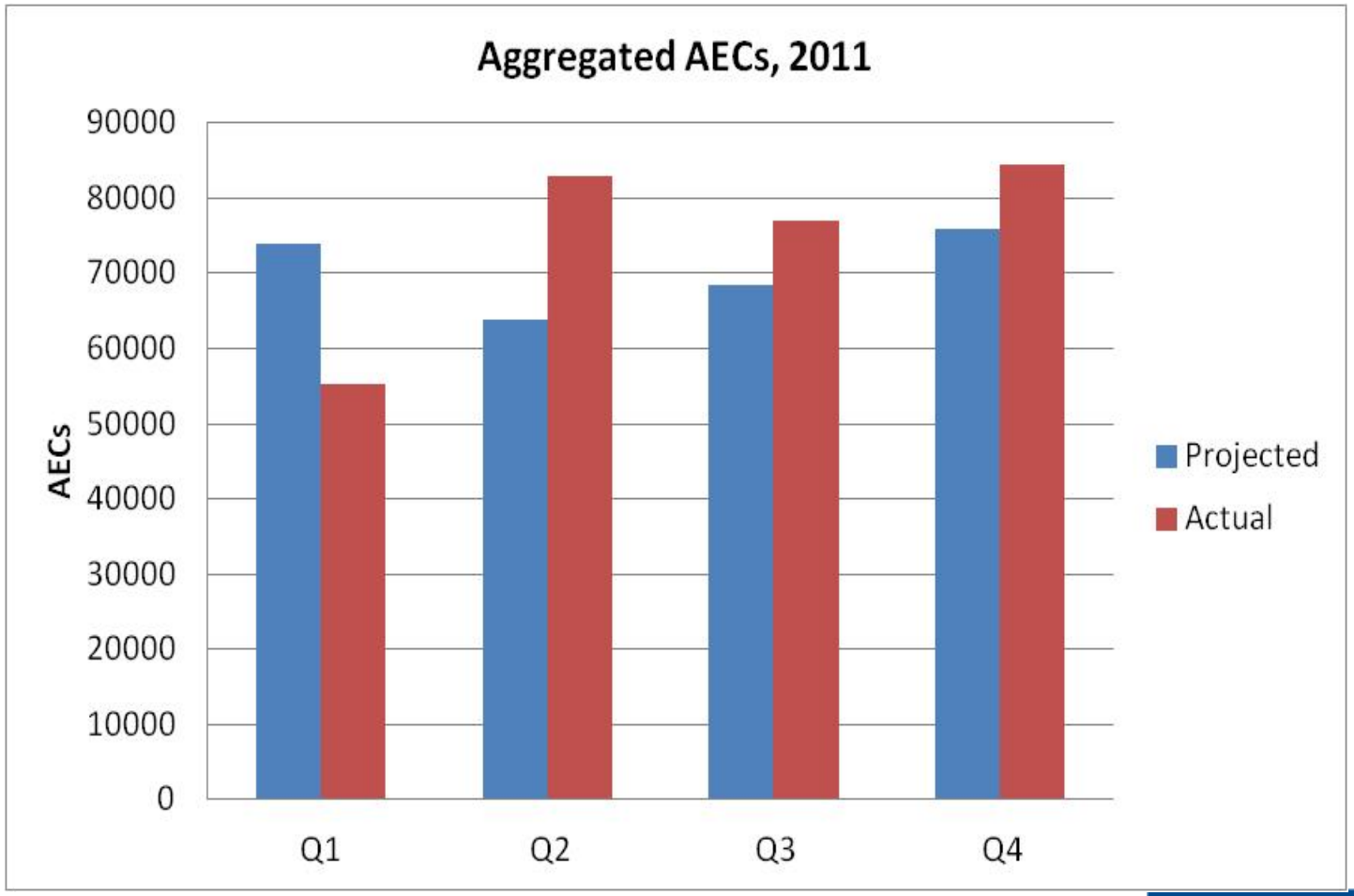
Performance Tool – Example of Graphs for Aggregated Systems



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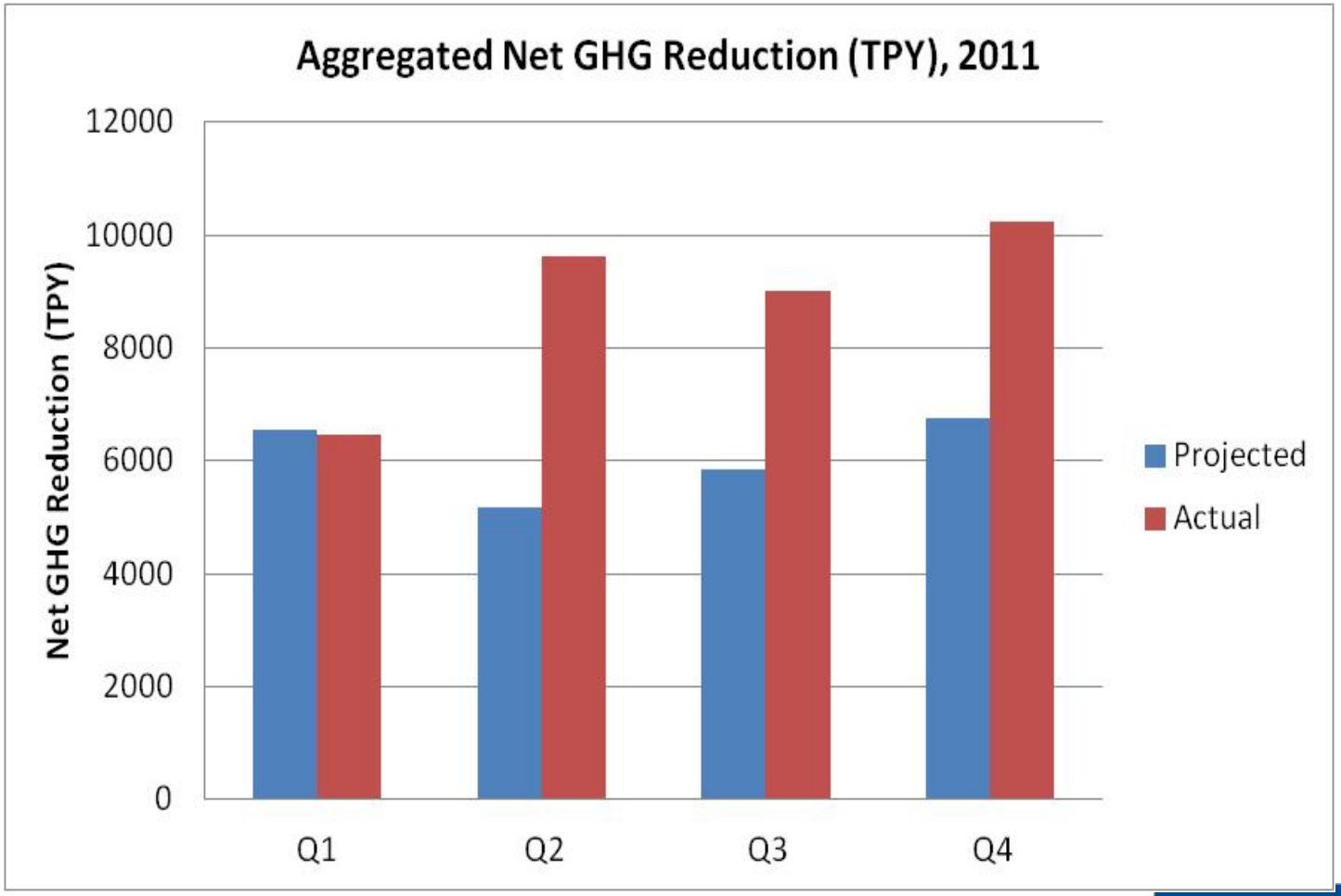

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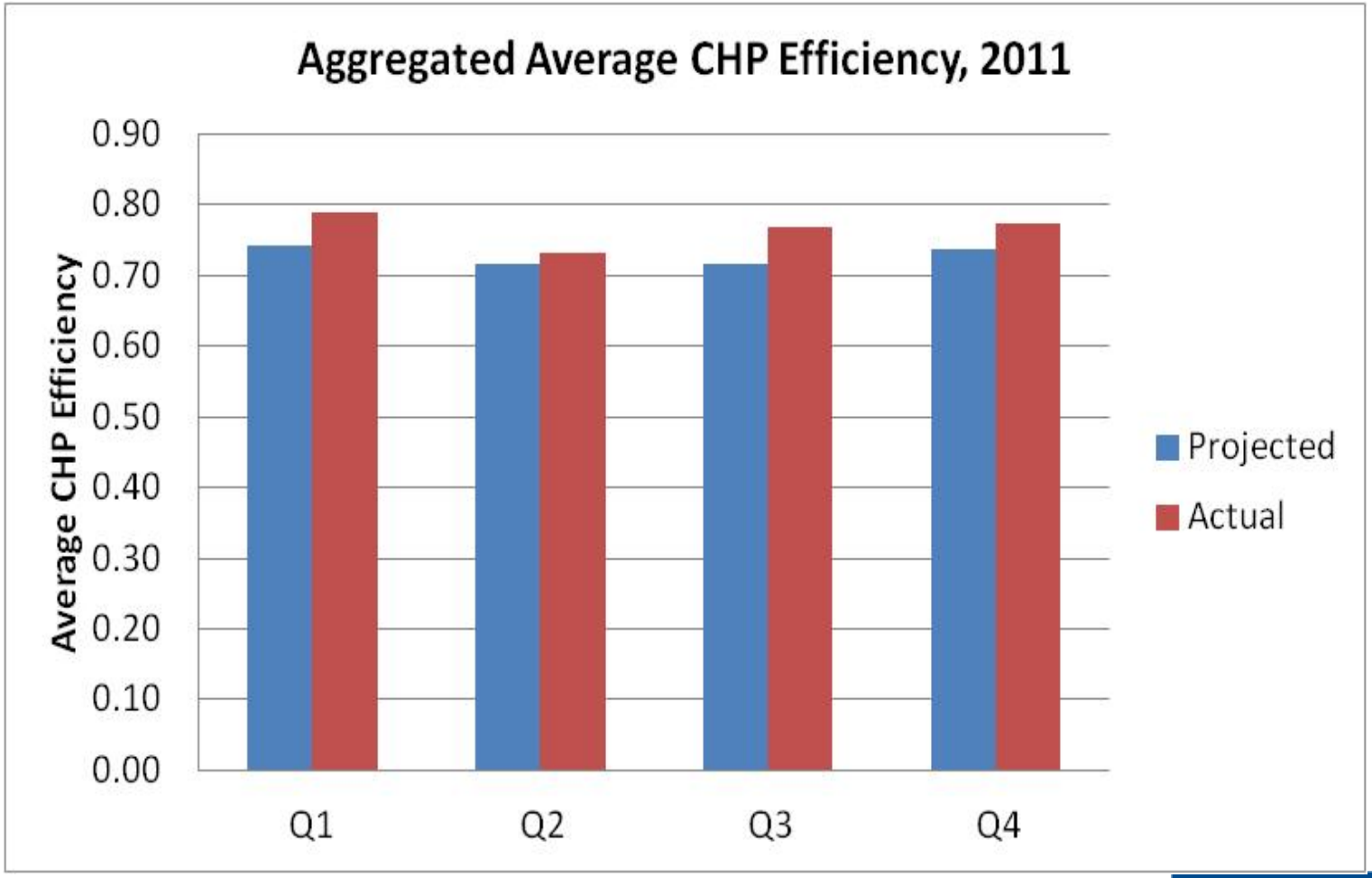

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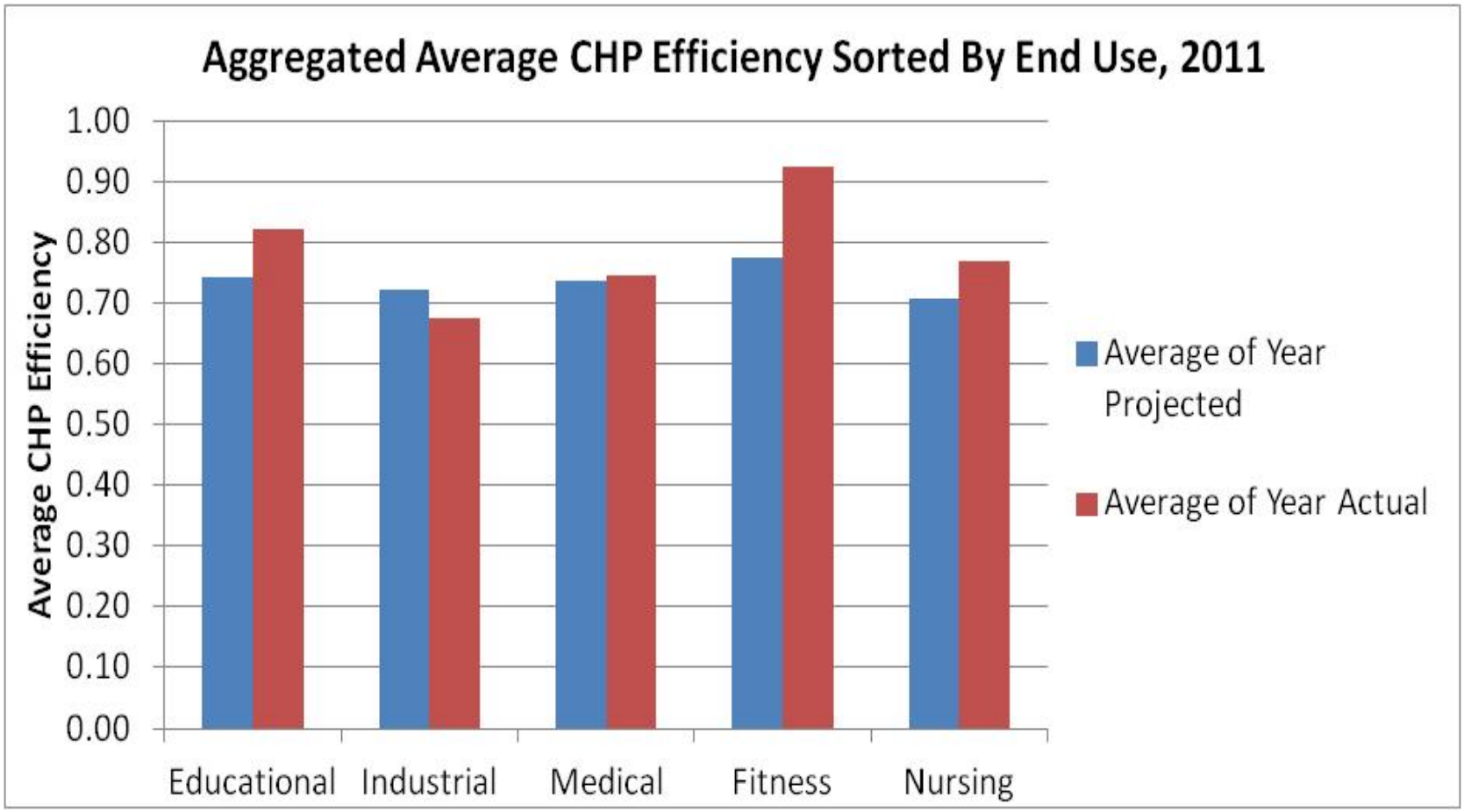
Performance Tool – Example of User Query to Show Actual .vs. Projected Efficiency by End Use



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NSTAR Standby Tariffs

The DPU has ordered (Docket 12-87) that until the next rate case is heard, both new and existing CHP partial service customers are free to choose between the existing standby tariff or the existing applicable business general service tariff.

Comments submitted by the DOER and others as a part of the standby tariff hearing have proposed that inequalities in the tariff and rate structures of all Mass utilities that affect the economics of customers operating CHP be reviewed with the view to ensuring that the system benefits and costs related to CHP are being accurately and completely reflected in the rates and tariffs.

Look Ahead

What does the APS CHP Program "pipeline" look like?

- 75 to 200 kW: Modest interest and participation by developers and owners in forming aggregations of systems in this size range.
- 500 kW to 3 MW: Expect steady growth, primarily in industrial, commercial and healthcare applications.
- 5MW to 15 MW : Two large industrial projects under final evaluation by owners.

Look Ahead

Some events or scenarios which separately or in combination could produce a significant increase in the rate of AECs being generated.

- New or incremental use of by-product heat generated by utility scale power plants.
  - A steam based plant supplies warm condenser return water for heating commercial green houses
  - Supply of heat to a nearby host or distributed energy system by changing operating mode and/or increasing the steam production capacity of the station.

Look Ahead

- Solution of the technical barriers to the interconnection of CHP systems with end users served by area and/or spot distribution networks (much of Boston).
- Growth of partnerships between investors, lenders, developers and end users which will allow the benefits and costs of CHP to be distributed over a wide base.

Resources at the MA DOER APS Website

www.mass.gov/energy/aps

Statement of Qualification Application
Standards for APS meters
Tools for estimating AECs generated for your project

DOER CONTACT INFO

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