

Green Harbor Energy Response to Daymark's Alternative Energy Portfolio Standard Review

Key findings of the Daymark Study include that (1) CHP systems are currently economic without the support of the APS program with a payback period of approximately 1 year and (2) CHP systems do not provide any emissions benefits. These findings are presented without supporting calculations and explicit data assumptions. However, the Study does reference the EPA Catalog of CHP Technologies published in September of 2017 and presents data from the Catalog on three reciprocating engines using natural gas. Using these data and other EPA and EIA published information, calculations were performed to determine the investment paybacks.

With regards to the paybacks of these 3 CHP systems, an analysis is presented below.

	CHP Payback Analysis			
	Small	Medium	Large	
Capacity	100	633	3,326	kW
Heat Rate	12,637	9,896	8,454	Btu/kWh
Heat Recovered	0.67	2.78	10.67	MMBtu/h
CAPITAL COST				
Plant Cost (2013)	2,900	2,366	1,801	\$/kW
Plant Cost (2020)	3,567	2,910	2,215	\$/kW
ITC	-357	-291	-222	\$/kW
MASS Save	-1,000	-1,000	-1,000	\$/kW
Capital Cost	2,210	1,619	994	\$/kW
Capital Cost	220,997	1,024,760	3,304,389	\$
OPERATING COST				
Fuel costs	86,177	427,179	1,917,482	\$/yr
O&M costs	17,500	110,775	582,050	\$/yr
Annual Costs	103,677	537,954	2,499,532	\$/yr
SAVINGS				
Grid Electricity	94,780	599,957	3,152,383	\$/yr
Boiler Gas	57,113	236,974	909,539	\$/yr
AECs	0	0	0	\$/yr
Annual Savings	151,893	836,932	4,061,922	\$/yr
PAYBACK	4.58	3.43	2.11	
Where:				
Inflation	3%			
ITC	10%			
MASS Save	1,000	\$/kW		
Natural Gas	9.74	\$/MMBtu		
Operational Hours	7,000	hours per year		
O&M	2.5	Cents/kWh		
Electricity	13.54	Cents/kWh		
Boiler Efficiency	80%			
AEC	0	\$/Credit		

All the cost and performance parameters are from the EPA Catalog of CHP Technologies (<https://www.epa.gov/chp/catalog-chp-technologies>). The natural gas price is the average Massachusetts industrial price of the 12 months of 2019 from the US EIA (<https://www.eia.gov/dnav/ng/hist/n3035ma3m.htm>) converted from cubic feet to MMBtu. The electricity price is the most recent Massachusetts industrial price, September 2020, from the US EIA (https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a).

It should be noted that not one of the numerous CHP systems represented by Green Harbor Energy sell power back into the grid, so this was not included in the analysis.

Also, most CHP systems in the MA APS program are in the small (100 kW) and medium (633 kW) size range and are reciprocating engines. The larger systems in the MA APS program, such as the 3,326 kW system, are actually gas turbines and not reciprocating engines. As a consequence, only the small and medium size reciprocating engine units in the study are representative of CHP systems in Massachusetts and are appropriate for payback analysis.

Replicating the Daymark analysis with the EPA data and EIA pricing, and without MA APS credits, the pay back years for the small and medium size systems are 4.58 and 3.43, respectively, not 1 year.

Most businesses will only fund investment projects with pay backs less than 3 years. As a result, most businesses will not invest in CHP systems without MA APS credits. Including MA APS credits with a price of \$15, the payback for small and medium CHP systems is reduced about 1 year to 3.60 and 2.68, respectively. These paybacks are at a level that many businesses would invest in CHP.

The key finding from the replication of the Daymark analysis is that businesses will not invest in CHP systems without MA APS credits. With current prices of MA APS credits in the \$3 range (not \$15), Green Harbor is seeing a significant drop in the development of CHP systems.

With regards to emissions, the Daymark study concludes CHP systems do not provide any emission benefits. It appears, since no analysis is provided, that this conclusion is based on the eGrid CO₂ emission rate of 522.3 lb/MWh (<https://www.epa.gov/egrid/power-profiler#/NEWE>) for NEWE region. Compared to the net emissions rates of 499 and 516 lb/MWh from the EPA Catalog of CHP Technologies for the small and medium systems, respectively, CHP systems would appear to provide little in the way of CO₂ reductions.

However, the EPA has established a methodology (https://www.epa.gov/sites/production/files/2015-07/documents/fuel_and_carbon_dioxide_emissions_savings_calculation_methodology_for_combined_heat_and_power_systems.pdf) and a calculator (<https://www.epa.gov/chp/chp-energy-and-emissions-savings-calculator>) for assessing the emission reductions from CHP systems.

The EPA methodology for assessing the emission reductions from CHP systems includes this key point:

- Estimating the energy and emissions displaced by CHP requires an estimate of the nature of generation displaced by the use of power produced by the CHP system. Accurate estimates can be made using a power system dispatch model to determine how emissions for generation in a specific eGRID subregion are impacted by the shift in the system demand curve and generation mix resulting from the addition of CHP systems.

As a result, eGRID provides in addition to the total output emission rate two other rates that can be used to estimate the mix of generation that is displaced by the use of clean energy technologies such as CHP: the fossil fuel output rates and the non-baseload output rates. **Use of the total output rates is not appropriate since it includes a substantial amount of baseload generation that is not offset by CHP projects.**

According to the EPA, CHP systems must be compared to the non-baseload output emission rate. This emission rate for the eGrid NEWE region is 931 lbs/MWh.

(https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf)

The Daymark study did not follow EPA methodology in their assessment of the reduction of CO2 emissions from CHP systems. As a result, their conclusion is incorrect.

In fact, all three natural gas fired reciprocating engine CHP systems in the Daymark study have CO2 emission rates well below 931 lb/MWh with emissions rates of 499, 516 and 520 lb/MWh for the small, medium and large systems, respectively.

Green Harbor Energy would be happy to discuss this analysis and the findings with the Massachusetts Department of Energy Resources (DOER) as well as address any questions. On behalf our clients, we appreciate the opportunity to respond to the DOER commissioned Daymark study and look forward to actions that address the imbalance in the current MA APS market as well as AEC prices.

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