



## **MICRO-COMBINED HEAT AND POWER:**

**THE FUTURE OF HOME ENERGY**

Presented for Joint Supporters by:

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# Micro-CHP – A Bridge to the Future

Grid-connected, professionally-installed space and water heating appliances that

1) generate significant electric power as a byproduct of normal heating operation

+

2) provide self-powering, emergency backup power, and grid support capability

Residential and Small Commercial



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# *Residential CHP = Micro-CHP*



Small Scale Cogeneration

Fuel Input = Heat + Electricity

Micro-CHP: Replaces existing furnace/boiler

Sized for residential use

Retrofit ready

Uses existing heating trade installers

Efficiencies can be >90%!!

*Makes Electricity While Heating Your Home: Follows thermal load*



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# Micro-CHP can get it done

Affordable



Practical & Reliable



The right capacity



Low emissions



Grid connection



Quiet



Suitable for

Northern Half of the US

Widely deployable

over 50 million US candidate sites

over 1,300,000 homes in NJ  
heated by natural gas fired  
furnaces/boilers

100,000 furnaces/boilers sold  
every year in NJ



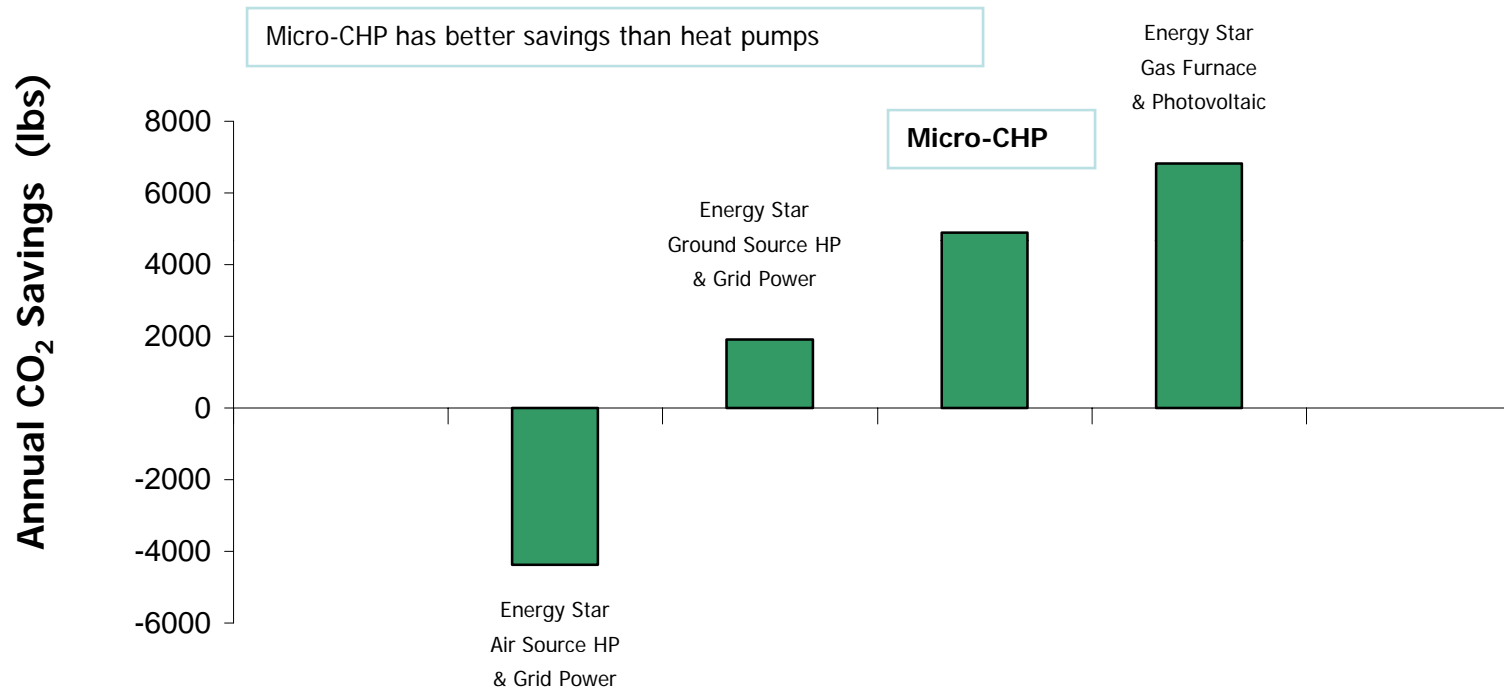
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# Micro-CHP Annual CO<sub>2</sub> Savings for Homes in the Northeast Compared to Traditional Heating with Natural Gas

When you look at total energy needs: heat and electricity

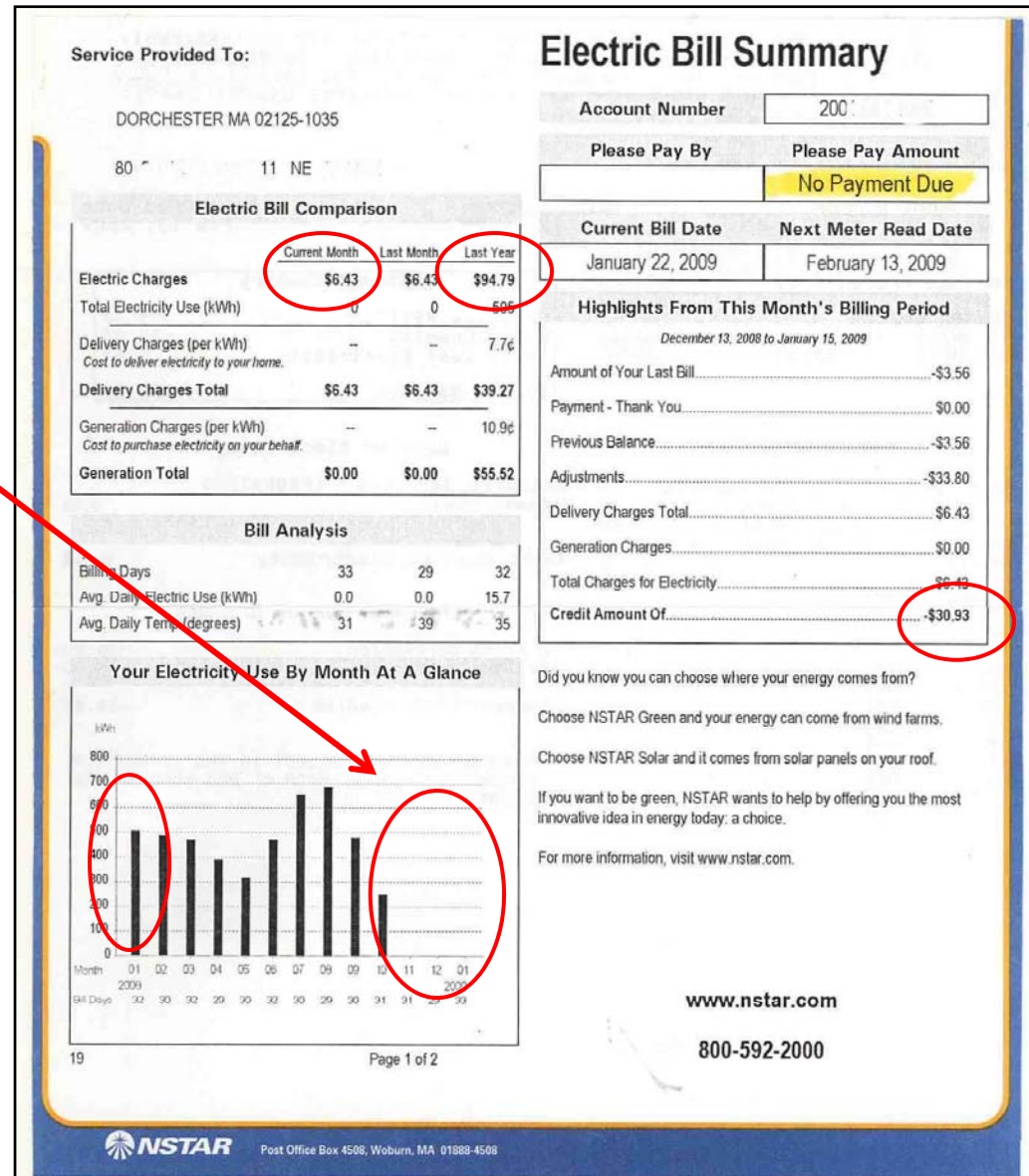


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## Customer Results (example)

- No billable consumption for winter
- 0\$ electric bills
- Very happy customers!!
  
- The continuous low level of heat from micro-CHP is much more comfortable to homeowners!



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# Micro-CHP Regulatory Activity - Momentum

- EPA – Climate Choice
- Net Metering: MD, ME, NY, VT, MA, CT ET.AL.
- Proposed Federal Tax Credit (30% of installed cost )
- Joint Industry Trade Effort
  - Establish larger team to tackle issues
    - Regulatory, educating Influencers and Opinion Leaders, etc.
  - Establish with others such as Marathon, Plug Power, Yanmar, Disenco, Whispergen, Honda, Infinium



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# Micro-CHP : Help needed to get it moving

- A three year pilot program:
  - 200 unit pilot program for 2010,
  - 900 units in 2011 and,
  - 1,800 units in 2012.
- Incentive of \$2,750 per kW
  - At 1.2 kW year 1 cost = \$0.7 million
  - Years 2 & 3 costs = \$3 & \$6 million



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**EPA – CHP Partner  
ECR International, Inc.**

**PARTNER PROFILE**

ECR International is a leading global manufacturer and marketer of hydronic and HVAC equipment since 1928. ECR's recent introduction of freewatt® Micro-CHP technology allows homeowners to reduce their electric bill and their carbon footprint while enhancing comfort. ECR International is committed to breaking new ground in the area of eco-friendly energy options by developing products with unmatched heating, cooling and power capabilities that benefit both the customer and environment.

**PROJECT DESCRIPTION**

The homeowner was offered an opportunity to participate in a utility demonstration project to install a state of the art warm-air micro-CHP system.

Site Characteristics:

- Williamsville (Buffalo), NY
- Built in 1964, 2,900 Sq. Ft. Home
- 2 adults, 1 child during the test period
- Replaced 83% mid-efficiency furnace
- Design Heating Load of 67,000 Btu/hr



The natural gas fired warm-air freewatt micro-CHP system integrates a state of the art 80,000 Btu per hour, 93% AFUE variable speed *Energy Star* listed furnace with a Honda MCHP engine generator module. The Honda MCHP is powered by a liquid cooled 163 cc internal combustion engine fueled by natural gas. The engine produces 1.2 kW of electric power and about 12,000 Btu's per hour thermal. The freewatt system incorporates a communicating *Energy Star* listed programmable thermostat and is Internet connected for remote monitoring, control, diagnostics and streamlined maintenance. The homeowner monitors their power savings and programs their thermostat remotely by logging on to their freewatt system's web page. Recent projects show that installation of this version of warm-air micro-CHP system by a certified contractor will cost in the range of \$20,000, depending upon the work required.

**PROJECT BENEFITS**

	Summary			
	Period through October 2007 - September 2008			
	Cost of Operation	Total Primary Fuel Used (Therms)	Electricity Generated (kWhr)	CO2 (lbs)
freewatt Micro-CHP System	\$2,273.24	1,568	4,673	18,615
Old Furnace + Grid Electricity	\$2,853.44	2,083	---	26,669
Savings	\$595.25	515	4,673	8,055

The modular nature of the micro-CHP system allows heat at the conclusion of the first day of installation. Running on thermostatic demand, the freewatt system provides all of the home's space heating needs and a significant amount of the home's electric power needs. The freewatt system controller incorporates an advanced heat and power algorithm to coordinate the activities of the system components and maximize power production. Heat is transferred into the home's existing ductwork via a heat exchanger in the furnace. This staged heating system operation enhances indoor comfort by providing continuous low level base load heat all winter long.

**CONTACT INFORMATION**

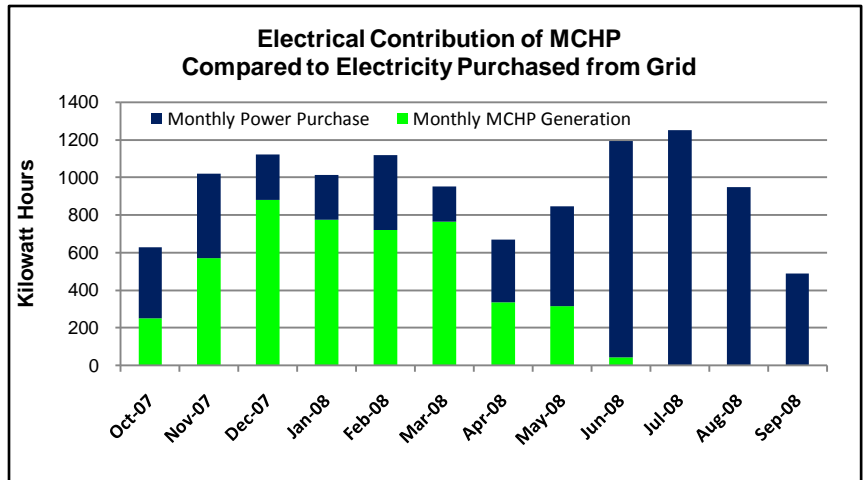
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# HOMEOWNER IMPACT

## POWER GENERATION

The chart to the right represents the power profile of this home from October 2007 to September 2008. The homeowner purchased 6,591 kWh from the electric company. The micro-CHP system cogenerated (in green) 4,656 kWh. During hours when all of the power could not be used in the home, the micro-CHP system cogenerated 1,255 kWh that was exported to the grid. So the net annual household power consumption was 9,992 kWh. Under a net metering scenario now in effect in New York State<sup>1</sup>, the power that the micro-CHP cogenerated is worth approximately \$600. The micro-CHP system cogenerated 47% of the household annual electric power needs.



## FUEL USE

Most retrofit projects such as this involve the replacement of old, inefficient equipment, and will utilize about the same or slightly less fuel by upgrading to micro-CHP. In this case, the replaced system was an 83% AFUE mid efficiency furnace. Reviewing the complete data set from the study period, the freewatt system had a slight increase in annual gas usage of 4%, utilizing only 56 therms more versus the mid-efficiency furnace supplying the same amount of heat. At an average cost of \$1.47/therm during winter 2007/2008, the customer paid an additional \$82 for gas to cogenerate 47% percent of their power needs.

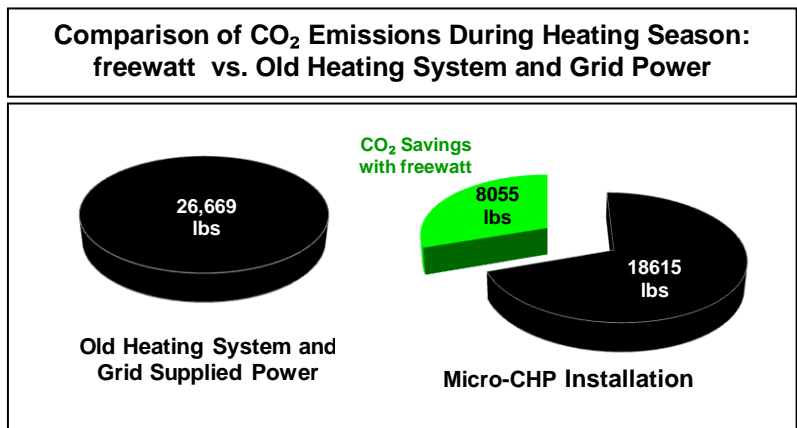
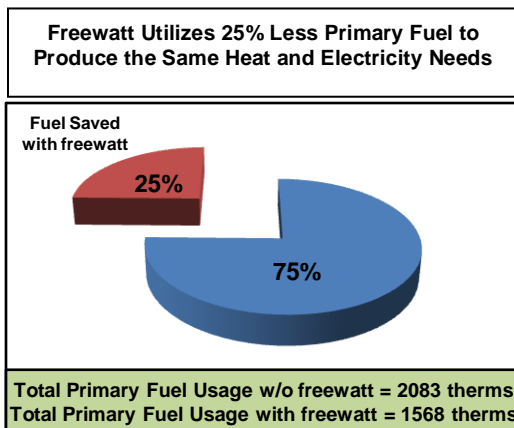
## SOCIETAL IMPACT

Cogenerating heat and power at the residential level has the ability to have dramatic societal impacts on emissions reductions and primary fuel use.

## CARBON EMISSIONS and PRIMARY FUEL USE

With the installation of a micro-CHP system in their home to replace an older inefficient furnace, the homeowners were able to achieve the following positive impacts:

- Cut approximately 4 tons of carbon dioxide (8,055 lbs) from their homes carbon footprint – nearly equivalent to removing one of their cars from the road<sup>2</sup>.
- This CHP installation utilized 25% less primary fuel. That means freewatt uses 25% less fuel to provide heat and power to this home versus the fuel used by the old furnace and the fuel used by the power plant to produce the same amount of heat and electricity... **THAT'S POWERFUL!**



<sup>1</sup> During the year represented by this case study, net metering for micro-CHP was not available in New York State. However, as of August 2009, NY State law was changed to enable micro-CHP systems up to 10kW to net meter in New York.

<sup>2</sup> Average displaced CO<sub>2</sub> production for electrical generation for region (1.74 lb/kWh) from EPA CHP Partnership CHP Emissions Calculator