# Residential & Light Commercial Applications of MicroCHP

**NIST Micro-Generation Technologies**

**October 27, 2010**

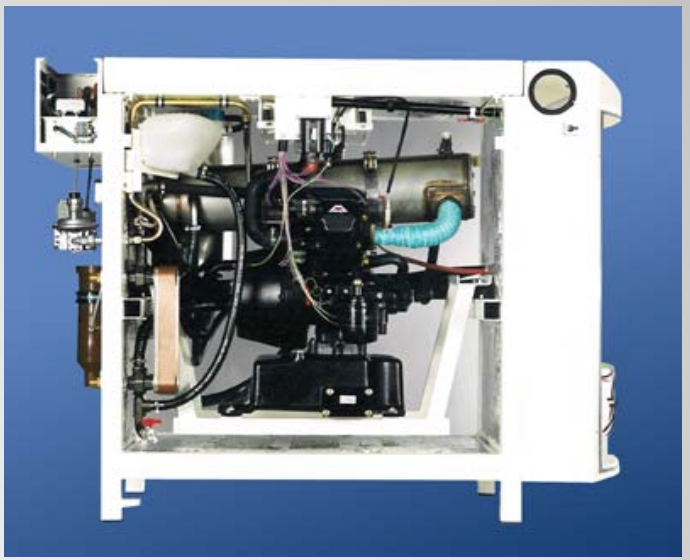

MARATHON ENGINE SYSTEMS

## Background and History

- Started in 1998 with Marathon Engine purchase.
- Engine developed in 1980's as a heat pump, long life power source.
- Swiss company *ecopower* needed a robust engine in 2000 for new CHP.
- Started a European presence in 2001 and then sold to Vaillant– 3500 installs.
- US market started by MES in 2007 with controlled installs to be monitored.
- Manufacturing facility in Wisconsin, developing the North American market for small scale CHP.
- Other products relate to remote power with the Marathon engine.

# ecopower™ Microcogen Appliance

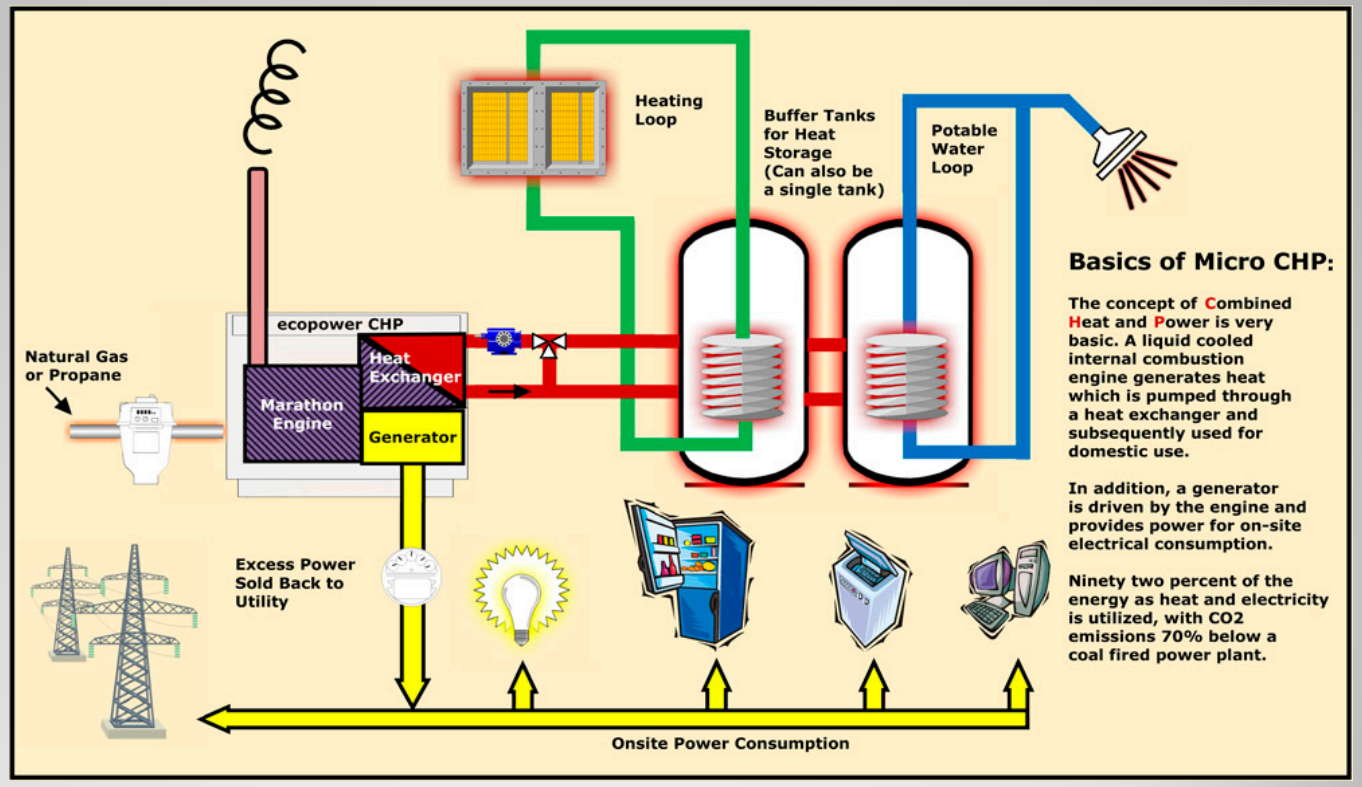
- **Electrical output 2.2-4.7kw/hr modulating**
- **Heat output is 22,000 -44,000BTU/hr**
- **Maintenance interval: 4,000 hours – Oil, filters, spark plug ($250)**
- **Engine life – 40,000 hours.**



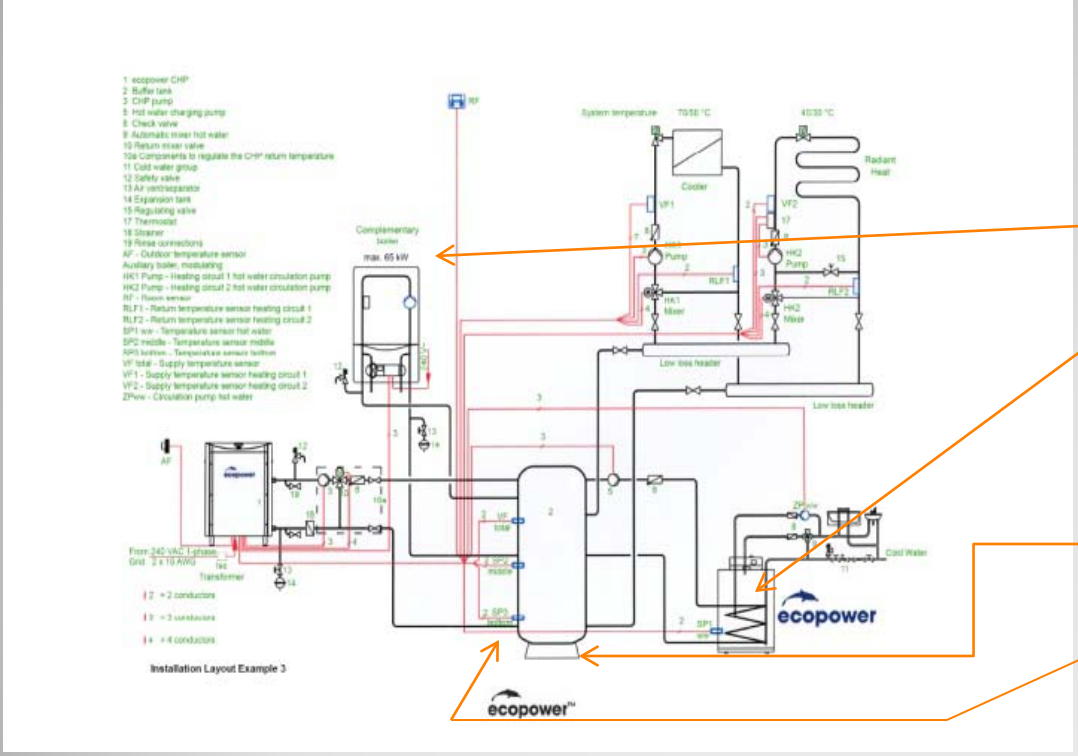
**“Energy cannot be created or destroyed..**

**Only converted from one form to another”**

First Law of Thermodynamics

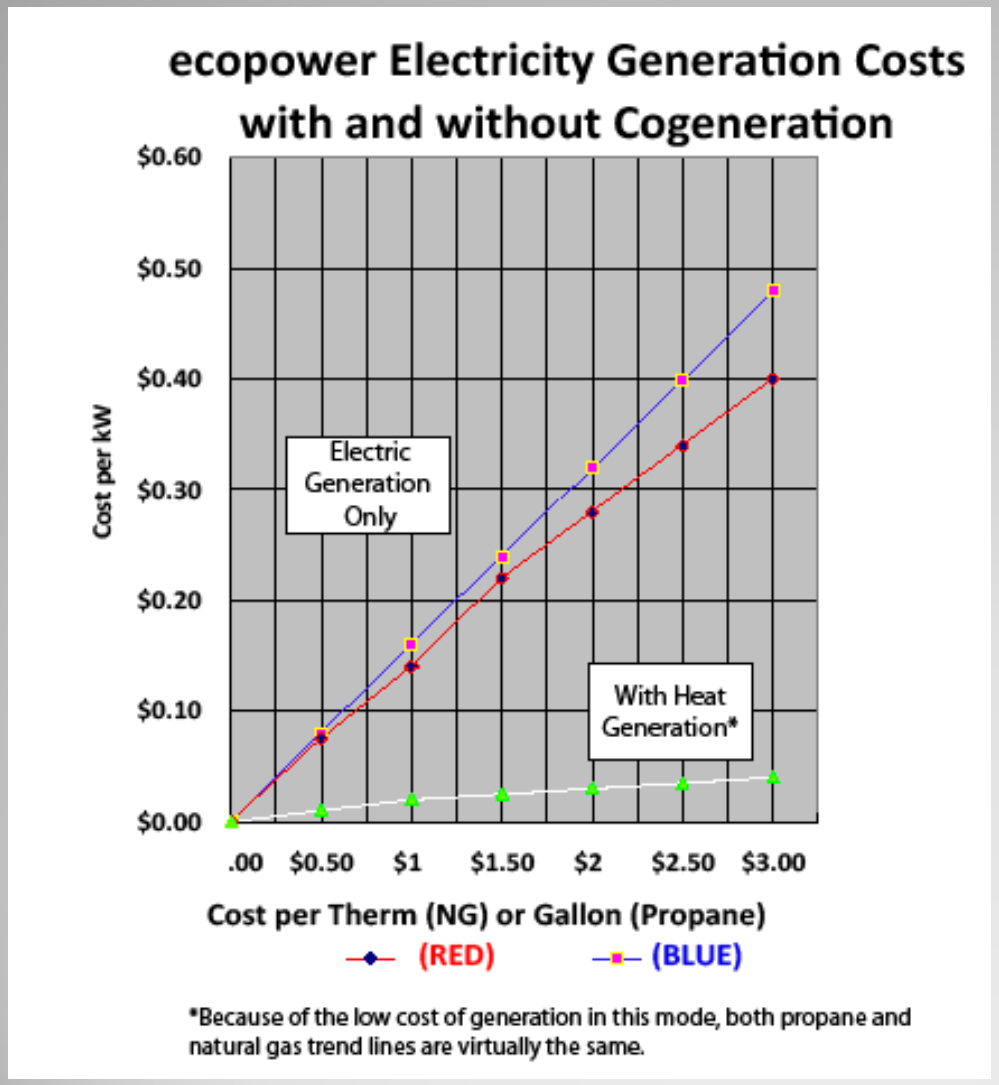


# Typical MicroCogeneration System




## Components and Concept

- A system can consist of up to FOUR units controlled by a master.
- This offers modular utility.
- Complementary boiler is that as well as backup.
- Domestic hot water is easily done.
- Can adapt to all hydronic and most non-hydronic heating systems.
- Buffer tank is radiator as well as storage.
- Thermocouples monitor heat striation for modulation.

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As the accompanying graph shows, the cost of generating electricity while in the heating mode is very low—looked on as a by-product of making hot water.

Case Study

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**Epping, New Hampshire --Town Hall**

- 125 yr. Old, 15,000 sqft building
- Two oil fired boilers ---70% efficient.
- Operate one unit in summer just for domestic hot water needs
- Windows, Solar Panels, Insulation
- Project cost was $60,000
- Anticipated four year payback
- Greenhouse gas emissions were cut in half.
- Through 08/10 generated 15Mwh of power and saving $2300 in electric and significant fuel savings.



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## New Heat and Power Plant

- ecopower microCHP with a ..
- Buffer Storage tank –250 gal.
- High efficiency 300,000 Btu modulating boiler
- Only runs in the heating season

## Small Lodge

**16 Rooms with Hot tubs**

**On site laundry**

**Domestic Hot water**

**Older oil fired boiler-65% efficient**


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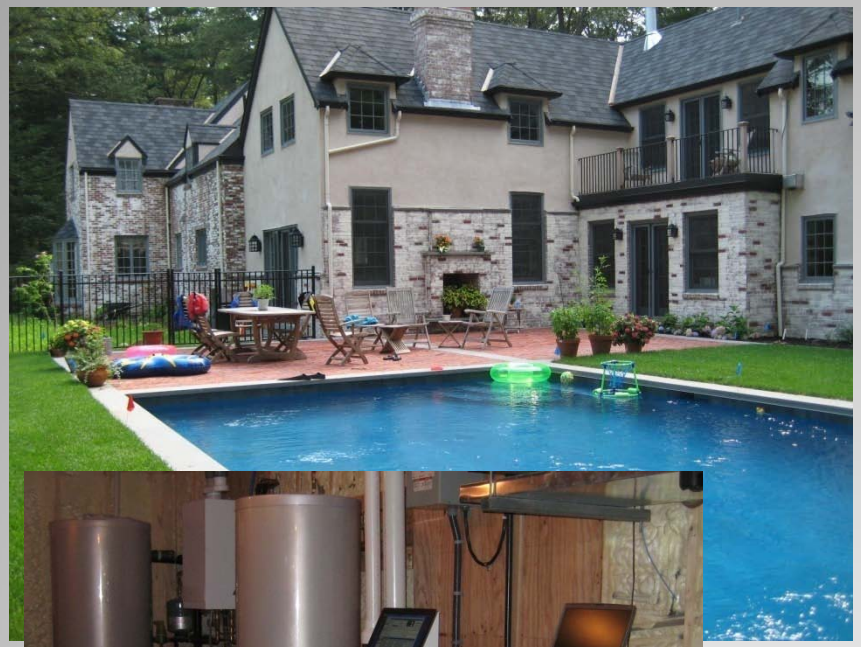
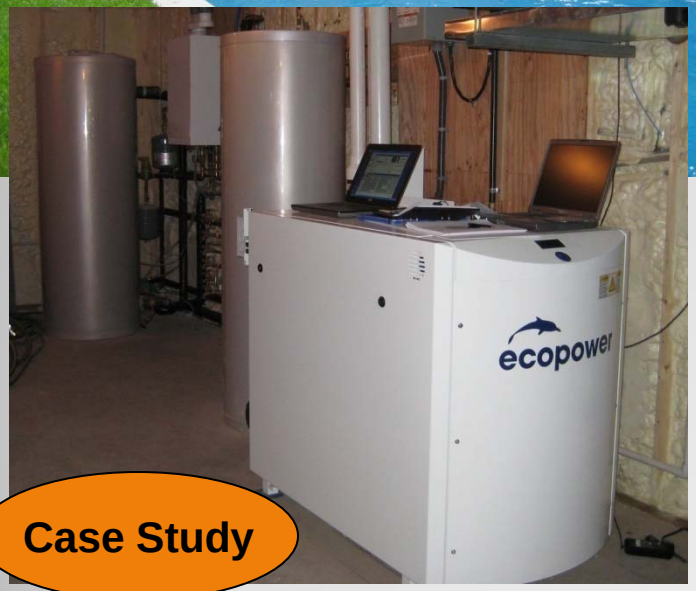
### Information

- Current Energy Costs $22,828/yr
  - 5300 gals of oil -- $13,850
  - 53,763 Kwh elec-- $8,978
- Ecopower plus modulating boiler
  - Conversion to natural gas
- Ecopower will generate 77% of the electricity needed
- **Savings for energy in one year: $10,603**






Case Study

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**Private Residence – Massachusetts**

- **8,000 sq.ft.**
- **28,000 gallon pool- 85 F (Grandkids)**
- **Full in-floor radiant heating system in the house**
- **Geothermal system as backup.**
- **In 20 months of ecopower use -- generated 40 Mwh of electricity @ $0.23/Kw savings of $9,000**



Case Study

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**Domestic hot water for a 56 Unit, LEED Platinum apartment building .**

**Bronx, NY**

- **Installed August 2009**
- **Can generate: 6 Mwh/mo**
- **Current electric rate is $0.25/kwh**
- **In the first 12 months – 69Mwh.**
- **Savings of $17,000 + per year in electrical costs.**

# Areas of Opportunity


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- **Commercial Market is Stronger and shows promise**
  - **Hotel/Motel**
  - **Laundries,**
  - **Car Washes,**
  - **Restaurants**
  - **Apartments**
  - **Green houses**
  - **High end homes**
  - **Nursing homes**
  - **Assisted living facilities**
  - **Truck stops**
  - **Hydroponic farms**
  - **Natatoria**

# Future for MicroCHP

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## Advantages

- Totally controllable and dispatchable
- Clean – significantly less $CO_2$ NOx and $SO_2$. Carbon Credits (?)
- Can offset demand issues
- Condition Power. Power Factor: 1
- Efficiency is >80% when applying both heat and electricity.
- Backup power -- Jan 2011
- Cooling --- coming

## Challenges

- High costs because of being as emerging technology.
- ROI is difficult to achieve in many cases. System: $30-$40,000
- Subsidies and/or rebates are necessary to bring it to the next level. Economies of scale will help.
- Utilities are slow to change.
- Not for all applications
- Generally need heat utilization--- for now.
- Education of the consumer
- Education of the dealers.
- Education of the service providers.


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