



INTERMOUNTAIN
CHP
APPLICATION
CENTER

Landfill Power Generation Upping the Efficiency by Using the Heat

CHP and Bioenergy for Landfills and Wastewater Treatment Plants

AUGUST 11, 2005

SALT LAKE CITY, UTAH



Why Bother

- Recovered heat replaces natural gas used
- Overall efficiency improved (from 28-30% to 60-80%)
- Improved efficiency may mean improved economics
- Improved efficiency means improved environmental performance additional local emissions reductions



Engine Example

- 2MW engine, 90 % load factor, 90% availability => **14 million kWh ~\$600,000 electrical** (Utah Power rate 6 primary)
- Heat recovery, hot water 4,000 Btu/h per kW, use 75% => ~42,500 decatherm/yr
- Gas @ \$6/dth **~\$250,000/yr**



Emissions Reductions

- Power Generation (Utah) - Global
 - NO_x 7,700 lb/yr
 - SO₂ 4,500 lb/yr
 - CO₂ 1,200 ton/yr
 - Hg 0.02 lb/yr
- Heat recovery adds local reductions
 - NO_x 2,000 lb/yr
 - CO₂ 1,000 ton/yr

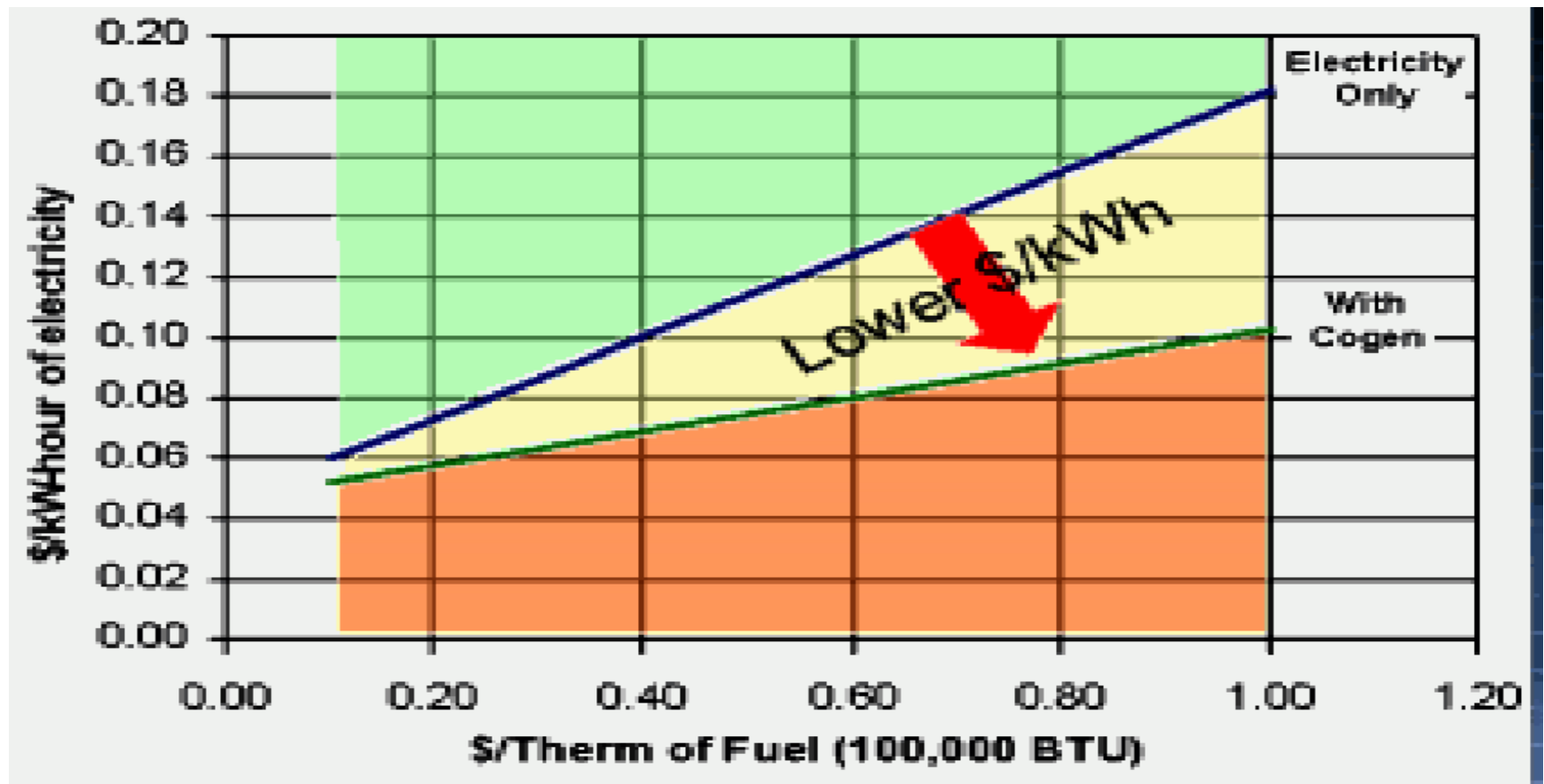


Microturbine example

- Twelve 30kW Capstone turbines
- Heat 290,000 Btu/hr/turbine
- Power only ~\$110,000/yr
- Heat recovery 8,500 dth (winter only)
~\$50,000



Another way to look at it



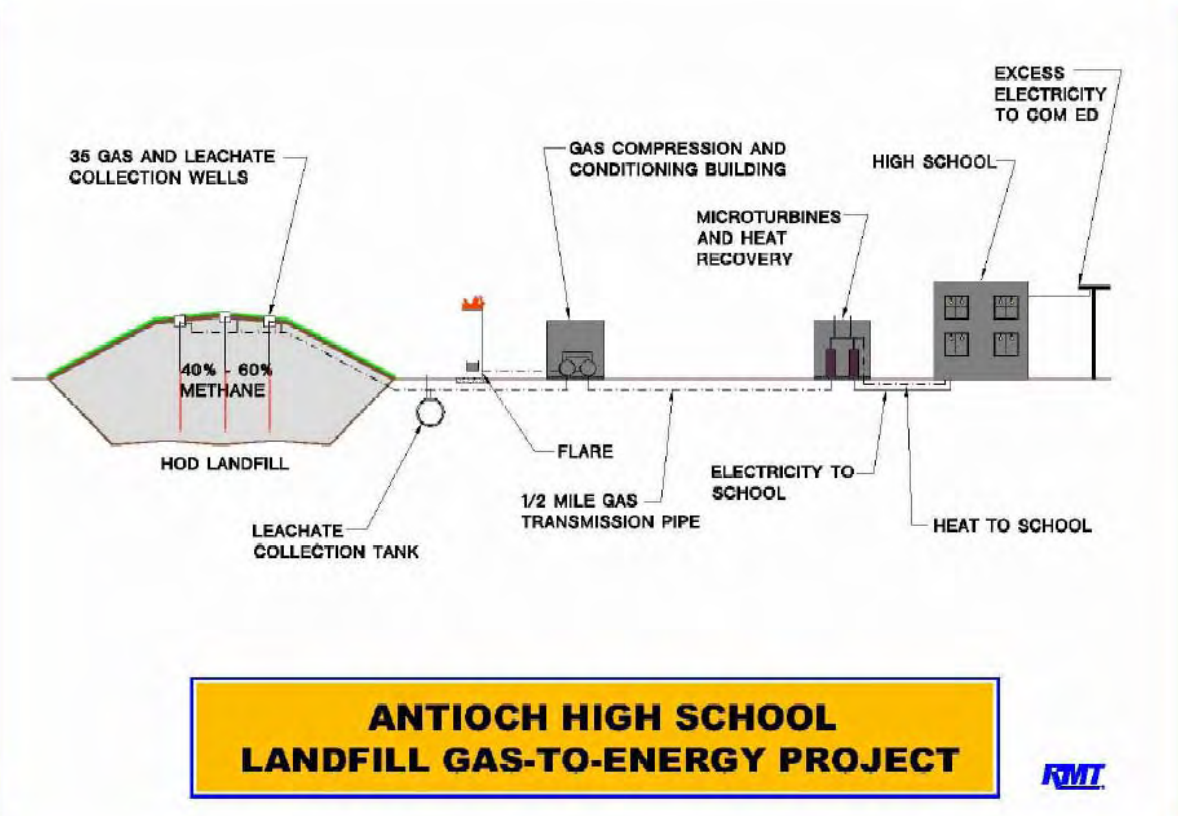


Use the heat for:

- Space heating
- Process steam
- Process heat
- Space cooling



Space Heating





Process Heat

- BMW Spartanburg, SC
- Gas from Palmetto Landfill
- 4.8 MW capacity - 25 percent of the plant's electrical
- 72 million Btu per hour of hot water - nearly 100 percent of its thermal.



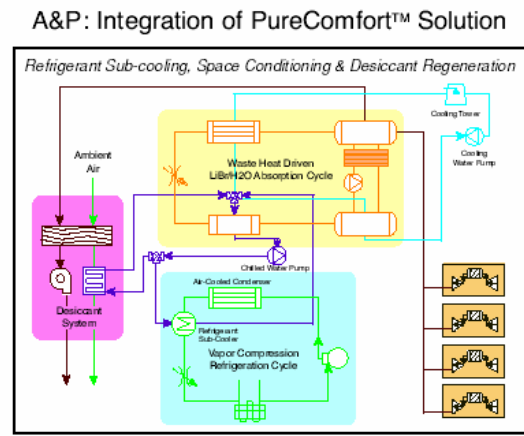
Space cooling

- Integrated system uses



Space cooling

- Integrated systems use microturbine with heat recovery and absorption chiller



The PureComfort™ 240M solution is a combination of four 60 kW microturbines and a double-effect absorption chiller/heater from Carrier Corporation, UTC Power's sister company. It is the industry's first integrated microturbine and double-effect absorption chiller system. The microturbine exhaust is collected in a manifold and used to directly drive the double-effect absorption chiller, enabling the PureComfort™ 240M solution to achieve an overall fuel utilization of more than 80 percent, far greater than the 33 percent typical of a central power plant.



Sites

Owner	MW Capacity	LFG Flow to Project (mmscfd)	Emission Reductions (MMTCO ₂ E)
Acme Fill	1.9		0.080
NEO	6.5		0.275
RMT, Inc.	0.4	1.296	0.015
DTE Biomass/LES	2.4	1.300	0.102
Granger Electric Company	3.2		0.135
Burlington County, Rutgers University		0.140	0.128
Siemens Building Technologies, Inc.	0.8		0.035
Ameresco	4.8	5.760	0.203
Northern Power Systems	3.2	2.080	0.135



Get creative

- 500 large federal sites within 5 miles of candidate landfills
- Look for sites with thermal loads
 - Hospital
 - Greenhouse
 - Prison