

Environmental Benefits of Using Natural Gas

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Outline

- Green Technology
- Emissions
- Emissions Factors
- CenterPoint Energy – Online Costs and Emissions Calculator
- Comparing emissions of Natural Gas Boiler versus Geothermal Heat Pump

Green Technology

- Green technology, or environmental technology, or clean technology is the application of the environmental science to conserve the natural environment and resources, and to curb the negative impacts of human involvement. (*source: Wiki!*)
 - From Air Pollution Perspective: Technology that consumes fuel to operate gives out the least amount of emissions to the environment.

Emissions

- Exhaust gas or flue gas is emitted as a result of the combustion of fuels such as natural gas, diesel, fuel oil, or coal. Discharge to the atmosphere as particles or emission factors.
 - Technology with least emission factors is preferred
 - Goal: Zero Emissions



➤ ***What about other Emission Factors beside CO₂***

Emissions Factors

- Carbon Dioxide CO₂ - a major greenhouse gas
- Sulfur Dioxide SO₂ - a key cause of acid rain and haze
- Nitrogen Oxides NO_x - the primary cause of haze
- Mercury Hg - a common cause of contamination in fish

Emissions Factors

Comparing emissions factors of a boiler:

- Using natural gas, #2 fuel oil, or electricity to operate

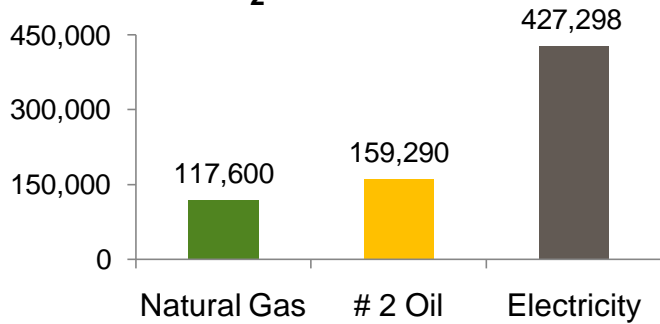
Assumptions:

- 1,000,000 Btu/hr input. 90% efficient natural gas boiler
- 1,000 hours of full load operating hours
- Compare to equivalent 90% efficient # 2 fuel oil and 98% efficient electric boilers

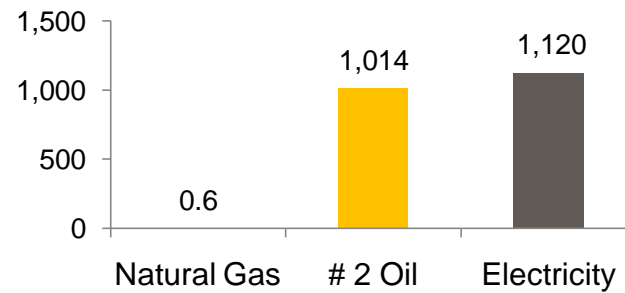
- Using AP-42 Emission Factors for natural gas and # 2 heating oil and using eGRID data for electricity per EPA. In Minnesota, about 65% of electricity is generated through coal.

Emissions Factors - lbs/year Emissions

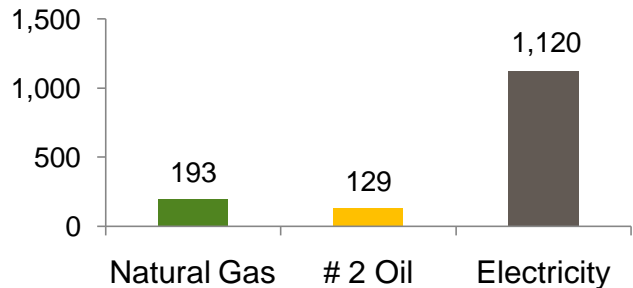
CO₂ Emissions



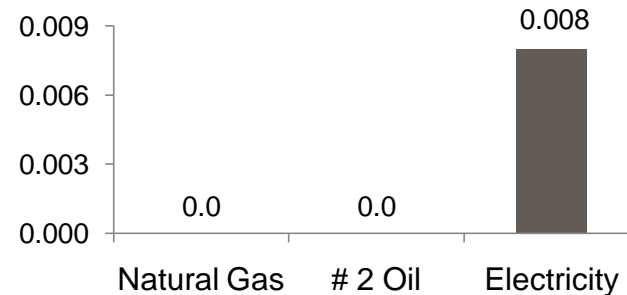
SO₂ Emissions



NO_x Emissions



Mercury Emissions



Online Calculator

- <http://www.centerpointenergy.com/energycalculator>

Energy Cost and Emissions Calculator

Use this calculator to:

- Calculate the cost difference between natural gas, other fuels and electricity at varying prices and efficiency factors
- Compare operating costs between standard and high-efficiency equipment
- Compare the environmental impact of different fuel types

Fuel information

Fuel type 1: **Natural gas** Fuel type 2: **Electricity**

Unit price: \$ per therm Unit price: \$ per kWh

Equipment efficiency: e.g. 80% = .80 Equipment efficiency: e.g. 80% = .80

Equipment information

Energy input: Btu/hr

Annual operating hours:

Online Calculator

Energy Cost and Emissions Calculator

Submitted values		
Fuel source:	Natural gas	Electricity
Unit price:	\$0.60 per therm	\$0.065 per kWh
Equipment efficiency:	.90	.98
Equipment energy input:	1,000,000 Btu/hr	
Annual operating hours:	1,000	

Cost comparison		
Cost per million Btu: <input style="font-size: small; border: 1px solid #ccc; padding: 2px 5px;" type="button" value="?"/>	\$6.00	\$19.04
Energy input:	1,000,000 Btu/hr	918,367 Btu/hr
Energy output:	900,000 Btu/hr	900,000 Btu/hr
Equipment operating cost:	\$6.00 per/hr	\$17.49 per/hr
Annual operating cost:	\$6,000.00	\$17,490.00
Net annual cost difference:	\$11,490.00	
Conversion factors:	View conversion factors	

Online Calculator

Emissions comparison*		
	Natural gas	Electricity
Carbon dioxide (CO ₂): <input data-bbox="643 596 678 622" type="text" value="?"/>	117,600.00 lbs/yr	427,297.63 lbs/yr
Nitrogen oxide (NO _x): <input data-bbox="643 668 678 694" type="text" value="?"/>	193.00 lbs/yr	928.86 lbs/yr
Sulfur dioxide (SO ₂): <input data-bbox="643 739 678 765" type="text" value="?"/>	0.59 lbs/yr	1,120.45 lbs/yr
Mercury (Hg): <input data-bbox="643 811 678 836" type="text" value="?"/>	0.000 lbs/yr	0.008 lbs/yr

* Sources - Electric emissions: The Emissions & Generation Resource Integrated Database for 2006 (eGRID 2006), U.S. Environmental Protection Agency (EPA); Natural gas, propane and no. 2 oil emissions: AP-42 Emission Factors, 2000, U.S. EPA

Geothermal Heat Pump

Comparing emissions factors of a natural gas boiler against geothermal or ground source (GSHP) heat pump.

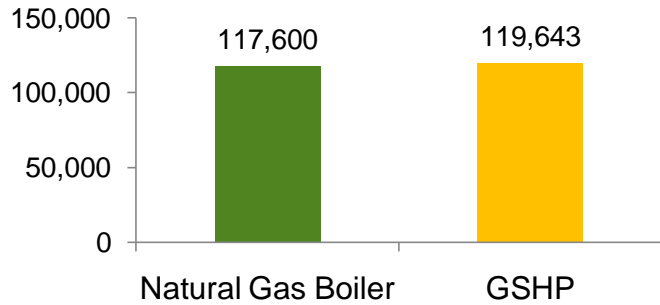
Assumptions:

- 1,000,000 Btu/hr input. 90% efficient natural gas boiler
- 1,000 hours of full load operating hours
- Compare to 3.5 COP Geothermal heat pump

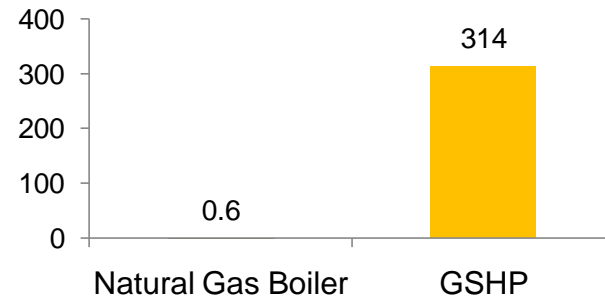
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Geothermal Heat Pump

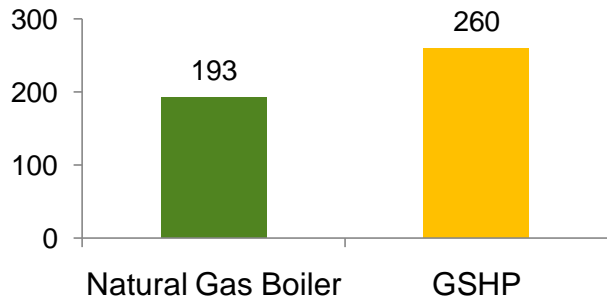
CO₂ Emissions



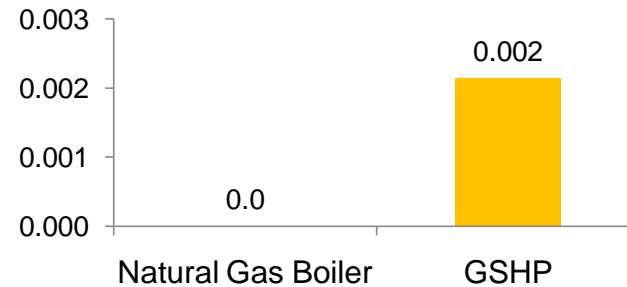
SO₂ Emissions



NO_x Emissions



Mercury Emissions



Questions?