



Operational Cost and Environmental Impact Comparison

Egenolf micro-CHP + Heat Pump vs. BC Hydro and PNG Natural Gas

February 2019

Base Cost as per February 2019, NW British Columbia:

- Dyed (Marked) Diesel / Heating Oil: \$1.20/L
- Biodiesel B100: \$0.90/L
- BC Hydro: \$0.14/kWh (residential)
- NG: \$22.00/GJ => \$0.08/kWh (residential) *1GJ = 277kWh*



Egenolf micro-CHP 12.5/20 + CX34 ATW Heat Pump:

Fuel consumption @ 75% load: 2.3L/h x \$1.20 = \$2.76/h

Biodiesel B100 @ 75% load: 2.3L/h x \$0.90 = \$2.07/h

Service interval 500h (synthetic oil, oil filter, air cleaner, misc.) \$100 / 500h = \$0.20/h

Wearables (engine rebuild after 30,000h) \$5,000 / 30,000h = \$0.16/h

Total operational cost: \$3.12/h (Diesel) and \$2.43/h (Biodiesel B100)

Energy production per hour @ 75% load:

9kWh (e) + 29kWh (t) *(combined COP = 3.3 average with air to water heat pump)*

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www.bvsolar.ca www.microcogen.ca www.biomassenergies.net





Environmental / GHG Emissions Comparison

- Diesel/Heating Oil: 0.27kg/kWh of energy content 9.94kWh/L x 0.27kg = 2.68kg CO2 per Liter
- Biodiesel B100: 0.05kg CO2 per Liter (due to processing)
- Natural Gas: 0.20kg/kWh / 80% average Boiler Efficiency = 0.25kg/kWh CO2 plus Methane emissions from NG wells and fracking. Methane is 30-40 times more disturbing than CO2 as a GHG. Depending on the portion of fracked gas in the grid it has at least an effect of estimated 0.10kg/kWh compared to CO2, which adds up to 0.35kg/kWh conservatively.
- Hydro Electricity: 0.00kg/kWh (the Biogenic GHG emissions from hydro power are not considered, since no database was available)

CHP + HP (Diesel):

$$2.3\text{L/h} \times 2.68\text{kg CO}_2 = 6.16\text{kg CO}_2 / 38.0\text{kWh} = \underline{0.16\text{kg CO}_2 / \text{kWh}}$$

CHP + HP (Biodiesel):

$$2.3\text{L/h} \times 0.05\text{kg CO}_2 = 0.12\text{kg CO}_2 / 38.0\text{kWh} = \underline{0.003\text{kg CO}_2 / \text{kWh}}$$

Natural Gas + Hydro:

$$\text{Electricity: } 0.00\text{kg CO}_2 \times 9.0\text{kWh} = 0.00\text{kg/kWh}$$

$$\text{Heat (NG): } 0.35\text{kg/kWh} \times 29\text{kWh} = 10.15\text{kg/kWh}$$

$$\text{Total: } 10.15\text{kg CO}_2 / 38.0\text{kWh} = \underline{0.27\text{kg CO}_2 / \text{kWh}}$$

Fazit:

An Egenolf micro-CHP system in combination with an Air to Water Heat Pump is emitting

41% less GHG emissions on Diesel fuel and **98.9%** less GHG emissions on Biodiesel,

compared to hydro power and Natural Gas.

