



## Microturbine Info

Global Energy has compiled a list of useful information regarding the purchase, operation and installation of the Capstone Microturbine, please see the categories below.

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## **Maintenance:**

What is required for general maintenance for the Capstone Microturbine ?

“The Capstone MicroTurbine is designed to run for extended periods of time with minimal maintenance. An air filter change is recommended after the first 8000 hours of operation, with routine maintenance typically following every 8000 hours. Factory engine servicing is recommended after 40,000 hours of intermittent or continuous use.”  
(Capstone)

## **Fuel Requirements:**

The standard configuration is natural gas. In most natural gas Capstones, you can also use LPG with proper fitting kit.

### **Biogas (special Capstone option):**

“The Capstone MicroTurbine (special unit not standard) can transform low grade, unprocessed waste biogas with methane content as low as 35 percent (350 Btu/scf) into usable electricity. It is proving a practical and cost-effective technology that can eliminate flaring at landfills, wastewater treatment plants, and agricultural or livestock facilities.”  
(Capstone)

Most biogas installations we've seen since 2001 have failed. We do not recommend this application due to the costly gas filtering, poor quality (btu) gas, and derated output.

## **Casing Gas:**

“Yes. The Capstone MicroTurbine can turn unwanted casing gas (700 – 2600 Btu/scf) with up to 7 percent sour content, into essentially “free” electricity to power the downhole pump, small compressors, motor loads and other onsite needs of a remote oil or gas development site.” (Capstone)

## **Time to Start:**

“Stand alone or black startup time takes approximately 120 seconds. For backup power applications that require faster start times, such as emergency generators, the Capstone MicroTurbine can be applied in conjunction with an Uninterruptible Power Supply (UPS) to provide compliant backup power.” (Capstone)

## Home and Remote Power:

The Capstone Microturbine is not designed for residential use. It is 3 phase 480 V. Most homes are single phase. Your best option for home power for tax credits, payback and wise system installation is a wind turbine or solar panels. If you need more power, put in more 1kw turbines. The Tesla Energy Wall with solar PV is another good residential solution.

## Home Use:

The Capstone is not designed for home use, since it is 3 phase 480 V. The Capstone Microturbine is primarily designed for commercial and industrial use, including condos, apartment complex applications, etc. We have had several large home projects – and know of even one home theatre project in Bermuda. Keep in mind that the Capstone produces 3-phase power. Most homes have 1-phase. For home use, we recommend a generator designed for that purpose, or just install solar PV.

## **Payback:**

How do I know if the Capstone Microturbine installation will save me money ? The Capstone saves the most money when you can use all the benefits of the microturbine CHP (combined heat and power). This includes the electricity, as well as the thermal product (using a heat exchanger to generate hot water or run a chiller), or using the hot air directly in a greenhouse or well ventilated space heating (indirect is best through the use of a large diameter heat pipe). You may contract through Global Energy to perform a feasibility study for the installation of a microturbine to show the costs, savings and benefits. In most cases, if you pay less than \$.10 per kwh (and your natural gas is near or above \$1.00 per therm), it is not worth it to install a microturbine (unless you need backup power or have other extenuating circumstances).

If you have thermal demands in addition to electrical needs, the microturbine may indeed save you money on your utility bills. Aside from electrical savings, you can generate thermal savings at the same time.

We recommend that you drive your microturbine based on thermal demands, and get the electricity as the added bonus (instead of the other way around).

If you have a boiler, or hot water thermal demands, the Capstone can produce up to 180-190 deg. F. hot water to peak-shave or supplement your boiler. The best way to incorporate the microturbine is to have it pre-heat your boiler feed water. That way your boiler doesn't fire as much, and has direct gas savings.

## **Sell-back of Power to the Grid (Utility): Can I sell power back to the grid ?**

While the utility (under PURPA) may be required to buy back power you generate, it only has to do so on a avoided cost schedule (this may only be \$.015 to \$.025 per kwh. Unless you have free gas (or diesel), it generally does not make sense to sell power back to the grid. With current natural gas prices, it may cost you anywhere from \$.05 to \$.15 per kw, which means you'd be selling at a large loss. There are some circumstances in California and New England where the utility may pay up to or more than \$.15 per kw, but those cases are rare – and most are for projects that generate power from wind or solar. The exception in some cases will include landfill or digester gas.

## **Can I get a tax credit for the use of the microturbine ?**

The only Federal credit is a 10 percent tax credit on the purchase of a new microturbine (please refer to DOE websites for current updates).

## **Can I use the microturbine to produce air conditioning, or to produce chilled water for ice making or cold storage ? Chiller:**

Using a Yazaki high efficiency chiller, you can use hot air directly from the microturbine exhaust, or via hot water to produce chilled water. The chiller generally requires a cooling tower to drop the delta T (temperature drop) before being re-heated. In this case, you can use geo-thermal (ground based heat exchanger) to replace the cooling tower. A vertical loop is the most efficient space saver. It also saves money (the cooling tower has fan and pump motors). The geo-thermal only has small pumps.

“Yazaki water fired SINGLE-EFFECT chillers or chiller-heaters have cooling capacities of 10, 20 and 30 tons of refrigeration and produce chilled water for cooling or hot water for heating in comfort air conditioning applications. The absorption cycle is energized by a heat medium (hot water) at 158 F to 203 F from an industrial process, cogeneration system, solar energy or other heat source and the condenser is water cooled through a cooling tower.

An absorption chiller or chiller-heater uses a solution of lithium bromide and water, under a vacuum, as the working fluid. Water is the refrigerant and lithium bromide, a nontoxic salt, is the absorbent. Refrigerant, liberated by heat from the solution, produces a refrigerating effect in the evaporator when cooling water is circulated through the condenser and absorber.

## **Combined Resources:**

If you have access to large amounts of solar energy, we always recommend large hot water applications be run with some sort of solar hot water heaters in concert with a microturbine. A solar hot water heater (for pool, spa or domestic hot water) can be as simple as coils of black colored PEX or Kitec flexible composite pressure piping with a circulation pump. This can also be used to run the chiller during the daytime hours.

## Hot Weather (desert) Operation:

Performance of any gas turbine will decrease with operations above 100 F.

## **What about the use of a turbine inlet air chiller to increase performance ?**

Microturbines do not like any water condensation in the airstream. It causes turbine blade imbalance and can significantly reduce the operational life of the turbine (and even failure in extreme cases). Yazaki has a chiller to a successful installation in Tahiti that uses a turbine inlet chiller to increase performance. This may invalidate your warranty (for factory new microturbines from Capstone).

## **Denver Colorado Legal Hemp Growhouse Energy Source**

The Capstone Microturbine is perfect for USA hemp botanical grow houses. The microturbine provides electricity (power), heat and CO2 which helps plants grow. All this from one fuel souce (natural gas or propane). Energy cost savings of 30 to 80 percent.

## Capstone Microturbine Greenhouse Grow Operations

The Capstone Microturbine is perfect for Greenhouse and Hydroponic Grow Operations. Using natural gas, propane, or biogas, the Capstone can provide up to 30-80 percent or more on utility cost savings. With the Capstone, you get grid connect or stand-alone power, plus the heat from the turbine exhaust, which you can vent directly into the greenhouse. The CO<sub>2</sub> is a byproduct of combustion and good for plant growth.

## What is beyond Capstone ?

Infinity Turbine LLC is working on Leapfrog technology called Supercritical CO2 Energy. They are also working on a tethered drone GPU power solution, and a hybrid aerial APU solution for V TOL and electric aircraft.

## **Microturbine Basics:**

Microturbines are basically compact gas turbine generators. They are similar in nature to the APU (aux power unit found in and supporting aircraft ground operations).

They produce power which is either grid-connected or stand-alone.

## **What about servicing and maintenance on the Capstones ?**

Capstones can be diagnosed via a phone modem or internet connection. CRMS software can help diagnose any problems.

