

Fuel Maker Fact Sheet

Summary/Principles of Operation¹

FuelMaker's full line of Vehicle Refueling Appliances (VRAs) provide an economical and convenient way to refuel over-the-road or in-plant natural gas vehicles. Five models are available, offering a wide range of refueling capabilities. Individual models can be installed separately or together with other FuelMaker VRAs and accessories to meet the refueling needs of specific applications.

Users of the FuelMaker System will appreciate how easy it is to operate. Under the time-fill method, initiating the refueling process is as simple as connecting the hose nozzle to the vehicle receptacle. From that point on, everything is automatic, including the shutdown of the system when the vehicle's fuel cylinder is full. Time-fill refueling takes place overnight or any other time the vehicle is not in use-completely unattended. Fast-fill refueling can be accomplished by using the FuelMaker fast-fill storage system. In this application, any number of FuelMakers are connected together to compress gas into a bank of storage cylinders, which is then dispensed to the vehicle. This allows most vehicles to be refueled in just a few minutes.

Compressed Natural Gas (CNG) is an ideal fuel for indoor forklifts, NGV's and ice resurface machines because of their substantially cleaner exhaust which improves indoor air quality, safer fuel, and reduced operating costs.

Strengths/Opportunities

- CNG is much safer than gasoline. The ignition temperature of CNG is much higher (1200 degrees) than gasoline (600 degrees) and there must be a close mixture (5-15%) of gas and air - this reduces the chances of a CNG fire/explosion.
- CNG is lighter than air; it will not "spill" or "puddle" in the case of a leak. You cannot "spill" CNG on yourself while refueling.
- Natural Gas is much cleaner than gasoline because it contains less carbon and other trace elements common to gasoline. This makes it very environmentally attractive.

Weaknesses/Barriers

- Even at high pressures, CNG is still not as dense of an energy source as gasoline. Therefore, given the same fuel storage space, natural gas will not drive a vehicle as far as gasoline.
- The cylinders are also much heavier because of the high storage pressure.

¹ DTE Energy Technology Profiles

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Market Niches

- Ice Rinks
- Fork Lifts
- Natural Gas Vehicles

Competition

Competition for this equipment is propane, gasoline and diesel.

Typical Costs

Costs vary widely. Refer to the manufacturer for costs.

Manufacturers (list is not comprehensive)

Manufacturer	Representative	Phone Number	Website
Hurricane Compressors		(800) 754-7408	hurricane-compressors.com/hc
ANGI International, LLC	Tim Boyle	(440) 238-4588	www.angiinternational.com

I. Zamboni

A **FuelMaker** compressor system and a natural gas ice resurfacing machine have become the standard fueling option for ice arenas concerned with indoor air quality and operator safety. Indoor fueling is allowed with optional methane detector and ventilation system. Strictly speaking from a fuel cost standpoint, there is a long payback for the CNG option. There is a savings on every gallon with natural gas, but ice resurface machines typically don't use that much fuel. The other advantages are what sell CNG for the ice rink.

Strengths/Opportunities²

- **Cleaner and Safer:** Emissions are reduced by up to 90% and with an octane rating of 130, natural gas burns more completely than other fuels.
- **Improved Indoor Air Quality:** Up to 90% reduction in carbon monoxide, virtually eliminating the possibility of carbon monoxide poisoning.
- **Odor:** From propane fumes are eliminated meaning no more headaches for drivers, players or spectators.
- **Safe & Proven:** Natural gas is safe. More than 350 arenas have converted to natural gas. It has been used as a vehicle fuel for over 60 years and has a proven record of being the safest fuel of all.

² www.fuelmaker.com

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- **No Risk of Injury:** Since natural gas cylinders are permanently mounted on your ice resurfacer, there is no more lifting or changing of heavy propane cylinders which can lead to back, wrist and shoulder injuries.
- **Convenient:** No need to order, stock or store cylinders. Available 24/7 on demand -simply refuel anytime.
- **Economical:** Natural gas costs less than propane. Reduced maintenance and extended engine life can also provide additional savings.
- **Simple Installation:** Each FuelMaker is a complete compression system. It runs on a single phase electric supply. The gas comes from the same natural gas supply already feeding your heating system.

Weaknesses/Barriers

- **Long payback for the CNG option:** There is a savings on every gallon with natural gas, but ice resurface machines just don't use that much fuel.
- **Need for a fueling station.**

II. NGV/Fork Lifts

Most any gasoline engine can be converted to run on CNG. Often engines/vehicles can be equipped to run on either fuel with either manual or automatic fuel selection. The availability of electronics and controls is usually the problem with after-market conversions. NGVs are most practical for fleets. Examples:

- taxi cabs
- street sweepers
- transit buses
- school buses
- airport shuttles
- ice resurfacers
- delivery vehicles
- forklifts
- over-the-road trucks

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Strengths/Opportunities

- A home compressor unit called the FuelMaker now makes it possible to compress your own CNG into your own vehicle in your own driveway.

Weaknesses/Barriers

- Because of their size, most vehicles will be limited in range by their CNG storage cylinders. If a vehicle has 10 Gasoline Gallon Equivalent (GGE) of CNG, it would go the same range as if running on 10 gallons of gasoline. It is typical for vehicles to have about 1/2 the range on CNG as gasoline - again, NOT because the fuel is less efficient, but because it is less dense.

More Information

Clean Cities- www.cleancities.com

Fuel Maker- www.fuelmaker.com