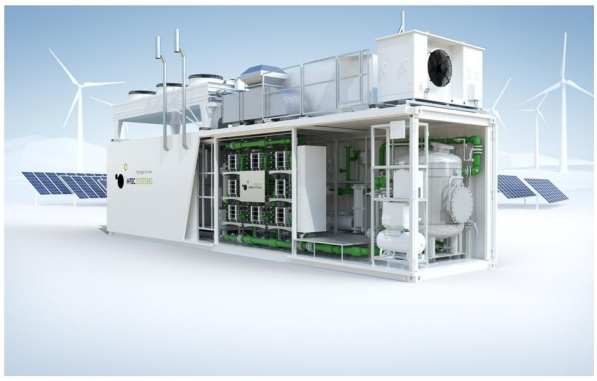
# EFCHG

ENVIRONMENTALLY FRIENDLY CARBON-FREE HYDROGEN GAS

Our Environmentally Friendly Carbon-free Hydrogen Gas is the fuel of the future. We will produce green hydrogen gas using three methods.

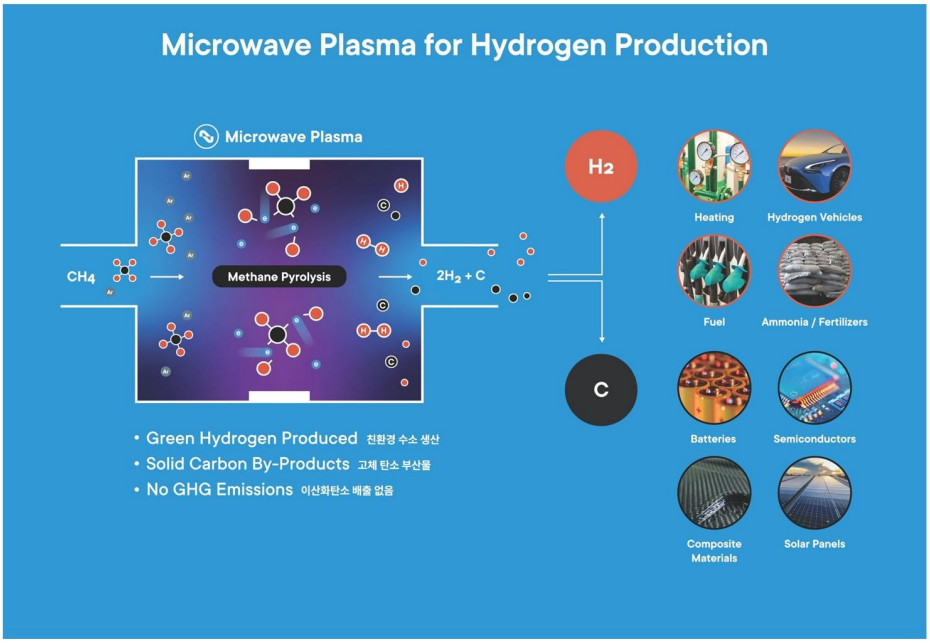
The first is using electrolysis to split the hydrogen and oxygen molecules from water. For this to become carbon-free you will need a carbon-free source of electricity.




The second is microwave plasma, which cracks natural gas into hydrogen without any CO2 emissions

We can use natural gas with 70 to 90% methane, oil production flare gas, coal mine gas and Bio-gas 40 to 60 % methane.

This process uses no water and produces zero CO2 emissions, all carbons are turned into solids that can be sold as an extra income stream. This process also produces ammonia that can be sold.



# Microwave Plasma Hydrogen Production  Carbon-Free

## RFHIC's GaN Solid State MW Generator

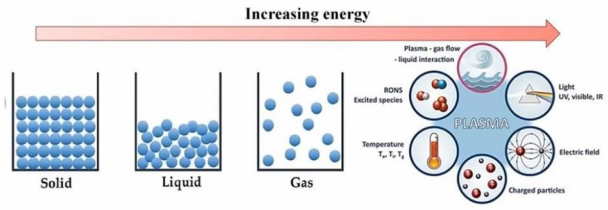
30kW, 900-930MHz, GaN Solid State MW Generator (RIK0930K-40TG)

Datasheet

| | Parameter | Unit | Min | Max |
|---|---|---|---|---|
| System Characteristics | Operating Frequency | MHz | 900 | 930 |
| | CW Variable Output Power | kW | 3 | 30 |
| | System Efficiency | % | 60 | |
| Control & Monitoring Characteristics | Generator On/Off | Enable/ Disable | | |
| | RF Mode | CW/Pulse | | |
| | RF Control | Frequency, Output Power, Pulse, Phase | | |
| | FWD & RVS Power | System Output and Reflect Power from 10 to 100% | | |
| Mechanical Dimensions | Waveguide Output | WR975 | | |
| | Size (mm) | 793 (w) x 1018 (l) x 2048 (h) | | |
| | Cooling Type | Water (Generator); Air (PSU) | | |


## What is Plasma

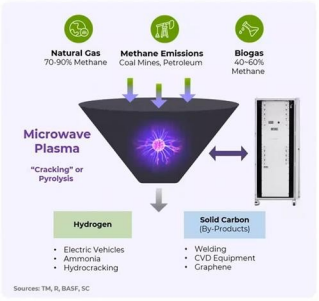
"The Fourth state of matter"




Plasma is superheated matter

## Plasma Conversion Technology

MW Driven Plasma for Methane "Cracking" or Pyrolysis




**• Key Advantages**

**Zero Water & GHGs**
No water consumption and zero $CO_2$ process emissions

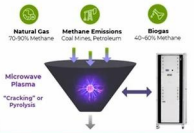
**4x Less Energy Consumption**
Electricity vs. Competing Hydrogen Technologies
(Source: TM)

**Economic Advantages**
Produce other solid carbon by-products for profitable use.
Ex) Acetylene, Graphene, Ammonia

**Efficient & Stable**
Microwave plasma using GaN solid state provides a highly efficient and stable source of plasma offering higher scalability for commercial production

## Next Generation Hydrogen Production

Steam Methane Reforming (SMR) vs. Microwave Plasma Methane Pyrolysis



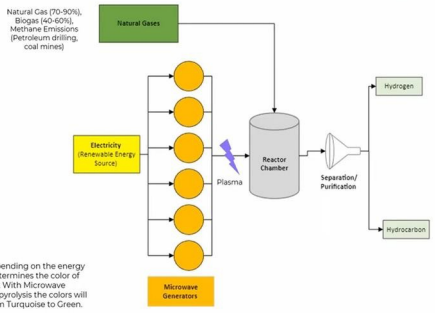

| Type | Steam Methane Reforming (SMR) | Microwave Methane Pyrolysis "Cracking" |
|---|---|---|
| Costs | High CAPEX & OPEX | Lower CAPEX & OPEX (Energy Cost: $1.50-$2.10/kg H2) |
| C02 Emissions | 13.7 kg CO2/kg of Hydrogen | Zero |
| Water Consumption | 19.8 L of H20/ kg of Hydrogen | Zero |
| Inputs | Fossil Fuels (Natural Gas & Methane) | Energy (Renewable Energy) |
| Outputs | Hydrogen + CO2, Carbon Capture & Storage | Hydrogen, Other valuable hydro-carbon products |

**C02 Emission Free Pathway for Hydrogen Production from abundant natural methane**

Sources: RFHIC, TM, R, BASF, SC

## Conversion Process

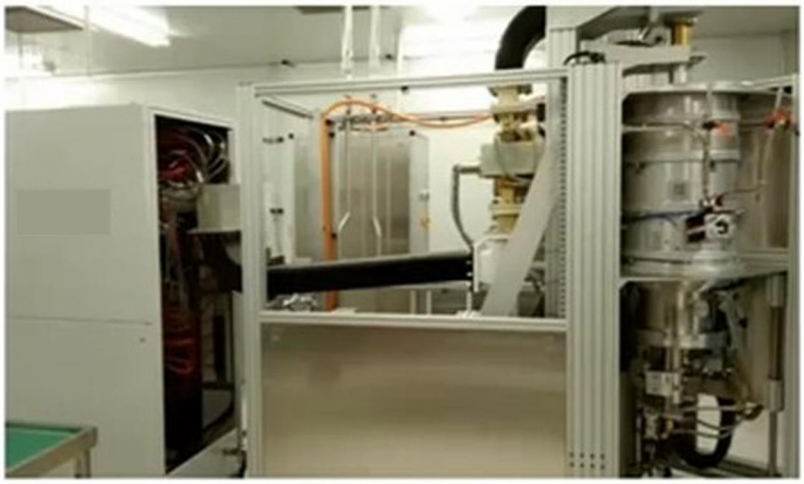
Additional yield can be achieved by adding more microwave generators




**Note:** Depending on the energy source determines the color of hydrogen. With Microwave methane pyrolysis the colors will range from Turquoise to Green.

**Source**: RFHIC, TM, WHL

*There is no air or oxygen used within the system = no oxygenated compounds being present



The third is microwave technology, which recycles carbon-based waste into hydrogen, other fuels, and usable carbon products with no CO2 emissions.

## NEW, IMPROVED METHOD FOR RECYCLING CARBON-BASED WASTE AND OBJECTS

Microwave technology that recycles scrap tires and plastics.

**Scrap Tire Recycling**
Recyclable rate of 99% with only 85% efficiency required, a Jet Fuel fraction of the energy of competing technologies

**Products**
Hydrogen, Methane, Butane, Pentane. Diesel #3/#4 and production of high grade Carbon Black and Jet Fuel.

**Zero Carbon Footprint**
Ensure safety meets or exceeds all applicable Federal or State standards for the environment, its neighbors and associates.

**Non-Pyrolysis Process**
Requires no externally applied heat, reducing combustion and eliminates release of CO, CO2, NOx, SOx, Fly ash and particulates.

**Sustainability**
Create value for the community through enhancing the environment and creating sustainable jobs for the local community

Environmentally Friendly Carbon-free Hydrogen Gas is the fuel of the future.

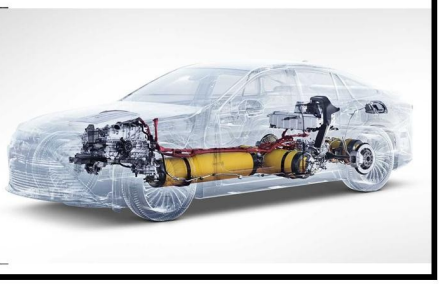
Hydrogen fuel cell cars will soon replace today's electric cars. The fuel cell takes hydrogen, mixes it with oxygen, and produces electricity. This is the answer to zero emissions.

A five-minute fueling will power the car for 300 to 500 miles. This replaces the hours of charging and the need to look for charging stations. Fuel cells operate during a power outage and will not need any electricity from our already failing electrical grid.

When fully fueled with hydrogen, the 2024 Mirai XLE has an impressive EPA-estimated 402-mile driving range rating * and the 2024 Mirai Limited has an EPA-estimated 357-mile driving range rating. * Driving in the city or cruising down the curvy roads, Mirai's dynamic rear-wheel -drive platform consistently delivers an exciting, zero-emissions ride.

**Toyota Mirai 2**

Fuel Cell System Evaluation

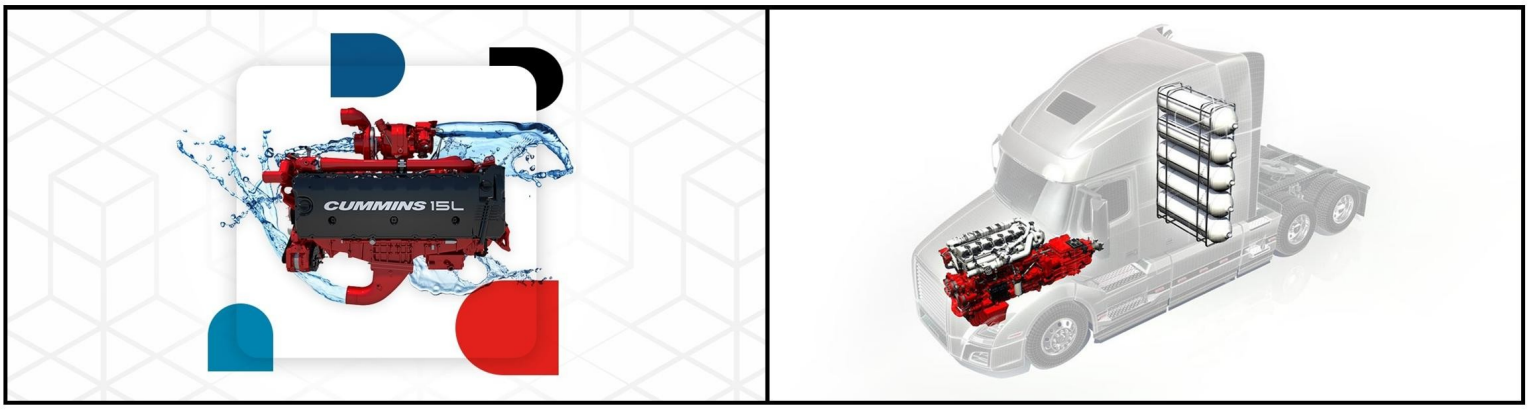


The world's first dedicated hydrogen-powered SUV, NEXO Fuel Cell gives you an EPA-estimated range of up to 380 miles. And with zero emissions

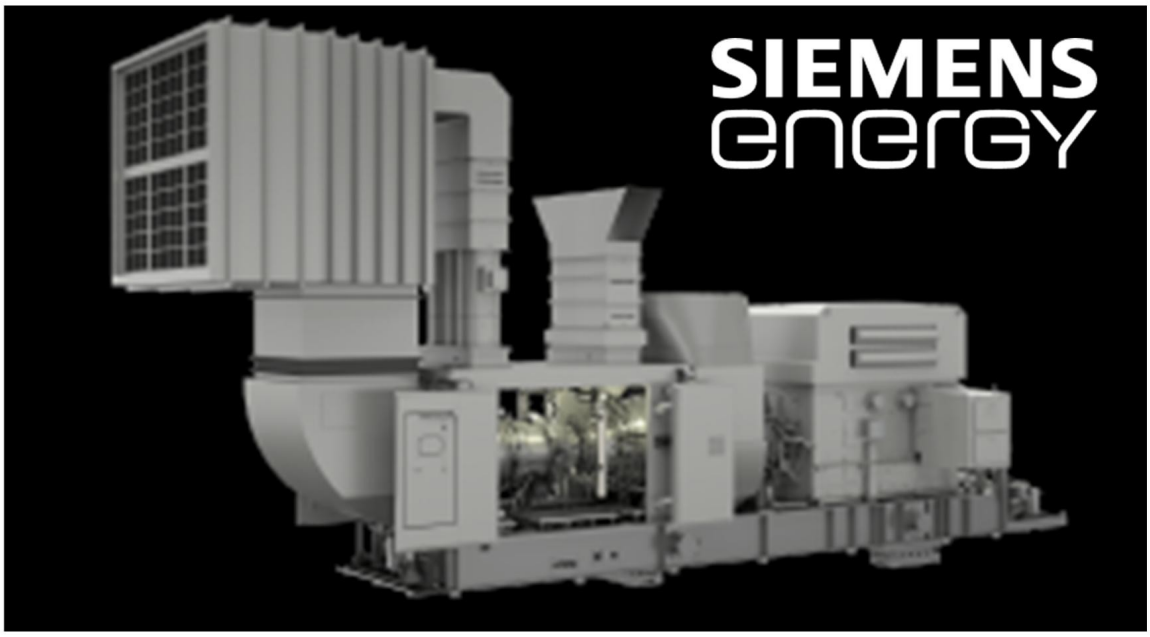
**Hyundai Nexo**

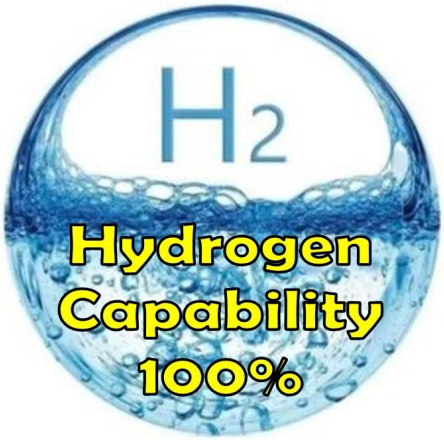
Fuel Cell System Evaluation

Explore how Cummins is leading the charge in hydrogen internal combustion engine technology. Cummins Inc. has announced the development of two hydrogen-fueled engines, specifically designed for the commercial vehicle and equipment markets. The X15H engine made its debut at ACT Expo in May 2023, while the B6.7H engine was displayed at the IAA Transportation exhibition in 2022.




Hydrogen is the solution to powering a gas turbine to produce electricity with no environmental impact. Siemens makes a number of turbines that can operate on 75% to 100% hydrogen.




## SGT– A35

Power Range: Variants span 30-40MW ratings, optimizing power output for each application.

Hydrogen Capability: Up to 100% volume, providing a carbon-free and future-proof investment.