



# Natural Gas: The Essential Fuel for Industry in a Sustainable Future

## The Role of Natural Gas for Fuel Cells

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# Energy Trends Driving Demand

1

## Grid resiliency & reliability

- ✓ Predictable on-site generation enhances resiliency and reliability
- ✓ Avoids costs and risks of interruption and transmission siting issues



\$29 B 20-year fuel sales

2

## Emission reductions & De-carbonization

- ✓ Highly efficient electro-chemical process, no burning
- ✓ Scalable & cost effective carbon capture that also generates power



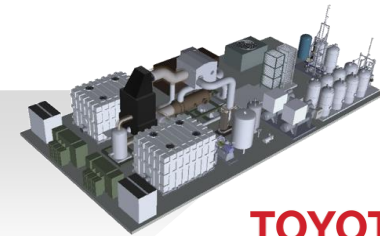
**ExxonMobil**

\$215 B 20-year fuel sales

3

## Distributed hydrogen

- ✓ Tri-generation for high-purity hydrogen plus power & heat
- ✓ Affordable and significantly cleaner than steam reforming

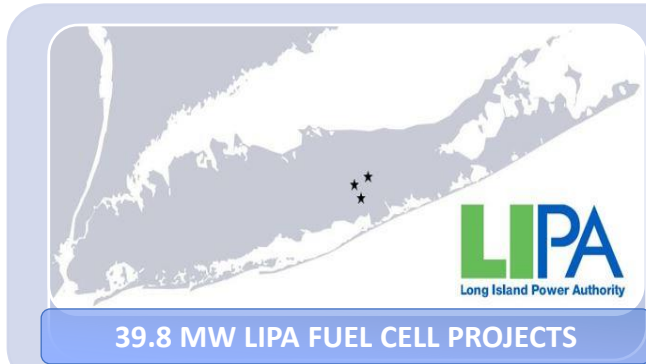


**TOYOTA**

\$8 B 20-year fuel sales

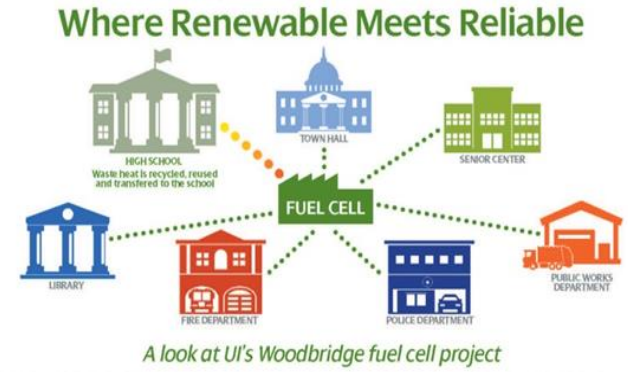
*These segments represent over \$250 Billion in 20 year fuel sales*

# Energy as a Service



- Power supplied with predictable on-island generation avoiding transmission investments
- Unused industrial land converted to income generating property

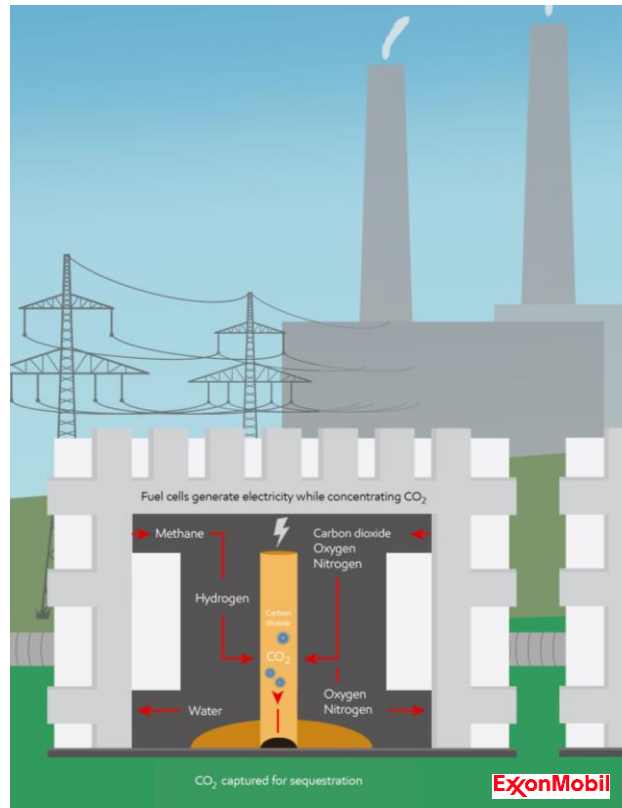
- State-of-the-art utility microgrid application supporting critical building loads with independent capabilities
- Replicable model for other customers evaluating similar structures



- ✓ Making the Power Grid Cleaner and More Resilient
- ✓ Adding Reliable Microgrid to a Utility Energy Portfolio

# Carbon Capture using Natural Gas Fuel Cells

## How it works



## Benefits

- Fuel cells separate carbon dioxide from a power plant's exhaust stream, making the carbon dioxide easier to capture and sequester (90% CO<sub>2</sub> capture, 70% NOX elimination)
- This process could vastly reduce carbon dioxide emissions by dramatically reducing carbon capture costs
- A breakthrough in commercialization would lead to a global marketplace

### Concentrates CO<sub>2</sub>



Carbonate fuel cells can concentrate up to 90% of carbon emissions that come out of power plants – emissions can be captured and utilized or sequestered

### Cleaner air



Removing carbon dioxide from the power plant exhaust eliminates a majority of smog-producing emissions



EnergyFactor  
By ExxonMobil

### Generates power



Carbon capture using fuel cells generates power from natural gas, critical to the commercialization of carbon capture

### Customizable

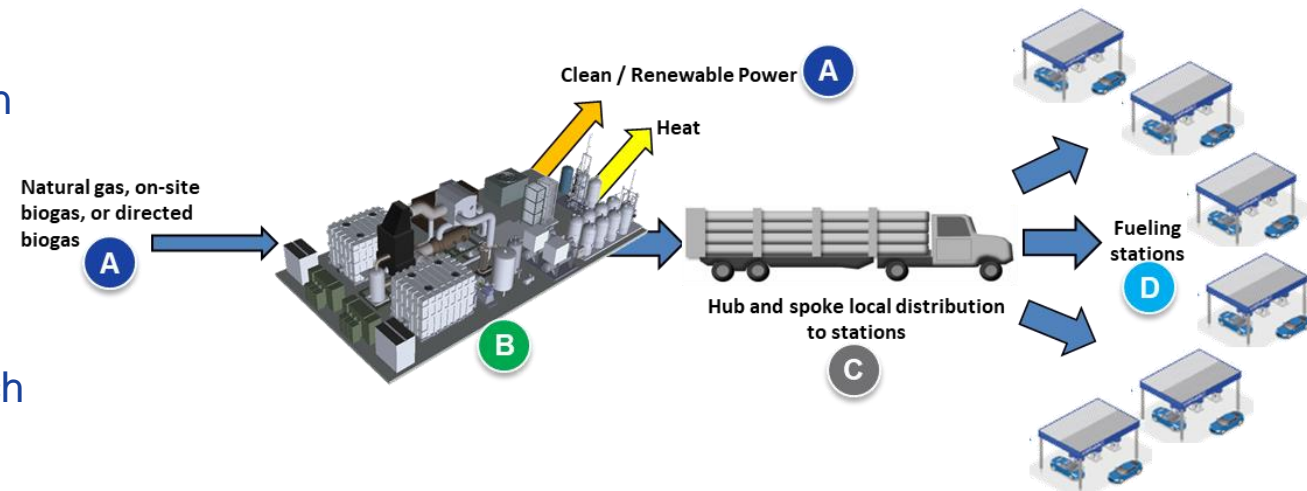


Modular solutions, allowing for gradual investments that help utilities meet carbon-capture targets over time

Natural gas fuel cells can be used to capture CO<sub>2</sub> from gas or coal power plants and industrial thermal sources

# Distributed Hydrogen Generation

- Efficient, clean production of hydrogen near end users
- Co-production of power enhances hydrogen affordability. Reduced transport distance reduces cost and emissions of hydrogen delivery
- Power, heat and hydrogen produced electrochemically, **avoiding pollutants** such as nitrogen oxide (NOx) that causes smog, sulfur dioxide (SOx) that contributes to acid rain, or particulate matter that aggravates asthma



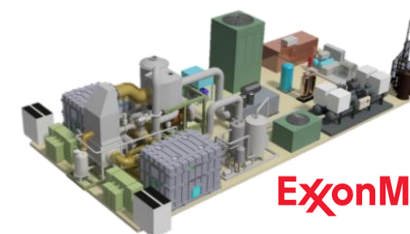
- Ⓐ *Utility for fuel supply and power offtake*
- Ⓑ *Hydrogen production in SureSource Hydrogen systems*
- Ⓒ *Transporter for delivery of hydrogen to fueling stations*
- Ⓓ *Owner/operator of retail hydrogen fueling stations*

## Power Generation and Hydrogen for Mobility and Industrial Use

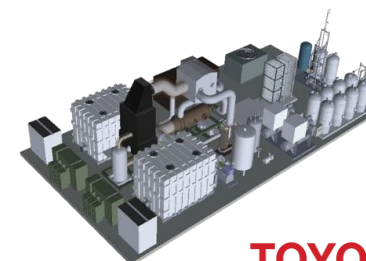


# Natural Gas Fuel Cells in a Sustainable Future

- Clean, distributed power generation
- Enabling natural gas power generation and thermal applications through cost-effective and modular CO<sub>2</sub> capture with power generation
- Efficient production of hydrogen local to users through sustainable tri-generation fuel cell process



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