OffgridCNG

by Clean Energy®

Cost-Effective CNG-based Natural Gas Delivery for Ranges up to 500km beyond the pipeline. Clean Energy Compression’s Fullfill™ and Maxoffload™ technology provides efficient and quick loading at source and near-complete offload at destination. This technology makes CNG virtual pipelines an affordable remote energy solution by decreasing the cost per energy unit delivered.
Affordable Natural Gas Delivery Beyond the Pipeline. Far Beyond.

YOU’RE NOT STUCK WITH OIL. CUSTOMERS WORLDWIDE ARE CHOOSING AFFORDABLE, ABUNDANT AND CLEAN NATURAL GAS.

Cost Effective, virtual pipeline customers report saving up to 30% of energy costs compared to fuel oil.

Abundant and local reliable domestic energy. Natural gas is the most affordable fuel source for most markets today and will continue to grow to be the most popular fuel source in the next 10 years.

Clean Energy Compression Natural gas is a clean energy solution. Burning natural gas can reduce CO₂ emissions by up to 40% over diesel, bunker fuel or coal and nearly eliminates harmful particulate, sulphur, and nitrate emissions.

Clean Energy Compression’s virtual pipeline systems have enabled customers worldwide to take advantage of the tremendous cost reduction and environmental benefits of converting to natural gas without waiting for expensive pipeline or LNG infrastructure. Industrial fuel users are realizing significant savings by replacing liquid fuels with natural gas for large-scale heating, processing, and power generation applications. Moving CNG by trailer eliminates the hurdles associated with pipeline development and provides a better fuel alternative for those companies off the gas distribution grid.
• **End-to-end Engineered System Efficiency**
  Ten sub-systems harmonized to deliver optimal return on investment.

• **FullFill™ and Maxoffload™ Technology**: Up to 10% more fuel going on and 10% more fuel coming off

• **Proven Scalability**: Modular and Mobile options make your asset more flexible to adapt to changing demands.

---

**FULLFILL™ TECHNOLOGY**

Clean Energy Compression’s Fullfill™ technology ensures that every bulk gas shipment is completed quickly and filled as completely as possible. Our systems ensure that transport modules are filled at the optimum temperature and gas density through integration of proprietary compression technology, PLC-controlled continuous thermal management, and comprehensive dispensing architecture.

**MAXOFFLOAD™**

In conjunction with CleanCNG™ compressors, Clean Energy Compression’s Pressure Reduction Systems (PRS) maximize offload capacity, ensures that only a minimal amount of gas is left on the trailer before it is disconnected. This is achieved by using two line unloading methodologies where possible, designing systems for minimal pressure drop, and employing scavenging compression as needed to remove remaining gas.

---

**PROVEN SCALABILITY**

Along with Clean Energy Compression’s CleanCNG™ compressors, our CleanPRS™ pressure reduction systems have proven scalability allowing us to provide standard product to custom applications. Standard products ensure excellent reliability and quality. Modular “building block” design makes it easy to add more units if demand increases or remove equipment and move it to several smaller sites once gas pipeline arrives. There are current systems installed with a capacity of up to 14,000 Nm³/hr.

---

**FEATURES & BENEFITS**

**CLEAN ENERGY COMPRESSION VIRTUAL PIPELINE SOLUTIONS**

- **Clean Gas Technology**: Non-lube compression delivers the cleanest fuel available and keeps your virtual pipeline running efficiently.
  Designing a high-fill efficiency virtual pipeline is much more than the sum of its parts. A sophisticated understanding of how systems interact; managing heat, pressure and back-pressures in both filling and decant phases, is required and has a major impact on operating efficiency and ultimately cost per unit of delivered fuel. Clean Energy Compression has developed sophisticated modeling tools to effectively harmonize the ten major sub-systems that make up a CNG virtual pipeline so that maximum end-to-end fuel delivery is achieved.

---

**FullFill™ Sophisticated Pressure & Temperature Management**

Clean Energy Compression’s technology uses advanced pressure and temperature management to optimize the efficiency of filling and offloading enhancing the overall system performance and improving virtual pipeline project feasibility.

Gas temperature and pressure is managed carefully to ensure a full fill. Temperature and downstream system pressure must be managed with equivalent precision at offloading to ensure consistent downward pressure through entire decanting cycle.
In addition to using proprietary FullFill™ algorithm contained in control software to manage heat and pressure and maximize filling, Clean Energy Compression’s engineering team conducts extensive modelling of the most finite interactions between all 10 critical elements in the virtual pipeline system to deliver up to 10% greater filling and 10% greater decanting versus typical virtual pipeline systems.
CLEAN ENERGY COMPRESSION VIRTUAL PIPELINE SERVES MANY REMOTE ENERGY APPLICATIONS:

Industrial Parks or small municipalities that are off-grid, with no access to a natural gas pipeline suffer from the expense and pollution of trucked in diesel or bunker fuel for power and heat generation.

Clean Energy Compression offers companies, utilities or towns the opportunity to deploy a clean and cost effective alternative utilizing a CNG Virtual Pipeline from a gas supply within 500 kilometers, supplying a local "Stranded Grid" or gas line system installed at the industrial park or town linking multiple customer locations.

Clean Energy Compression’s integrated high fill/offload efficiency system compresses gas at the last mile of the closest natural gas pipeline (within a 500km range), loads CNG transport trailers, which transport the gas to the industrial park or town. Clean Energy Compression’s Pressure Reduction System then offloads the CNG, bringing it down to utility pipeline pressure and feeds the local grid and clients, fully replacing the former diesel system.

Large factories or mines are often out of reach of natural gas pipelines and their large heat and electrical generation demands can use tens of thousands of liters of trucked in diesel or bunker fuel each day.

Clean Energy Compression can work directly with engineering teams or third party engineering firms and service companies to establish a dedicated CNG Virtual Pipeline from the nearest natural gas supply. This supply can be used to fully offset the most demanding liquid fuel requirements with a clean and cost effective alternative.

RESIDENTIAL OR INDUSTRIAL OR NATURAL RESOURCE POWER & HEAT

Large factories or mines are often out of reach of natural gas pipelines and their large heat and electrical generation demands can use tens of thousands of liters of trucked in diesel or bunker fuel each day.

Clean Energy Compression can work directly with engineering teams or third party engineering firms and service companies to establish a dedicated CNG Virtual Pipeline from the nearest natural gas supply. This supply can be used to fully offset the most demanding liquid fuel requirements with a clean and cost effective alternative.

Since the road systems of many regions were built long before natural gas distribution systems came into existence, the fueling station requirements and locations for broad Natural Gas Vehicle adoption often extend well beyond the existing gas grid.

Clean Energy Compression has over a decade of experience around the world, working with Natural Gas Vehicle fuel station networks providing cost effective "Mother-Daughter" CNG virtual pipeline solutions that take the gas from the last mile of the available line, compress it onto transport trailers and roll those trailers out to provide a steady supply to a network of off-grid NGV stations.

A Broad Range of Projects Served Economically:

- Residential Remote or Industrial Power & Heat Beyond Grid
- A Broad Range of Projects Served Economically:

  - Power Range: 0.5 - 200 MW
  - Gas Flow Range: 1-60 MMSCFD
  - Range up to 500km beyond pipeline
CLEAN ENERGY COMPRESSION BULK GAS SYSTEM INSTALLATION SCENARIOS

Clean Energy Compression Bulk Gas systems fit different applications, depending on site parameters:

PERMANENT SITE

Industrial applications where natural gas pipeline infrastructure is not available, yet significant cost savings can be realized by utilizing natural gas as the energy source instead of conventional fuels such as bunker oil. Clean Energy Compression’s compression and decompression equipment can be used together with mobile storage to create a virtual pipeline in order to recognize these cost savings.

DEPLOYABLE SITE

Multiple modular PRS units that are easy and cost-effective to transport can be installed in parallel at temporary sites in order to allow rated capacities in multiples of Clean Energy Compression standard equipment rated flowrates. Individual units can be re-deployed to other sites with different capacity requirements once the need at the original site changes.

MOBILE SITE

Clean Energy Compression’s Mobile PRS can set the delivery end of your virtual pipeline free to support mobile applications like Frac Truck that move from well to well using thousands of gallons of diesel or seasonal applications that don’t require fuel all year round.

CLEANCNG™ NON-LUBRICATED NATURAL GAS COMPRESSION

No oil contamination — non-lubricated cylinders, pistons, and valves means no oil changes and no oil damage to vehicles or virtual pipeline infrastructure

BENEFITS OF A NON-LUBRICATED COMPRESSOR DESIGN INCLUDE:

- Reduced oil contamination in CNG supply (< 5ppm), safeguarding storage tank cylinder, manifold and downstream machinery (including turbine) integrity while reducing maintenance requirements.
- Lower CNG station maintenance costs, as daily or frequent oil filling is not required
- Reduced waste oil disposal cost
- Heat exchanger surfaces remain clean resulting in better thermal performance, and do not require cleaning
- Reduced equipment such as lubricators, oil reservoirs, filters etc.
- Low vibration and noise due to balanced reciprocating compressor design

WHERE TO START:

Initial project viability analysis. Your local representative can assist in a complete project viability analysis.
Feature Projects

EXPANDED CNG-BASED VEHICLE FUELING STATION NETWORK. Urumqui, China

CNG Vehicle Fueling Station Network. Large central “mother station” provides fuel distribution for NGV vehicle fueling network.

GREENER HEAT & POWER FOR FOOD PROCESSING. CAVENDISH FARMS, CANADA

Food Processing
- 140km around trip
- 11 Type 1 tube trailers
- Remote, food processing plant
- Offsets 22M liters of heavy fuel annually
- Flow capacity 159 SCM/Minute (5,600 SCFM)

RELIABLE & AFFORDABLE POWER FOR ONE OF MEXICO’S LARGEST BOTTLING PLANTS. JUAREZ, MEXICO

- Bottling plant & brewery
- Type 4 Trailers ~160km round trip
- Flow capacity 159 SCM/Minute (5,600 SCFM)
- Proven daily delivery capacity: 170 000 SCM / Day
CLEAN ENERGY COMPRESSOR PRODUCTS

COMPRESSOR

CleanCNG™:
150 HP – 300 HP modular expandable compressor line.

CleanCNG-C™:
150 HP – 300 HP modular expandable compressor line specific to the regulatory environment in China.

UnpluggedCNG™:
Gas engine drive compressor system where electricity has low availability or is unreliable. 200 HP & 300 HP.

CompleteCNG™:
The six elements of an NGV station in a single unified system. Compressor, dryer, storage, time-fill dispensers, priority panel, and control panel. Currently only available for the North American market. 100 HP – 300 HP [twin 150 HP].

PRESSURE REDUCTION

CleanPRS™:
The Pressure Reduction System (PRS) is made up of a separately installed Pressure Reduction Module and a gas-fired Heat Control Module delivering 2000 Nm3/hr. Can be “daisy-chained” to deliver up to 10,000 Nm3/hr.

CompletePRS™:
An all-in-one, single skid PRS, with or without enclosure delivering 1000 & 2000 Nm3/hr. Pressure reduction Systems can be “daisy-chained” to deliver up to 10,000 Nm3/hr.

MobilePRS™:
An all-in-one, enclosed, trailer mounted PRS delivering 800 Nm3/hr.

DISPENSING

TimefillCNG™:
A timetill CNG fill post for overnight fleet filling. Mountable on standard k-rail for ease of installation in fleet yards.

TrailerfillCNG™:
Advanced industrial bulk gas trailer filling centre managing 3500 & 5000 Nm3/hr.

TrailerdecanterCNG™:
Advanced industrial bulk gas trailer off-load centre.

HIGH FILL EFFICIENCY VIRTUAL PIPELINE

OffgridCNG™:
High fill efficiency virtual pipeline system design utilizing Fullfill™ and MaxoffLoad™ technologies to achieve up to 20% greater system efficiency.

CleanCNG-Essential™ is also available where requested. This unit retains all the quality and safety of the fully featured CleanCNG™, but does not include certain higher level capabilities.

THE CLEAN ENERGY DIFFERENCE

EXCLUSIVE ADVANTAGES

- Low Oil Contamination. Non-lubricated compressor means no oil damage to vehicles or virtual pipeline infrastructure.
- Ultra-low noise & vibrations allow for a better station experience with smaller footprint.
- Compact Footprint in all Configurations. Standardized skid layout optimized to minimize site footprint in one and multiple compressor layouts.
- Efficient Modular Design. Easily add capacity and redundancy. Adapters are designed into each unit to support enclosure connection in series. Heat flow planning ensures hot air is never re-circulated through units. Rigorous commitment to standardization ensures that the compressors bought today will interface with future site expansions.
- Reduced on-site maintenance costs and downtime. Peace of mind with optional remote monitoring means less service emergencies and critical downtime.
- Reduced Servicing Costs. Optimized compressor bay layout is designed specifically to cut installation times down on most common standard maintenance procedures.
- Low-Cost Site Preparation Requirements and Commissioning Time. Modular architecture contribute to significant efficiencies in compressor placement and required site preparation.
- Less Energy consumed per Volume Flowrate. Improved cooling design and new ultra-high efficiency cooling reduce energy requirements per unit produced.
- Simplified Engineering. Standardized units are pre-engineered to meet demands of a vast majority of global markets & requirements with no additional engineering.
- A Proven Platform. The CleanCNG™ builds on 25 years of engineering leadership in non-lubricated compressors with the same proven compressor block.

SAFETY & ENVIRONMENTAL


SAFETY

- The compressor enclosure is suitable for installation into a Class 1, Div. 2, with gas detection, ventilation and lighting
- The exterior MCC area rated as non-hazardous
- Signal lights on operation panel to indicate compressor status and alarm state in event of gas leaks or ESD alarm activation
- MCC connections available for site fire detection cameras and communication hardware
- Can be equipped for phone, pager, or email warning, or an alarm will be sent in the event of an emergency
- ESD (emergency shutdown device) is located inside and at each end of the enclosure, and on the MCC; if activated ESD will completely cut-off of gas supply, isolate storage, and drain compressors.
- Overpressure protection with appropriately certified pressure relief valves
- Optional control panel (MCC) connections available for site fire detection cameras and communication hardware

ENVIRONMENTAL

- Non-lubricated compressors cut out the waste, cost, and negative environmental issues of additional filters, auto oil drain systems and supplementary oil tanks (+ 5ppm vs. up to 100ppm for conventional lubricated compressors)
- Our clean technology prevents costly, troublesome oil accumulation in heat exchangers, storage vessels, and vehicle systems. This ensures lower operating costs, more effective fleet and vehicle performance, happier customers, and increased station profitability.