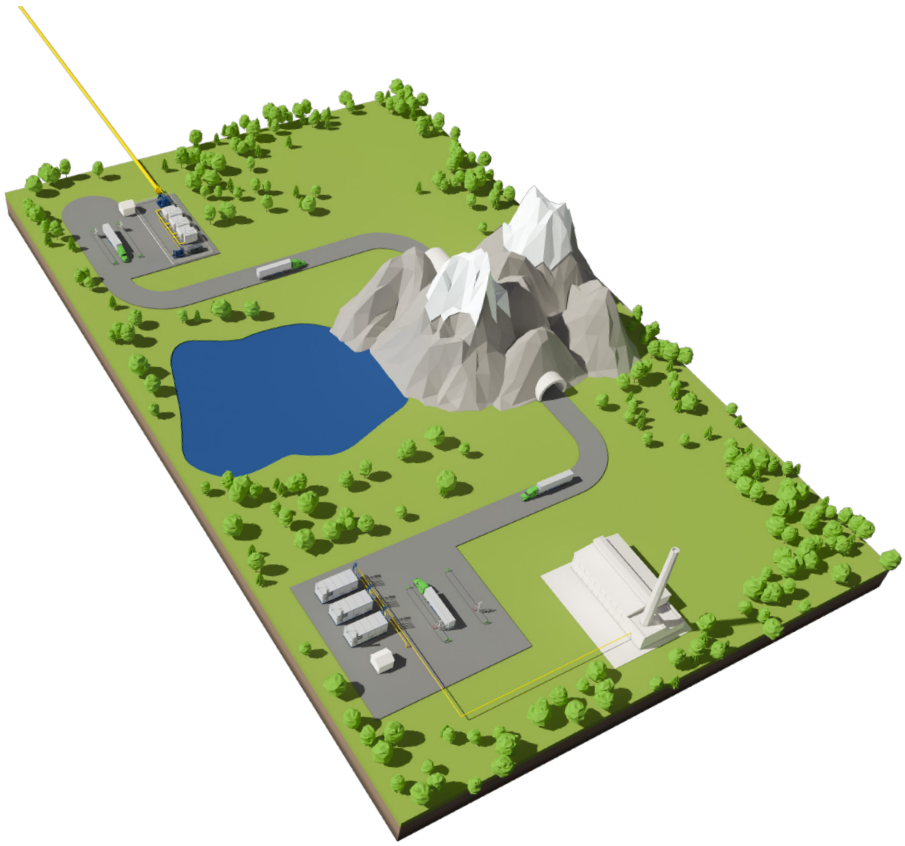
OffgridCNG

by Clean Energy®



AN INTEGRATED VIRTUAL PIPELINE SYSTEM

Proven Clean Energy Compression technology harmonized to deliver optimal return on investment.

FULLFILL AND MAXOFFLOAD TECHNOLOGY

Up to 10% more fuel being uploaded and offloaded.

PROVEN SCALABILITY

Modular and mobile options make assets more flexible to adapt to changing business demands

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 with OffGridCNG

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.

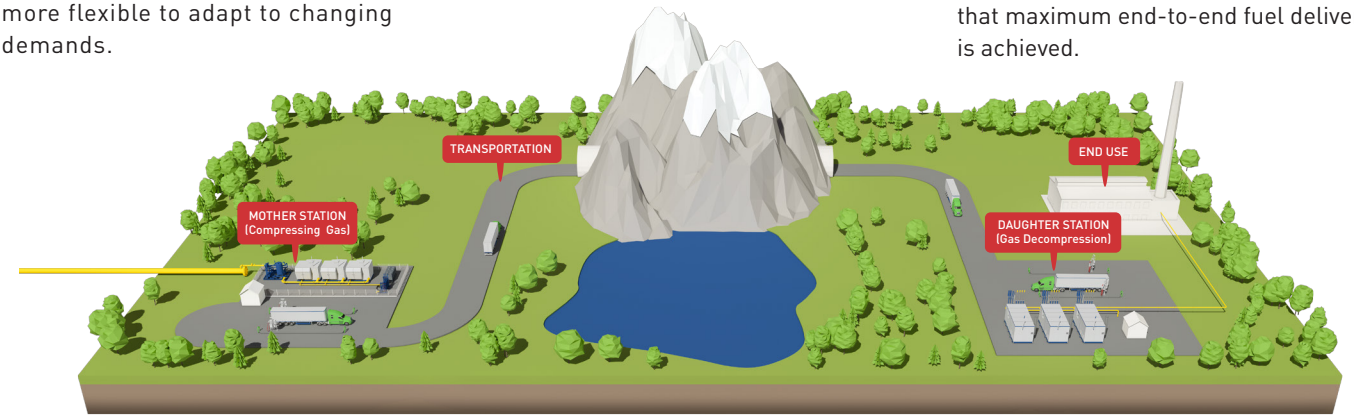
Clean Energy Compression Natural gas is a clean energy solution. Burning natural gas can reduce CO2 emissions by up to 40% over diesel, bunker fuel or coal and nearly eliminates harmful particulate, sulphur, and nitrate emissions.

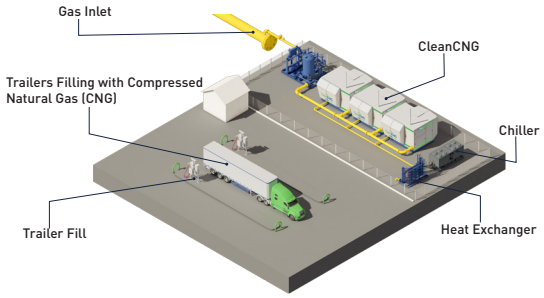
Clean Energy Compression's virtual pipeline systems have enabled customers worldwide to take advantage of the tremendous cost reduction and environmental benefits of converting to natural gas without waiting for expensive pipeline or LNG infrastructure. Industrial fuel users are realizing significant 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.

Features & Benefits

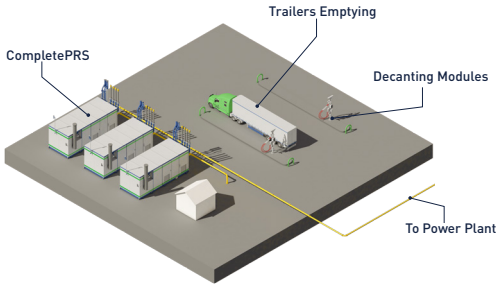
- End-to-end Engineered System Efficiency Ten sub-systems harmonized to deliver optimal return on investment.
- Fullfill and Maxoffload Technology: Up to 10% more fuel going on and 10% more fuel coming off
- Proven Scalability: Modular and Mobile options make your asset more flexible to adapt to changing demands.
- Clean Gas Technology: Non-lube compression delivers some ofthe 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. Clean Energy Compression has a sophisticated understanding of how systems interact: by managing heat, pressure and back-pressures in both filling and decant phases, we ensure operating efficiency, and ultimately reduce 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.





MOTHER STATION



DAUGHTER STATION

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.

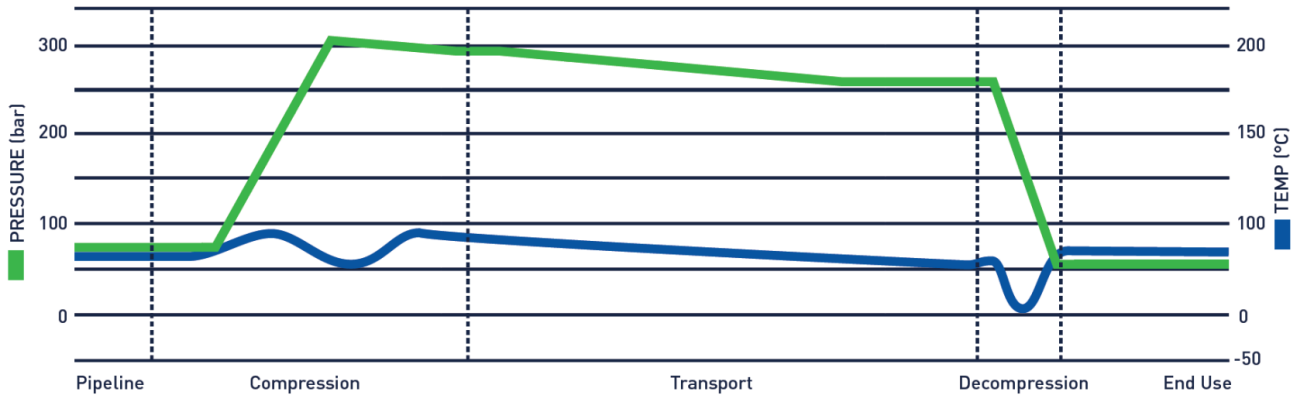
MAXOFFLOAD

In conjunction with CleanCNG™ compressors, Clean Energy Compression's Pressure Reduction Systems (PRS) maximize offload capacity and 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 is 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.

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.

TO ACHIEVE MAXIMUM FILL & DECANT EFFICIENCY, CLEAN ENERGY COMPRESSION ENGINEERS EXAMINE ALL CRITICAL COMPONENTS & THEIR IMPACT ON PERFORMANCE IN DETAIL:

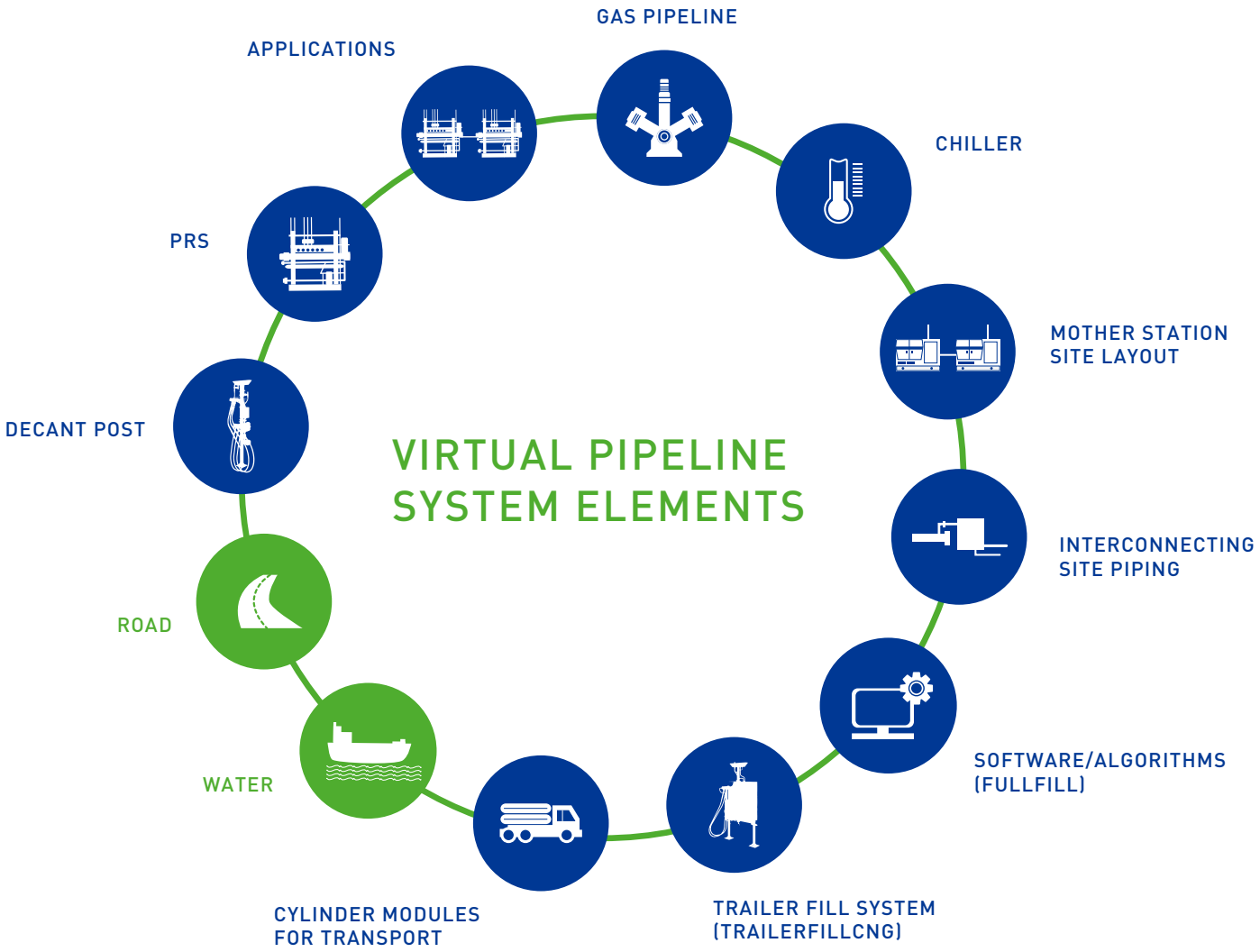
- Heat and pressure upon filling
- Cylinder type selection right down to the internal physical properties and how this impacts heat transfer efficiency during filling
- Trailer cylinder materials and weight
- Trailer/cylinder piping design to decrease back pressure
- Delivery scheduling
- Gas composition
- Mother & daughter station altitude and ambient temperatures

When your key assets, the CNG trailer systems, cost half a million dollars each, getting 10% more on and 10% more off at every trip makes a huge impact on your virtual pipeline's payback and profit.

VIRTUAL PIPELINE PERFORMANCE REQUIRES SOPHISTICATED MODELING & ENGINEERING

AN INTEGRATED VIRTUAL PIPELINE SYSTEM CONSISTS OF:

- CleanCNG™ Compressor (Clean Energy Compression)
- Chiller – fuel is cooled to below ambient temperature before reaching the cylinder to ensure maximal fill
- Fill posts (Clean Energy Compression)
- Fullfill software and algorithms maximize loading (Clean Energy Compression)
- Mother station layout
- Interconnecting site piping
- Cylinder modules for transportation
- Decanting posts (Clean Energy Compression)
- Pressure Reduction Systems (Clean Energy Compression)
- Daughter station site layouts



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.

Virtual Pipeline Applications

STRANDED GRID – INDUSTRIAL PARK & MUNICIPAL SUPPLY

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.

OFF-GRID 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.

ROLL-ON-ROLL-OFF OVER THE WATER REQUIREMENTS

Barge accessible island communities no longer need to suffer with the expense, pollution, transportation and spill risk of diesel or bunker power and heat generation.

Clean Energy Compression offers companies, utilities or municipalities the opportunity to install a CNG "Mother Station" on-shore, at the nearest natural gas pipeline, where the gas will be compressed and loaded onto CNG transport trailers. These trucks will then roll onto a local barge, transit to the island, roll off, and, using a Clean Energy Compression Pressure Reduction System (PRS) "Daughter Station", to feed a locally installed grid to supply the distributed requirements of the community.

OFF-GRID NATURAL GAS VEHICLE FUELING STATIONS

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.

CLEAN ENERGY COMPRESSION VIRTUAL PIPELINE SERVES MANY REMOTE ENERGY APPLICATIONS:

Residential Remote or Industrial Power & Heat Beyond Grid

- Base load or peaking power plants
- Industrial or Residential Applications

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

Low 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

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 round 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 COMPRESSION PRODUCTS

COMPRESSION

CleanCNG™

CleanCNG-C

UnpluggedCNG

CompleteCNG™

PRESSURE REDUCTION

CleanPRS

CompletePRS

MobilePRS

DISPENSING

TimefillCNG

TrailerfillCNG

TrailerdecantCNG

HIGH EFFICIENCY VIRTUAL PIPELINE

OffgridCNG

PROJECT MANAGEMENT

Clean Energy Compression has a dedicated Program Management office that oversees projects in all phases; including initiation, planning execution, monitoring, control, and completion. All projects include a project charter, stakeholder register, responsibility assigned matrices, and project schedule.

MANUFACTURING

A global leader in manufacturing CNG fueling systems, Clean Energy Compression meets all ISO 9001:2008 Quality Management System Safety and Environmental protocols. Clean Energy Compression offers complete CNG fueling systems that are tested in house with Natural Gas and don't leave the factory until they are 100% certified field-ready.

SERVICE

All Clean Energy Compression projects are supported by a global service network. Customer Care representatives closely monitor performance of units in the field in real-time 24/7. A global network of parts and service providers are available for first-class support on all products.

Clean Energy COMPRESSION

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