

Liquefied Natural Gas Conversion Systems

for Plant Startup and Shutdown
and Natural Gas Curtailment at CT Stations



Experience the Power of Partnership





POWER
GENERATION



EAPC Industrial Services and North Dakota LNG have partnered to provide liquefied natural gas startup conversion systems to displace fuel oil.

CONTENTS

EAPC Industrial Services.....4
North Dakota LNG6
Engineering the Conversion.....8
Case in Point10
Conversion Advantages 12
How it Works 14
The Need to Know 16
The Power of Partnership 18

EAPC INDUSTRIAL SERVICES

ENGINEERING FOR HEAVY INDUSTRY

EAPC Industrial Services is a multi-disciplinary consulting firm with offices in Bismarck, Dickinson, Fargo, Grand Forks, Minot, and Williston, ND; Sioux Falls, SD; Bemidji and St. Paul, MN; and Phoenix, AZ.

The staff of EAPC has performed hundreds of power generation and process industry projects for a wide breadth of clients nationally.

ISO 9001:2015 CERTIFICATION

EAPC has completed ISO Certification for its Industrial Design Process which formalizes our culture of constant improvement and quality in our project management and execution process.

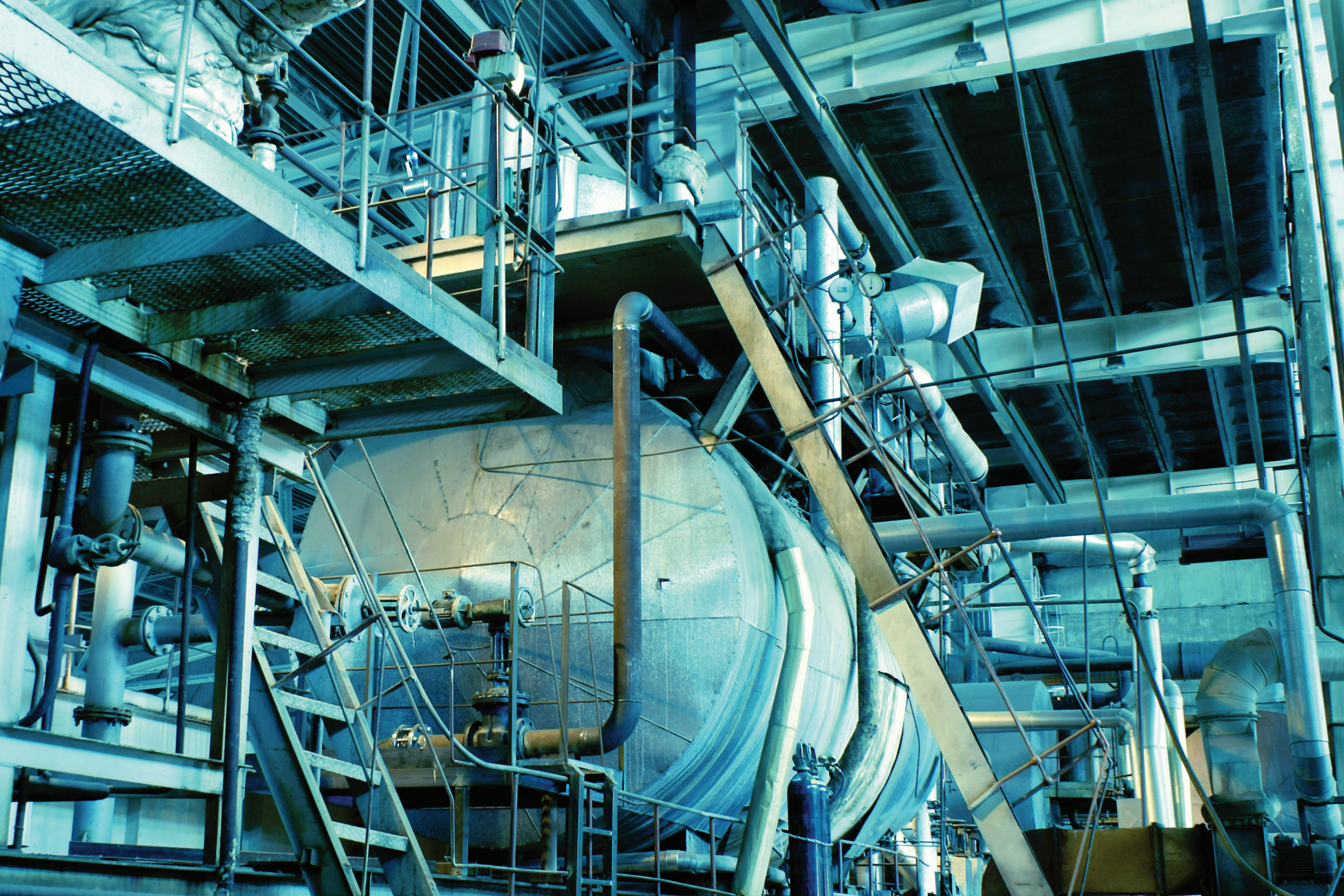
HSE QUALIFICATIONS

EAPC is certified under ISNetworld (ISN# 400-217037)
NCMS NON-DOT Qualified

EAPC has 180+ employees providing services in the following areas:

Engineering: Chemical, Mechanical, Electrical, Structural
Architecture
Procurement
Construction Management
Maintenance Planning





NORTH DAKOTA LNG

THE PREMIERE UPPER MIDWEST LNG PRODUCER

North Dakota LNG is part of Prairie Companies, a portfolio of growth-oriented businesses that support the energy industry in North Dakota. A pioneer in liquefied natural gas (LNG) production, North Dakota LNG provides turn-key alternative fuel solutions for customers at any point in the LNG logistics supply chain, resulting in lower costs, and reduced emissions and environmental impact.

CORE OPERATIONS

North Dakota LNG is a two-phase liquefied natural gas (LNG) production plant that can produce more than 70,000 gallons per day.

SAFETY FIRST, ALWAYS

Like other Prairie Companies operations, safety is the number one priority for North Dakota LNG. Strict safety and operating procedures guide the operation.

LNG APPLICATIONS

Potential LNG power generation industry applications include boiler startups and shutdowns, heating boiler operations, backup generator operations, and combustion turbine backup fuel supply.

ENVIRONMENTALLY FRIENDLY

Natural gas is the cleanest fossil fuel and supports the country's drive for clean energy. There is an abundant supply due to horizontal drilling and fracturing.

TRANSPORTATION & LOGISTIC SERVICES

Together with Prairie Field Services, a sister transportation company, we monitor your fuel to ensure we are always meeting your on site requirements and dispatch as needed.





METHANE
REFRIGERATED LIQUID

NORTH
DAKOTA
LNG

NO SMOKING

NO SIKING
FLAMS OR SPARKS

ENGINEERING THE CONVERSION

UTILIZING LNG OR NG TO REPLACE FUEL OIL FOR PLANT STARTUPS

New EPA MATS Rule: Startup Definitions

This requires all back-end emission control systems to be in service at the end of the startup period. (Baghouse, Scubbers, ESPs)

1. Startup ends 4 hours after the generation of electricity begins to the grid or station service
2. Startup ends within 1 hour of coal being fired in the boiler

These new MATS rules limit the ability of some power plants to meet the new startup guidelines without causing damage to the back-end emission control systems.

EAPC has completed fuel oil to natural gas conversions for boiler startups on two 450 MW units.

Since most power plants do not have a reliable source of natural gas within a close proximity, LNG is a great solution to replace the current fuel oil systems used for startups and shutdowns as well as for natural gas curtailment issues at combustion turbine facilities.





CASE IN POINT

EXAMPLES OF LNG AND NATURAL GAS USED FOR STARTUPS AND SHUTDOWNS IN THE POWER GENERATION INDUSTRY



This West Virginia coal fired power plant experienced continued curtailment issues during startups. They installed a mobile LNG system consisting of 18 LNG trailers and 3 gas fired vaporizers. This system supplied 450,000 SCFH required for startup.



EAPC Industrial Services provided engineering and design services at Basin Electric Power Cooperative's Antelope Valley Station to convert two 450 MW units from fuel oil to natural gas for boiler startups.

NEW SYSTEM REQUIREMENTS

- New natural gas vertical manifolds in all four corners of the boiler
- Associated supply piping, control valves, isolation valves, venting system
- 4 new burners and 32 igniters with associated control system
- Electrical area classification evaluation



CONVERSION ADVANTAGES

REDUCED ENVIRONMENTAL IMPACT

LNG vs. Fuel Oil

	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
CO2	20-30%									
CO	Up to 75%									
NOx	50%									
GHG's	20%									
VOC's	55%									
Particulate Matter	95%									
<i>Ground Water Contamination Risk = 0</i>										

OPERATIONAL RELIABILITY

Igniters and warm-up guns start immediately. No issues with flame outs or plugged tips. Positive ignition and light-off every time.

Boiler startups and unit tie-on meet pre-arranged schedules with system dispatch or designated ISO or RTO for your area.

Master boiler trips can be avoided during unit upsets.

LNG can be utilized to supplement fuel demands when coal quality becomes an issue without having to reduce load.

Downstream emissions control systems “Baghouse” can be put in service immediately and warm-up slowly throughout startup without any impact to the bags.

REDUCED O&M

Pump and relief valve repairs

OT for E&I throughout startup to deal with scanner issues

Fuel oil tank cleaning due to decomposition and algae

Fuel oil spill cleanup

Scanner replacement and/or rebuilds

Oil ring replacement

Potential air heater fires

REDUCED COSTS

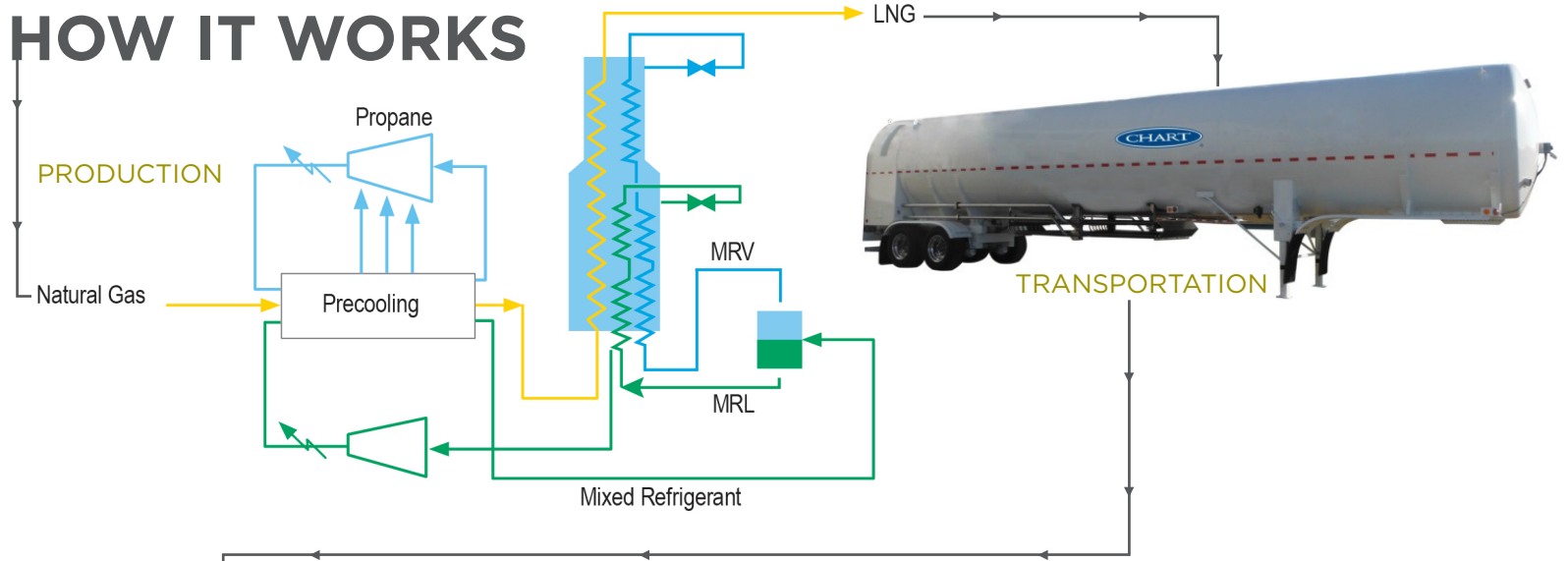
30-40% reduction on startup costs compared to fuel oil

Lost production due to extending startups related to fuel oil firing issues

O&M costs related to fuel oil handling and firing for startups

Lost production due to coal quality issues

HOW IT WORKS



OFFLOAD/STORAGE



VAPORIZATION





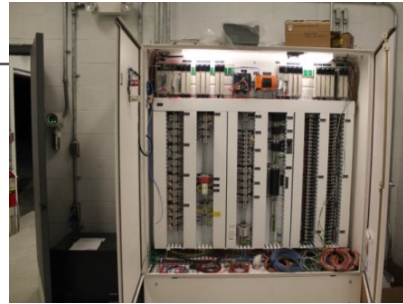
REGULATION



INTERCONNECTING PIPE



CONTROLS



THE NEED TO KNOW

DESIGN CONSIDERATIONS

GAS CONSUMPTION

Average Flow Rate (SCFH)
Hours/Day Operation
Peak Flow Rate (SCFH)
Peak Duration/Duration Frequency

DAYS/HOURS STORAGE REQUIRED

OUTLET GAS PRIORITIES

Max/Min Pressure
Max/Min Temperature

ENVIRONMENT

Temperature
Humidity
Wind
Earthquake Zone

AVAILABILITY OF ON-SITE ENERGY

Steam
Hot Water
Electrical

HORIZONTAL VS VERTICAL TANKS

PROPERTY SETBACKS

LEVEL OF AUTOMATION

ODORIZATION

SAFETY SYSTEMS

NUMBER OF UNITS

BOILER SIZE IN MW

NUMBER OF BURNERS AND IGNITERS PER BOILER

AREA CLASSIFICATION ASSESSMENT





THE POWER OF PARTNERSHIP

The EAPC and North Dakota LNG partnership brings together a seasoned engineering firm with over 15 years of experience working with power generation clients throughout the upper Midwest and a large scale LNG producer with industry expertise, production facilities, and transportation infrastructure.

This partnership provides power generation companies a proven option for boiler startups.

An LNG system can match or exceed current fuel oil startup system capacities while eliminating EPA MATS startup limitations and O&M issues related to fuel oil used for startups.

These same LNG systems can also be a great option for natural gas fired generating stations. Many combustion turbine facilities experience curtailment issues. An LNG backup system would provide a seamless transition while eliminating the environmental and O&M issues related to using fuel oil as backup.





WARNING
NO VEHICLES
WILL
ENDANGER
ABOVE
GROUND
PIPING OR
OTHER
EQUIPMENT
BEING
OPERATED

NOTICE
OF VISUAL
ALARMS
TO ALL
UNLOADING
OPERATIONS

NOTICE
ALL TRUCKS
MUST CH
BEFORE LO
UNLOAD



3100 DeMers Avenue
Grand Forks, ND 58201
701.775.3000
www.eapc.net/is

Cory Vaughn PE, Principal/Partner
218.751.0151 | cory.vaughn@eapc.net

Jesse Sandry PE, Industrial Services Program Director
701.461.7471 | jesse.sandry@eapc.net



10387 68th Street NW
Tioga, ND 58852
701.609.1196
www.northdakotalng.com

Ed Wood, Director of Business Development
303.304.4724 | ewood@northdakotalng.com