GTI BI-FUEL® PRESENTATION

LNG: Siting a Twin Ports Liquefaction Plant

Great Lakes Maritime Research Institute

A University of Wisconsin - Superior and University of Minnesota Duluth Consortium

Duluth Seaway Port Authority

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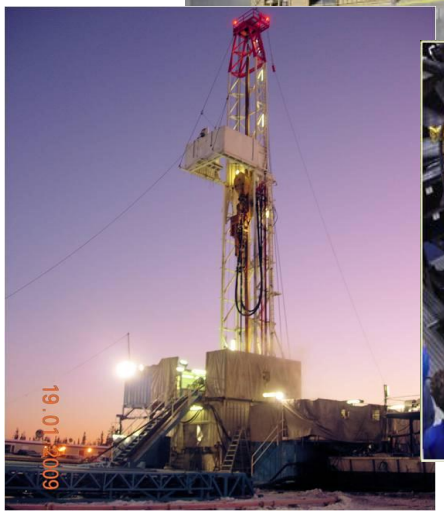
HOERBIGER Engine Solutions

What Is Bi-Fuel ?

- Bi-Fuel® is a “co-firing” of standard diesel fuel and natural gas (methane)
- It is designed for use on conventional, heavy-duty & light-duty diesel engines
- No engine modifications are required
- The GTI Bi-Fuel® Systems can be installed in the field or accomplished as an OEM up-fit
- Natural gas may substitute up to 70% (max) of the diesel fuel required to maintain a given speed and load

Primary Applications

- Prime Power
- Peak Shaving
- Standby Power
- Distributed Power Generation
- Pumping applications
- Drilling Rigs, Fracing & Well Service Units
- Data Centers
- CNG/LNG Market Bridge
- Marine Propulsion and Auxiliaries



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Characteristics of GTI Bi-Fuel® System

- Maintains diesel-like performance and efficiency
- Compression ignition
- Low gas supply pressure
- Sophisticated Altronic engine protection system
- Auto-switching of fuel modes
- Non-intrusive, simple installation
- Easy to operate

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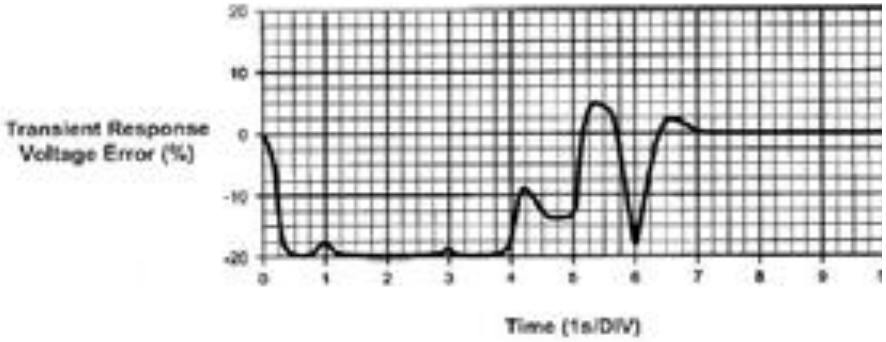
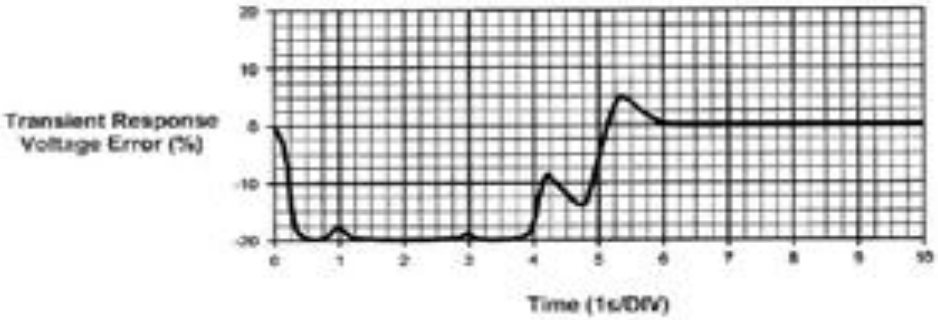
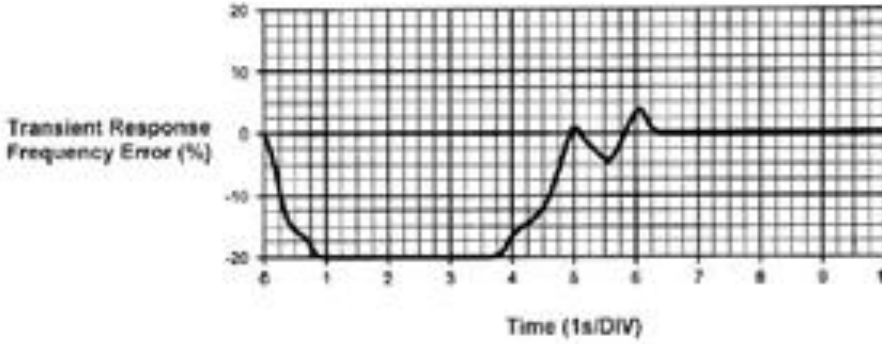
Diesel vs. Bi-Fuel® Response Performance

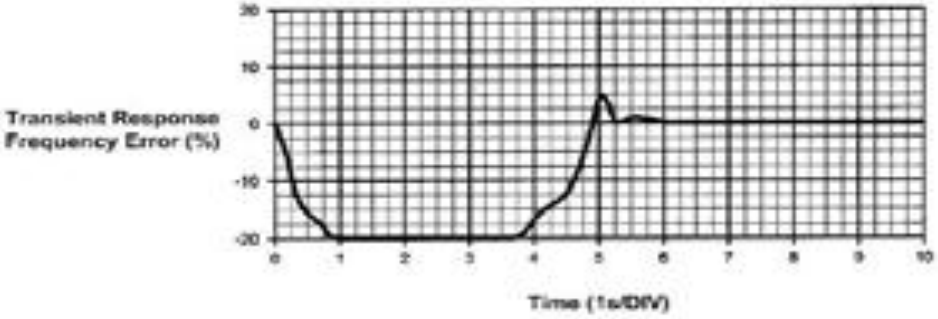
100% Diesel
100% Block Load



30% Diesel / 70% Bi-Fuel
100% Block Load







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Benefits to the User

- Reduced energy costs
- Rapid payback
- Extended runtime for emergency operation
- Reduced exhaust emissions
- Fuel flexibility

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Fuel Gases Compatible with GTI Bi-Fuel® System

- Pipeline natural gas
- Liquid natural gas (LNG)
- Compressed natural gas (CNG)
- Wellhead gas*
- Bio-gas (landfill, wastewater, etc.)*
- Coal-bed gas*

*With proper pre-treatment

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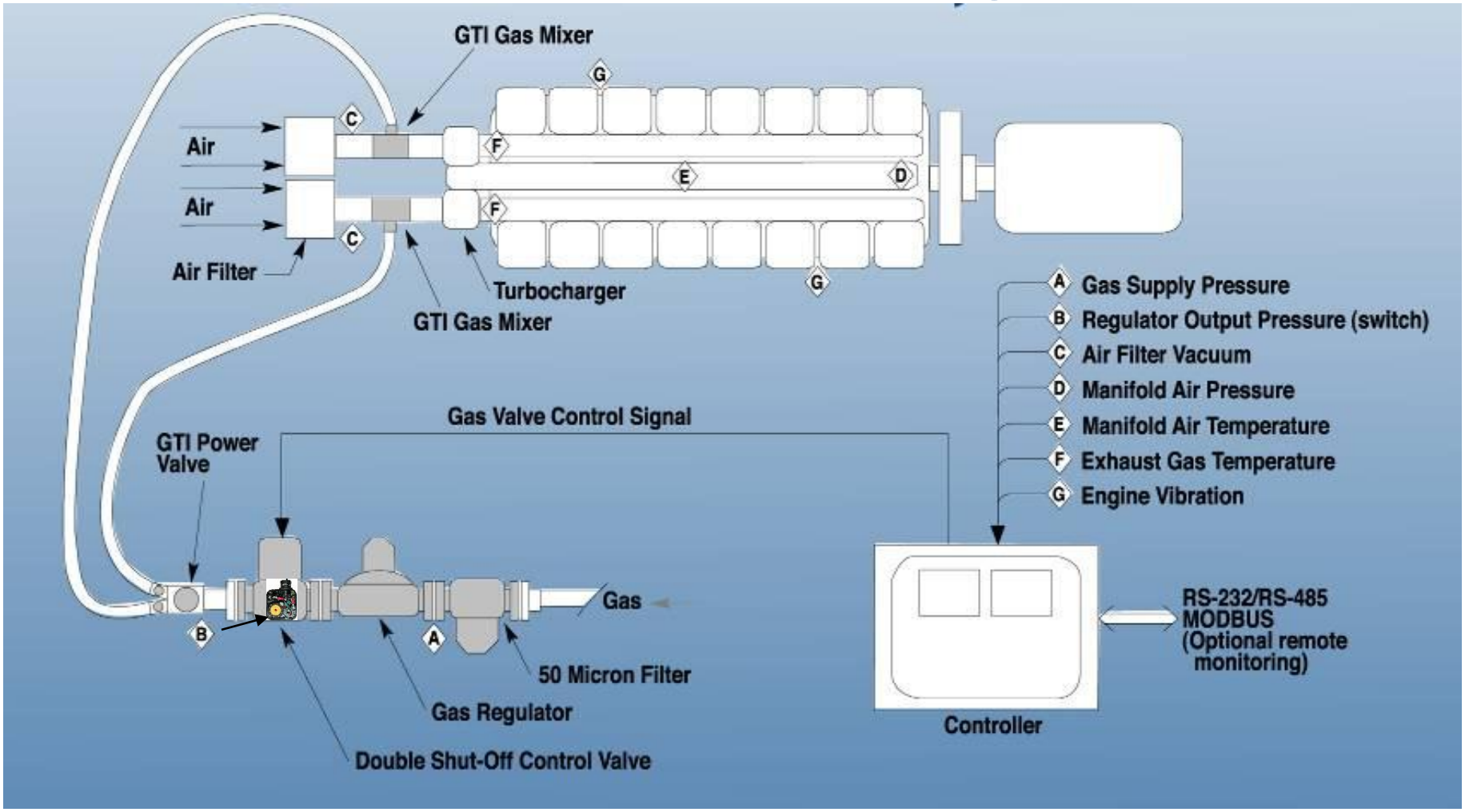
GTI Bi-Fuel® System Diagram



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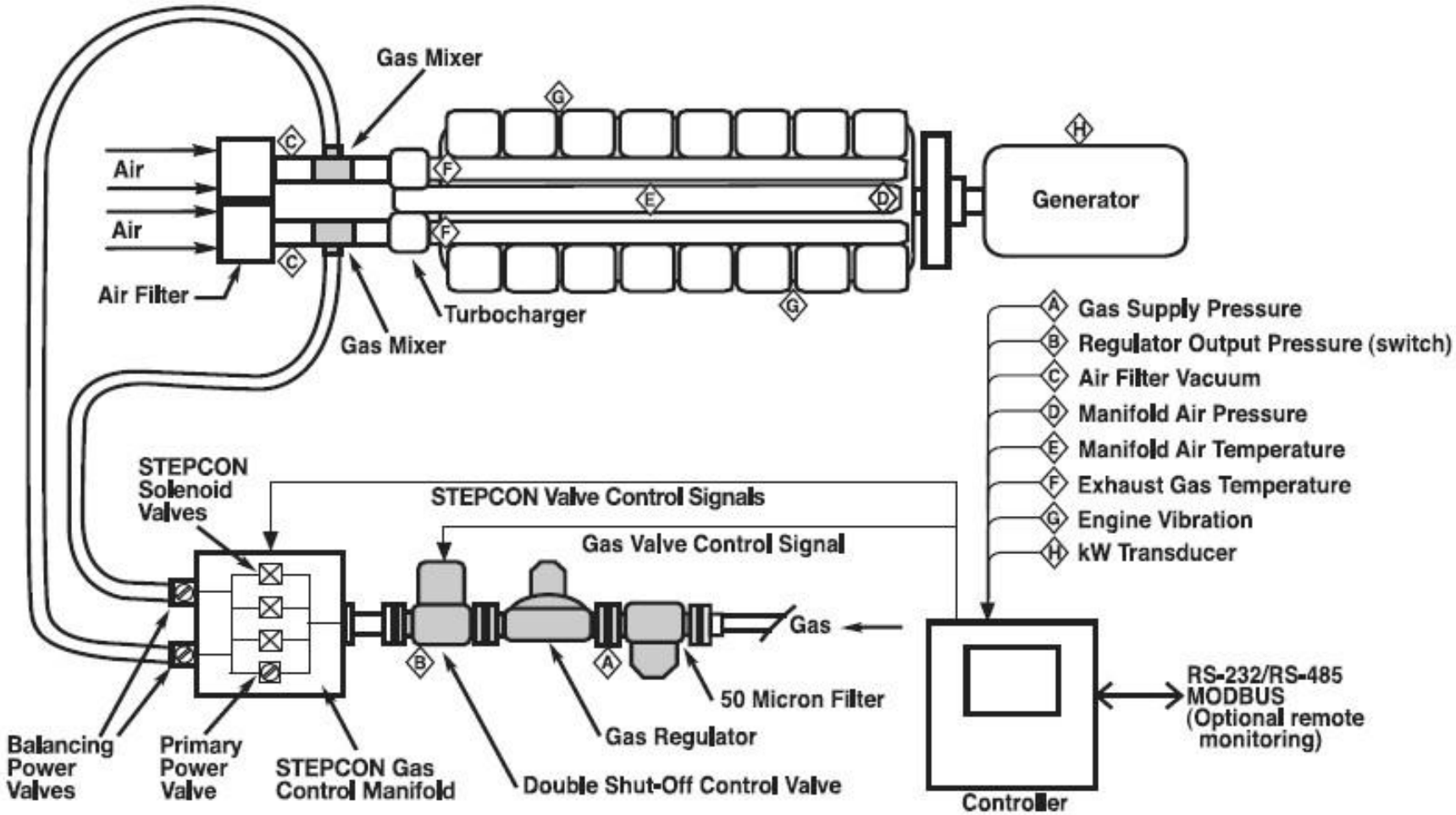
The STEPCON® System

GTI Bi-Fuel STEPCON System Diagram



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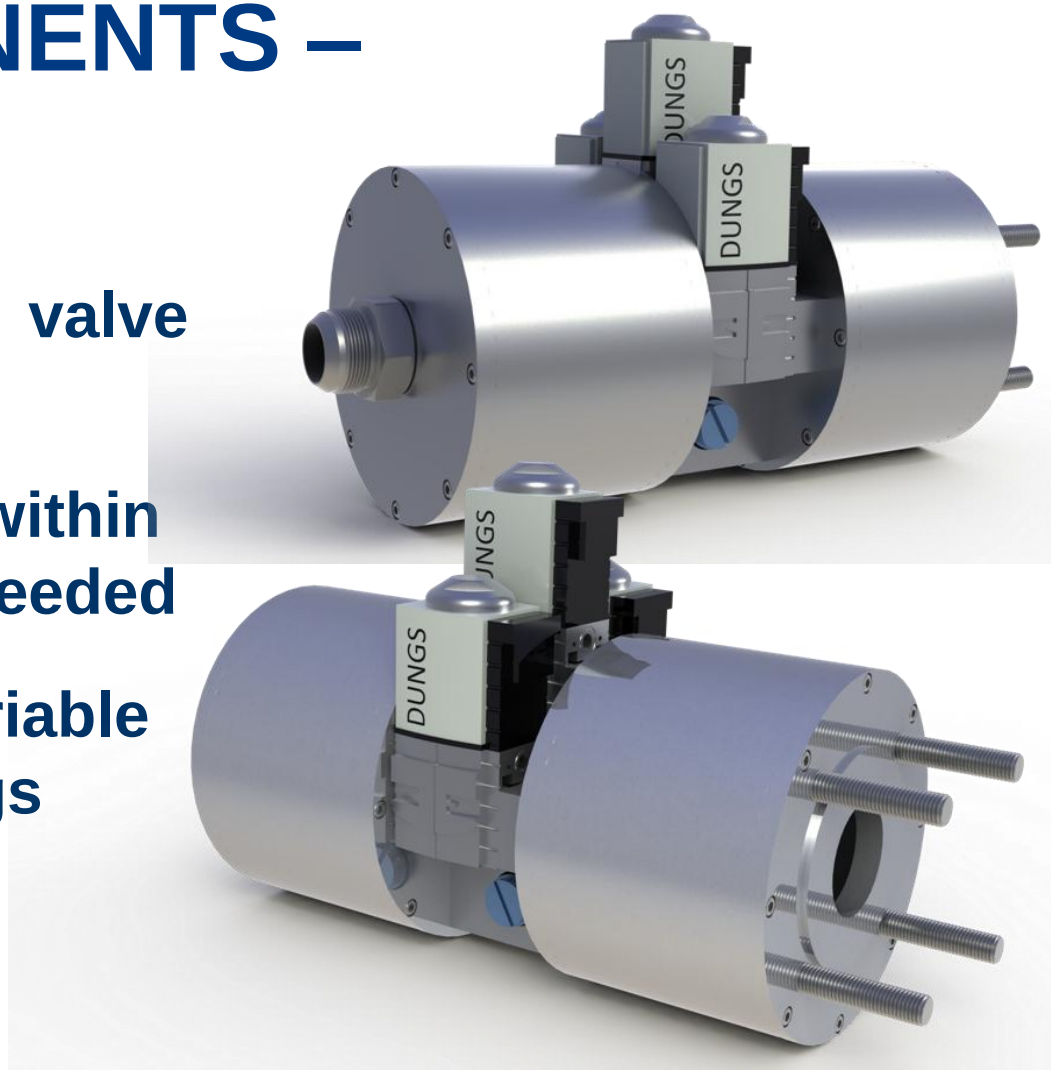
SYSTEM COMPONENTS – *STEPCON® Valve*

- **Up to 4 individual power valve setpoints.**
- **Maximizes substitution within widest loadband when needed**
- **Ideal for rapid widely variable loads such as drilling rigs**
- **Anodized for corrosion resistance**



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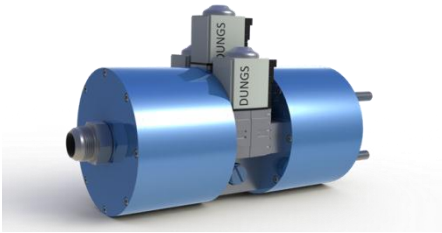
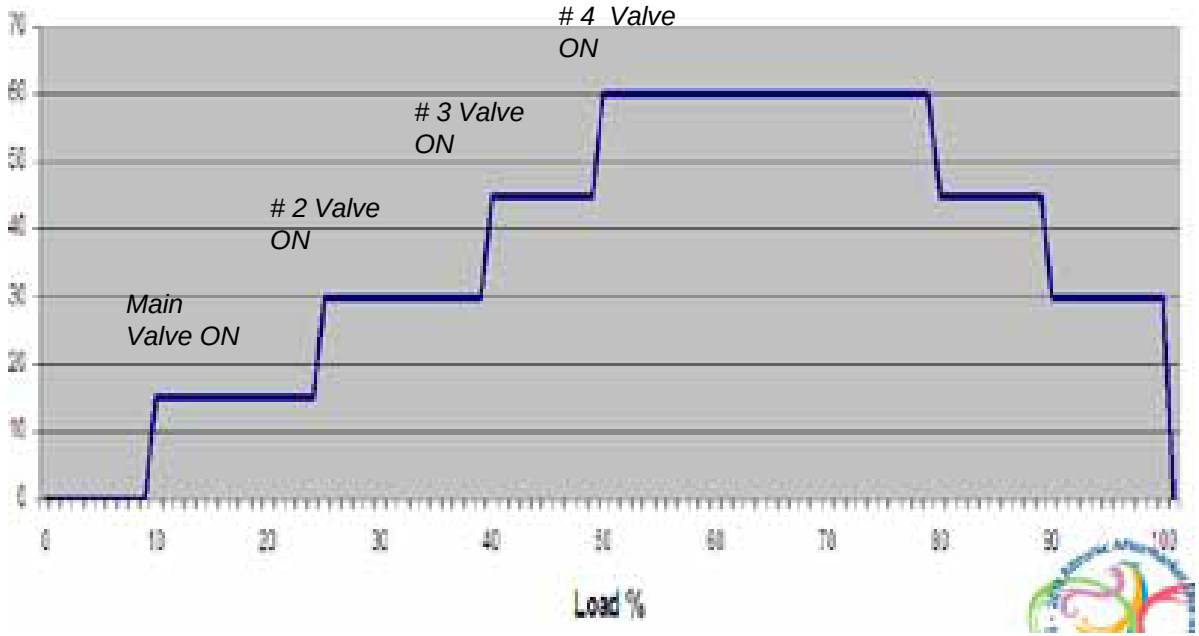
STEPCON® Technology





The STEPCON™ is designed to enhance the basic GTI bi-fuel system allowing its application over a wider load range, adjusting the optimal substitution rate based on load with the capability to make substitution level adjustments in response to rapid load changes.

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STEPCON® Installed on Drilling Rig

http://www.ecoafs.com/CaseStudyVideo.asx

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Proper Application

- **The STEPCON™ is designed to enhance the basic GTI Bi-Fuel system**
- **It allows Bi-Fuel application over the widest load range**
- **It adjusts for the optimal substitution rate based on near real-time load**
- **It makes substitution level adjustments in response to rapid/drastic load changes.**
- ***The majority of applications will continue to be satisfied by the application of the standard kit***

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MARKETING & TYPICAL INSTALLATIONS

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Publix Supermarkets

- Location: Southeast US
- Units Installed: over 600 from 2007 to 2009
- Size: 500kw
  CAT C15
- Driver: Emergency Power to avoid loss of perishable food

Hospitals & Healthcare

- Location: Fort Myers, FL

- Units Installed : (2) CAT 3516 bi-fuel systems 2004

- Size: 2,000kw x 2

- Driver: Extended runtime up to 300% for emergency standby power in critical care application.

High-Rise Office / Retail Bldgs.

- Location: Toronto, Canada
- Units Installed : Cat D349 in 2005
- Size: 800 kw
- Driver: Extended runtime up to 300% . Emergency back-up power for elevators, lights, computers, etc.

Water Treatment Plant

- Location: Wichita, KS
- Units Installed: 2010
  (4) Cat 3516C's -paralleled
- Size: 2,000kw – ea.
- 55% Substitution
- Drivers:

  a. Emergency
     Standby Power
  b. Extended runtime
  c. Emissions

Irrigation Pumping

- Location: Amarillo, TX and New So. Wales, Australia
- Units Installed: 2009
  - DDC Series 60
  - Cummins M11C
- Size: 350kw & 300kw
- 70% Substitution on both
- Driver: Prime power cost savings on diesel fuel. - Agriculture

Textile Manufacturing

- Location: New Delhi, India
- Units Installed: 2005 Cummins
- Size: 350kw
- Driver: Prime Power cost savings to operate small factory
- Rapid Payback – 16 days !

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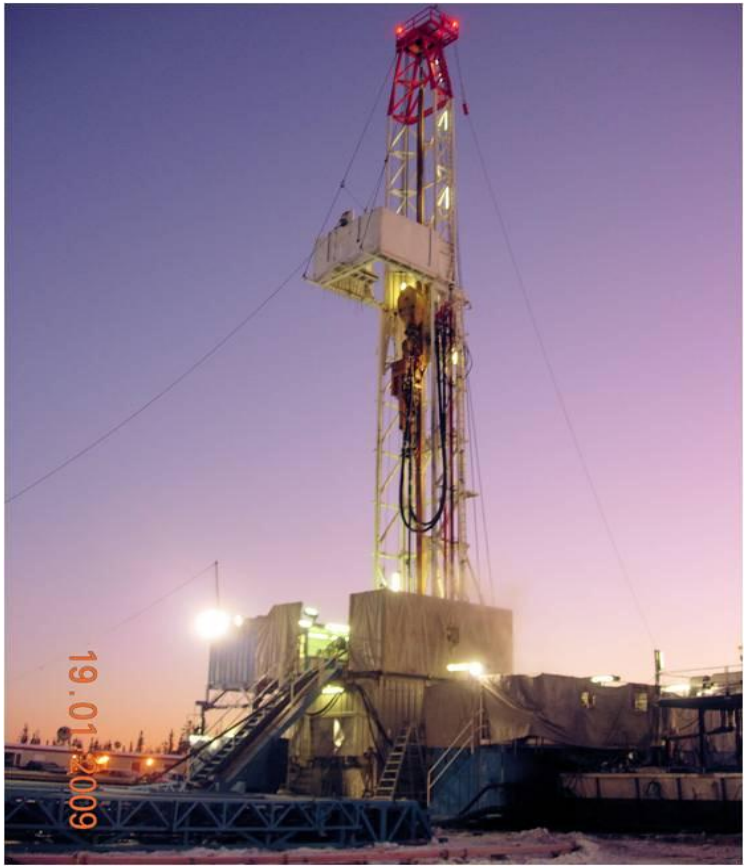
Oil & Gas – Drilling Rigs

- Location: Various locations in U.S., Canada, and China
- Units Installed: Approx. 350 bi-fuel systems installed on drilling rigs. Hundreds more projected 2012 – 2013
- Size: Average 1500kw x 3 engines per rig
- Driver: Huge cost savings on diesel fuel with rapid payback



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Oil & Gas – Fracing Trucks

- Location: Western Canada and various locations in U.S.

- Units Installed: 11 Units to date. More companies ready to start bi-fuel testing on large fracing fleets

- Size: 1500kw - 2,000kw per engine @ 124 gph. Each frac job may require 10 – 20 engines.

- Drivers: (1) Huge Cost savings with rapid payback. (2) Reduce truck traffic to jobsite. (3) Reduce fire potential from diesel refueling.

Oil & Gas – Well Servicing
Nitrogen & Foam Units

- Location: Colorado
- Units Installed: 5 units
- Size: 350kw Cat & DDC
- Average Substitution : 65%
- Driver: Huge Cost savings and rapid payback

Oil & Gas – Rental Generators

- Location: Williston, ND
- Units Installed: 40 Units
- Size: Various
- Picture: 200kw Cummins with 15,000+ hours on bi-fuel with no downtime !
- Average Substitution : 55 - 65%
- Gas : Using wellhead gas
- Driver: Temporary power to run wellhead pumps. Also, uses flaring gas !

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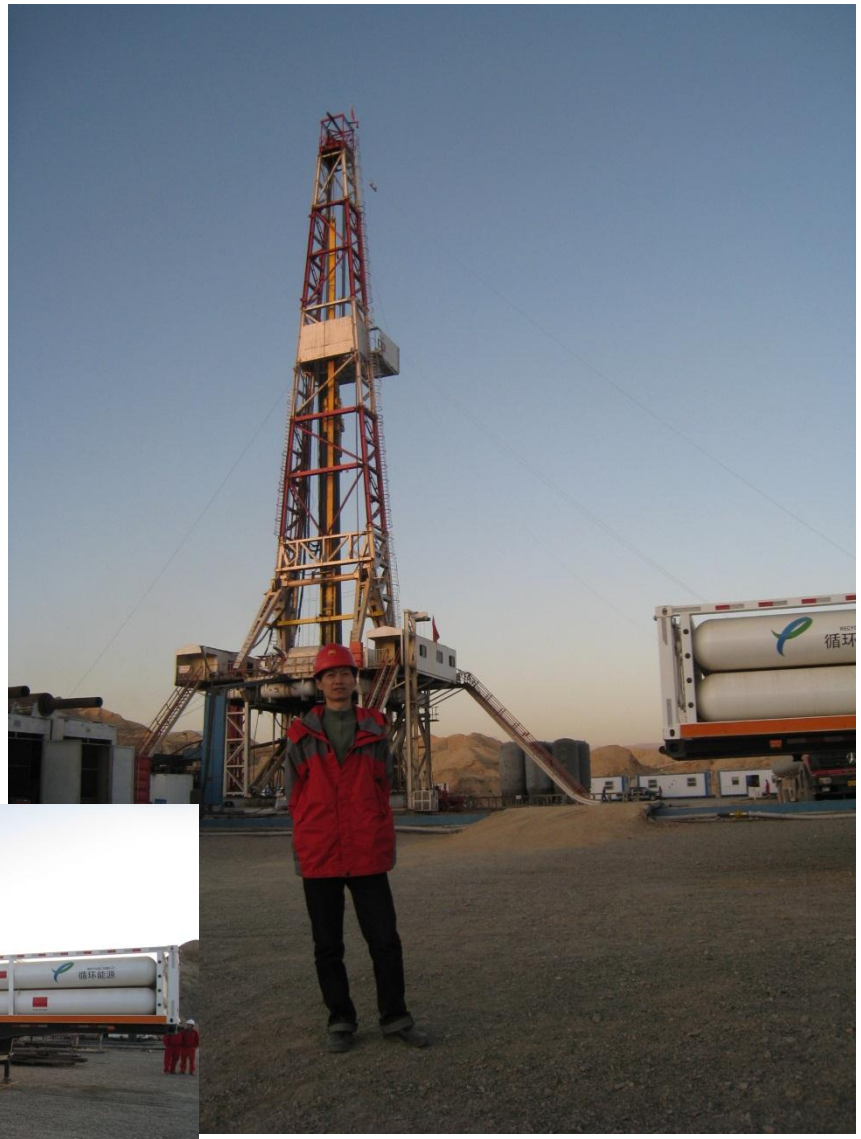
GTI Bi-Fuel® on Drilling & Fracing Rigs

40 GTI Bi-fuel systems running on

CNG

Xinjiang Province

CHINA



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GTI Bi-Fuel® on Drilling & Fracing Rigs

40 GTI Bi-fuel systems running on

LNG

Xinjiang Province

CHINA

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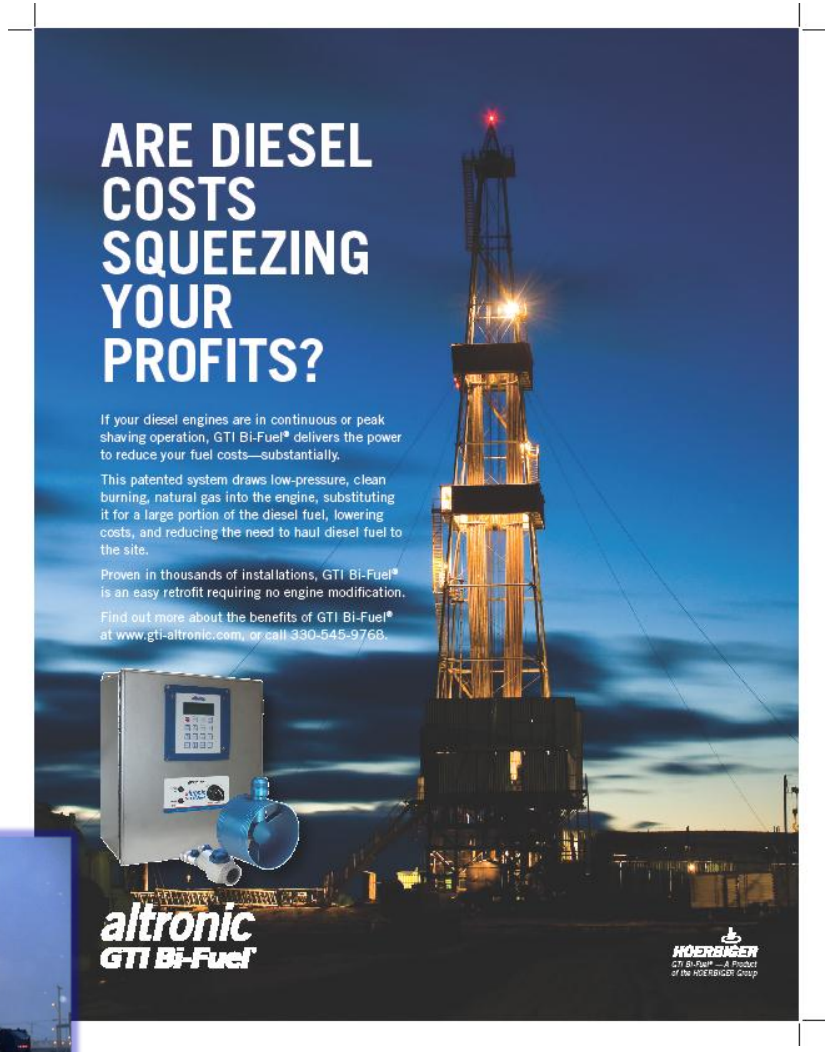
GTI Bi-Fuel® on Drilling & Fracing Rigs

Total Bi-fuel units sold:

3,200

Total installed on Drilling Rigs & Frac Units:

350



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GTI Bi-Fuel® on Drilling Rig

ACTUAL COST SAVINGS with (3) STEPCON® Systems

	DIESEL			BI-FUEL		
	6.5 Drlg	0	1585	5.5 Drlg	49.7	864
	17.0 Drlg	0	1999	16.0 Drlg	49.5	1046
	13.0 Drlg	0	2050	13.5 Drlg	101.3	933
	12.0 Drlg	0	2400	13.5 Drlg	101.3	933
Total Drlg Time	48.5 Hrs			48.5		
Gals of Diesel			8034		301.8	3776
Cost of fuel			$3.50		$4.00	$3.50
Cost of Fuel			$28,119.00		$1,207.20	$13,216.00
Total Cost of Fuel			$28,119.00			$14,423.20
Saving			$13,695.80	(SAVINGS)		

ACTUAL SAVINGS:

$ 6,848 PER DAY

MARKETING of BI-FUEL

- ***COST SAVINGS – Rapid payback and huge savings on prime power applications***

- ***EXTENDED RUNTIME – Increase runtime by 300% or more on standby power applications***

- ***MARKET BRIDGE – Flexible means of building LNG/CNG customer base while taking advantage of a growing infrastructure***

- ***REDUCED EMISSIONS – Typical installations reduce many toxic emissions***

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Bi-FUEL & LNG / CNG

Bi-Fueled engines are creating opportunities all over the world for LNG & CNG

- ***Marine – Inland Waterways, Coastal, and Open Water – propulsion or auxiliary***
- ***Flexible use of existing assets that "pay" for new dedicated equipment***
- ***Areas without gas pipeline infrastructure – stationary or mobile, remote or otherwise***
- ***Areas without natural gas resources***

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Key Marine Attributes

Altronic GTI Bi-Fuel Marine Modifications

- Sealed casing for gas train
- Casing Leak detection system
- Casing designed to be incorporated to vent (30ft vent)
- Explosion resistant connection plugs to casing (DMV, ROP, GSP)
- Marine Enclosed Panel (NEMA 4R)

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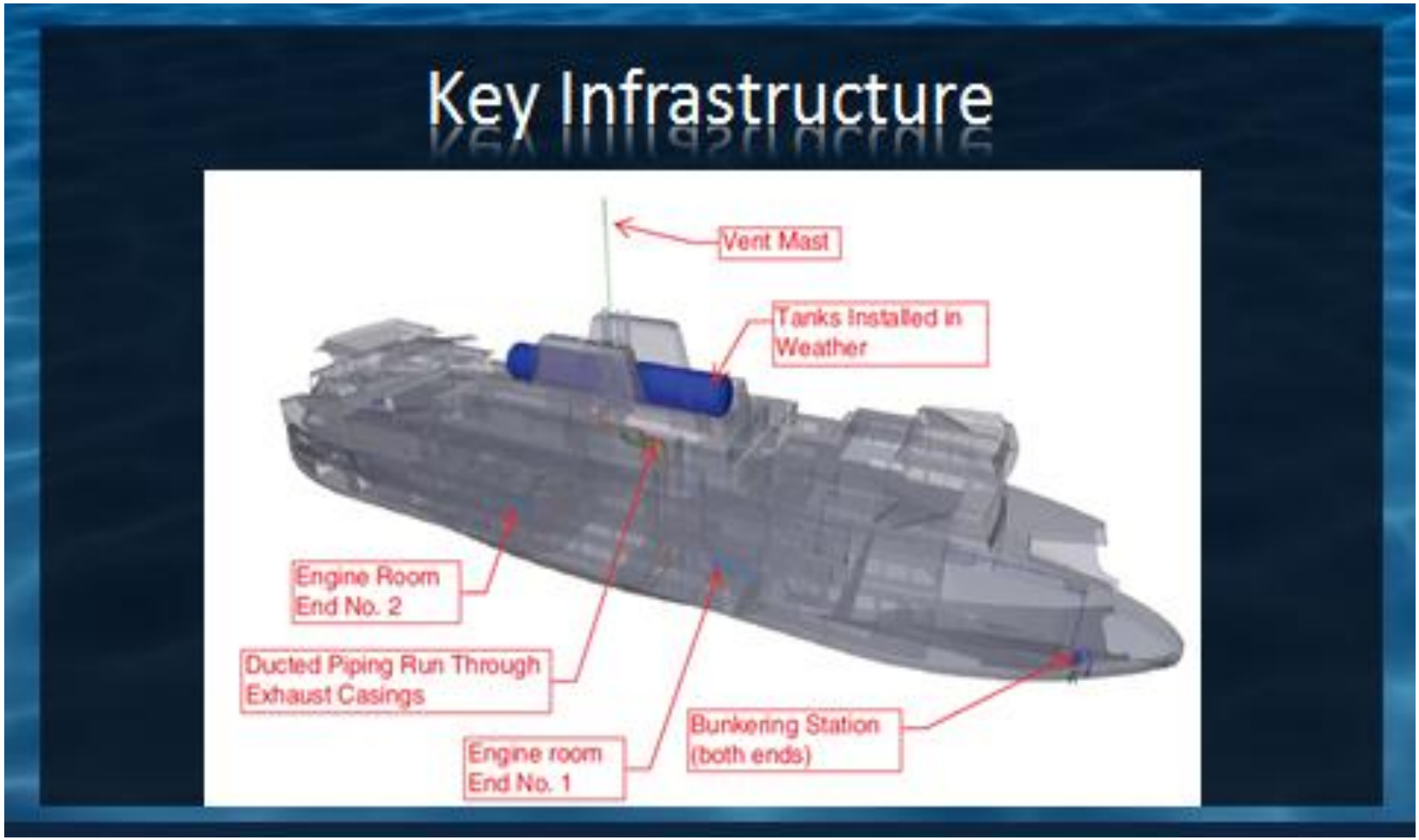
Marine Bi-Fuel® Application



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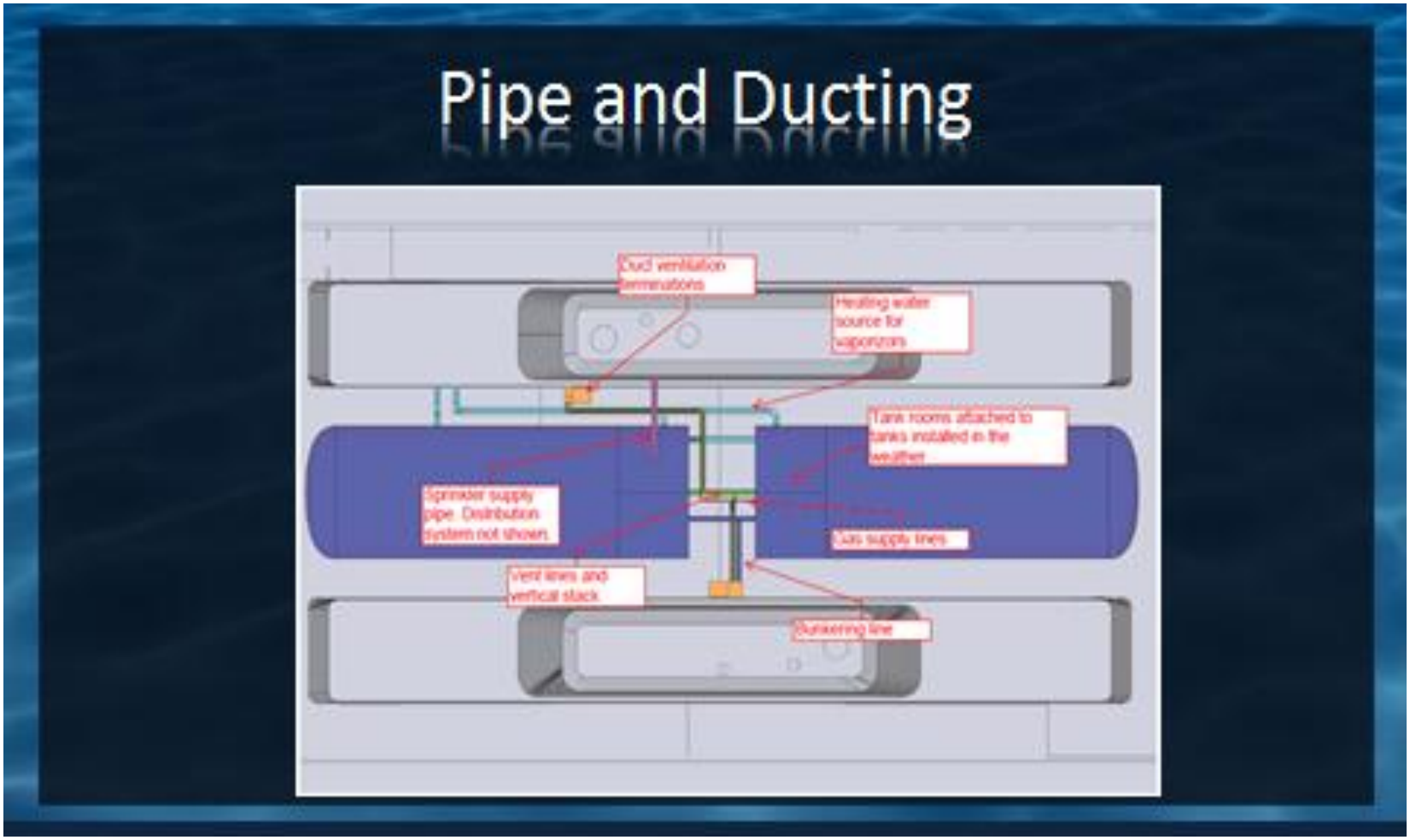
Marine Bi-Fuel® Application



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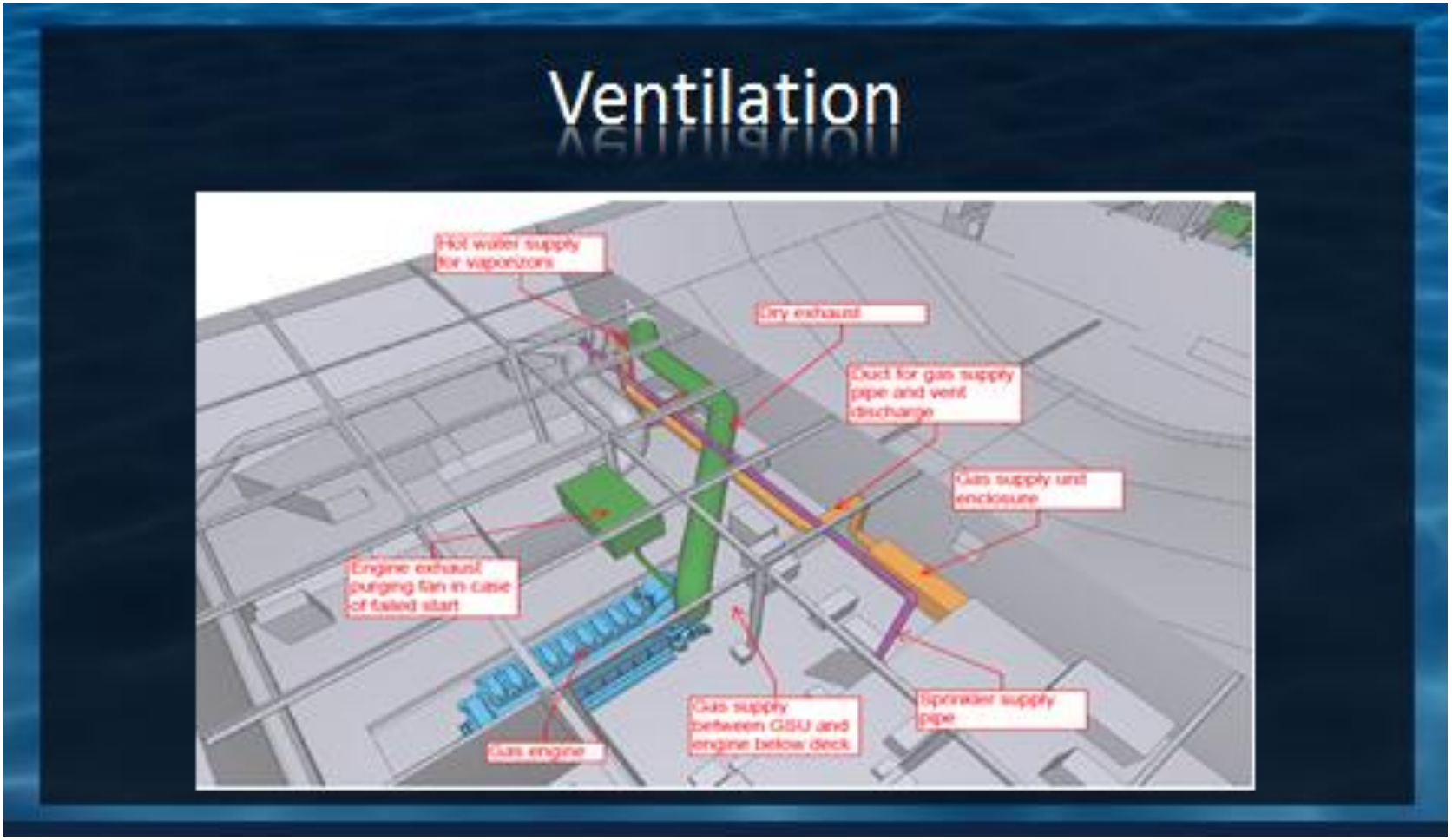
Marine Bi-Fuel® Application



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EERC / GTI Research Efforts

PROMOTING CNG / LNG

"Demonstration of Gas-Powered Drilling Operations for Economically Challenged Wellhead Gas and Evaluation of Complimentary Platforms"

Thank You
For
This Opportunity !

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