

2016 Gas/Electric Partnership

# COMPRESSOR TUTORIALS FOR GAS PIPELINES

**February 2** (afternoon)  
& **February 5** (morning)

CenterPoint Energy Tower, 13th floor  
1111 Louisiana, Houston, Texas

**Gas/Electric Partnership Conference XXIV  
is February 3-4, 2016**

Kinder Morgan Tower, 1001 Louisiana  
CenterPoint Energy Tower, 1111 Louisiana  
Houston, Texas

RECIPROCATING  
COMPRESSORS

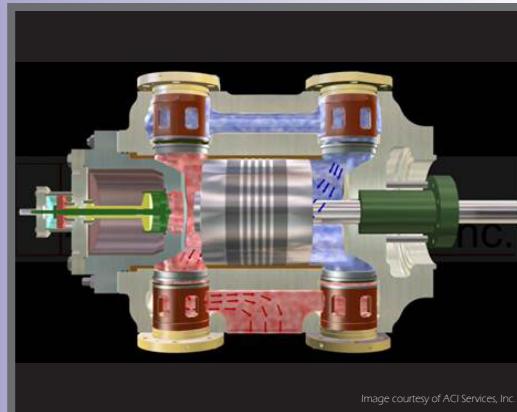


Image courtesy of ACI Services, Inc.

CENTRIFUGAL  
COMPRESSORS

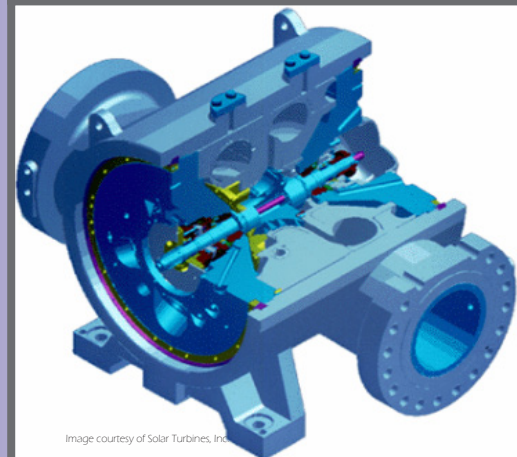
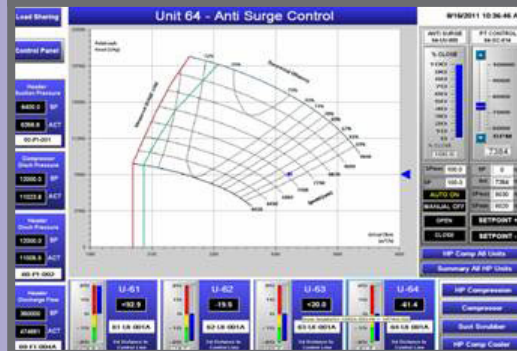


Image courtesy of Solar Turbines, Inc.

SURGE  
CONTROL



# Tutorial Agenda

Tutorials at 13<sup>th</sup> Floor

CenterPoint Energy Tower, 1111 Louisiana

Produced by **GAS/ELECTRIC VENTURES**

505.490.9119 for registration information

713.529.3216 for program information

## Tuesday, February 2

1:00 pm

### **Centrifugal Compressors – Dynamic Considerations for Station Design**

Southwest Research Institute

Augusto Garcia-Hernandez, Jeffrey Bennett,  
Eugene “Buddy” Broerman, Ben White

#### **Basic Operation**

- Basic Function
- Components
- Performance

#### **Flow Simulation**

- Performance Map
- System Layout
- Boundary Conditions
- Fluid Properties

#### **Transient Surge**

- Control Sequences
- Anti-Surge Loop and Valve Details
- Emergency Shutdown (ESD) and Upset Conditions

#### **Flow Induced Pulsation/Vibration Issues**

- Acoustic/Strouhal Issues
- Piping Design for Vibration Control

#### **Mixed Compression**

- Centrifugal & Recip Units in Parallel
- Surge Margin Consideration

#### **Thermal Piping Flexibility**

- Piping Layout
- Compressor Nozzle Loads

**Adjourn at 5:00 pm**

## February 3-4

### **Gas/Electric Partnership Conference**

Visit: [www.gaselectricpartnership.com](http://www.gaselectricpartnership.com)

## Friday, February 5

8:30 am

### **Reciprocating Compressor Basics**

Norm Shade, ACI Services, Inc.

#### **Basics**

- Compressor Types
- Applications
- Compressor Rating Criteria and Drivers
- Mechanical Components and their Functions
- Basic Compression Thermodynamics and Terminology

#### **Break**

#### **Performance**

- Compressor Capacity (Flow) and Horsepower
- Performance Curves
- Compressor Rod Load and Pin Reversal
- Multistage Compression
- Effects of Gas Properties

#### **Capacity Control**

- Suction Throttling, Bypass, Clearance Pockets and End Deactivation
- Examples of Some Common Problems
- Recap

**Adjourn at 12:00 noon**

*\*Certificate for Professional Development Hours will be earned.*

## **UNDERWRITERS**

MAN Diesel & Turbo North America Inc.

CenterPoint Energy

ACI Services, Inc.

American Electric Power

CompressorTech II

HOERBIGER Compression Technology

Voith Turbo

Ariel Corporation

GE Oil & Gas

ABB

Custom Compression Systems

Nidec ASI LLC

Entergy

Southwest Research Institute

Neuman & Esser

Alphabet Energy

GE Power & Water

# **Opportunities in Gas & Oil Infrastructure**

**February 2-5, 2016**

**Conference: February 3-4**

**Compression Tutorials February 2, 5**

Kinder Morgan Tower, 1001 Louisiana

CenterPoint Energy Tower, 1111 Louisiana

**Houston, Texas**

# Opportunities in Gas & Oil Infrastructure – Agenda

**Tuesday, February 2** . . . . .

*CenterPoint Energy Tower, 13th floor*

1:00 pm Tutorial, Centrifugal Compressors – Dynamic Considerations for Station Design, Southwest Research Institute

**Wednesday, February 3** . . . . .

*CenterPoint Energy Tower, 1st floor auditorium*

## Macroeconomic Drivers of Change

9:00 am North American Oil & Gas Trends, Christopher Kopczynski, Wood Mackenzie

9:40 am Oil and Gas Markets – The Production Response, and Recovery, Edward Kelly, IHS Inc.

10:05 am **Oil/Gas Price Futures and Impacts –** Roundtable, Edward Kelly, IHS Inc., Michael Juden, McKinsey & Co., Andrew Slaughter, Deloitte Services LP, Christopher Kopczynski, Wood Mackenzie

10:55 am Break

11:15 am Power Generation – Risks and Opportunities for Gas Use, Gurcan Gulen, University of Texas Center for Energy Economics

11:40 am Battery Technology and Energy Storage Outlook, T. Kent Flanery, Middough

12:10 pm An Installation of Integrating Generators with Renewables and Batteries – Pierluigi Barutta, Nidec-ASI

12:25 pm Lunch

## Technology Updates

*Moderated by Norm Shade, ACI Services, Inc.*

1:25 pm Advances for Pipelines, Southwest Research Institute & ACI Services, Inc.

## Changes in Pipeline Systems

1:50 pm Gas/NGL/Crude Imbalances, LNG Exports, Power Storage, and Pipeline Consequences, Michael Juden, McKinsey & Co.

2:25 pm Delfin Floating LNG Project, Dan Werner, Delfin LNG

2:45 pm Break

3:05 pm Pipeline and Power Generation Coordination, Brian Fitzpatrick, PJM Interconnect, remarks by Hubert Eldridge, Kinder Morgan

3:40 pm **Gas Pipeline Roundtable –** Changes in Gas Pipeline Utilization and Flow Directions, Power Storage Impacts on Pipeline Growth, and Conversions of Gas Pipelines to Liquid Lines – Michael Juden, McKinsey & Co., moderator with Kinder Morgan, Boardwalk Pipeline, Williams panelists

4:20 pm Adjourn and refreshments

# Opportunities in Gas & Oil Infrastructure — Agenda, continued

**Thursday, February 4** . . . . .

*Kinder Morgan Tower, 1st floor, room TBD*

## Compressors & Drives

- 9:00 am Are You Ready for Clean Air?, Thomas D. Hutchins, Kinder Morgan, remarks by Ronald Miller, Basic Systems & Randy Hayes, Energy Transfer
- 9:45 am Fuel Gas Boosters for Power Generation – Greg Herman, UE Compression
- 10:05 am Break
- 10:25 am New FERC Policy on Pipeline Modernization Cost Recovery, Brian Adams, Columbia Pipeline Group & Ben Johnson, Boardwalk Pipeline
- 11:05 am Cost and Lead Time Reduction for Compressor Systems – panel, Bryan Kendig, SBM Offshore, moderator with Domingo Fernandez, MAN Turbo & Diesel NA, Elliott Smith, Voith Turbo, Tom Parrow, JW Power, Karetha Foster, Spectra Energy, Randy Rhoads, BP (retired), Scott Simmons, Repsol
- 11:45 am Lunch

*Kinder Morgan Tower, Meeting Room 1B-1D, 1st floor SE side*

## Compressors & Drives, continued

### Offshore

- 12:55 pm Opportunities in Offshore Brownfield, Olivier LeNormand, SBM Offshore
- 1:15 pm Technical Updates from Deep Water to Onshore – moderated by Norm Shade, ACI Services, Inc., MAN Turbo & Diesel North America, Voith Turbo

- 1:40 pm How Rental Fleets are Adjusting to Current Conditions – Panel, Norm Shade, ACI Services, Inc., moderator with JW Power, Natural Gas Services Group
- 2:15 pm Break

## Technology Updates

*Moderated by Norm Shade, ACI Services, Inc.*

- 2:35 pm Advances from Alphabet Energy, GE Oil & Gas, Inc., Hoerbiger Corporation of America, Custom Compression Systems
- 3:20 pm Adjourn


**Friday, February 5** . . . . .

*CenterPoint Energy Tower, 13th floor*

- 8:30 am Reciprocating Compressor Tutorial, Norm Shade, ACI Services, Inc.
- 12:00 pm Adjourn Tutorial

# 2016 GAS/ELECTRIC PARTNERSHIP CONFERENCE — REGISTRATION

Fax to 713.529.3318 or email to [jennifer@gaselectricpartnership.com](mailto:jennifer@gaselectricpartnership.com)

<input type="checkbox"/>	Yes, I plan to attend the conference, February 3-4, 2016. Fee is <del>\$650.</del>		\$ _____
<input type="checkbox"/>	Add Centrifugal Compressor Tutorial (February 2)		+ \$125
<input type="checkbox"/>	Add Reciprocating Compressor Tutorial (February 5)		+ \$125
	Total		\$ _____

*For Gas/Electric Partnership rate, use the corporation booking code Z61 at the Marriott Courtyard on [www.marriott.com/HOUDT](http://www.marriott.com/HOUDT) or for the Springhill hotel on [www.marriott.com/HOUZD](http://www.marriott.com/HOUZD).*

*Both hotels are at 914 Dallas near Main Street, 3 blocks southeast. Rates are refundable up to 24 hours before date.*

<input type="checkbox"/>	Check payable to Gas/Electric Ventures is enclosed. Mail to: Gas/Electric Ventures, P.O. Box 28357, Santa Fe, NM 87592
<input type="checkbox"/>	Charge credit card number _____ _____
	Expiration Date _____ Zip Code Associated with Card _____

Signed \_\_\_\_\_

Print Name \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Phone \_\_\_\_\_ Email \_\_\_\_\_

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