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2020

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Visit TTS Midstream We Know Gas Turbines.

TURBINE TECHNOLOGY SERVICES CORPORATION

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TMOS
Maximum Performance,
Minimal Hassle
Read On

TURBINE TECHNOLOGY SERVICES
ENERGY SERVICES (ENGLISH)

Our legacy is founded on a global footprint and technical solutions for operational excellence

We specialize in innovative and high-value-engineered solutions and that help our clients maintain, upgrade, and enhance their power generation and gas compression assets. Our longevity, experience, and global agility distinguish us, our integrity and intellectual candor align us with our client's interests and success.

38 Years 102 Countries 454 Clients 27MM kW 21 Innovations

TurbineTech.com
RecipTech.com
TTSMidstream.com

We know recip.

RECIPROCATING TECHNOLOGY

About Us What We Work On What We Do What We Say Our Library Contact Us

Slow and Steady Wins the Race
While integral engine-compressors are very reliable, they'll need some love every now and then. We've got you covered.
Read More

Innovative Technologies and Solutions for the Gas Compression & Power Industries

By improving equipment reliability, performance and operations through our diversified solutions and innovative products and services, our team of engineers and service technicians provide technical support and comprehensive services, ensuring years of continuous processing for your compression and power equipment.

Reciprocating Technology Services (RTS) serves upstream, midstream and downstream operators and is an integral part of the TTS Energy Services group. As part of the TTS Energy Services portfolio, TTS and its sister company, Turbine Technology Services, offers agility, innovation and experience delivering industry leading aftermarket parts, modernization, optimization, upgrading and custom services for the power generation and compression industries.

We know compression.

TTS MIDSTREAM

What We Do What We Say Resources Contact Us

It feels different to work with us.

Maximizing Revenue for Fluid and Gas Transmissions Operators

TURBINE TECHNOLOGY SERVICES CORPORATION We Know Gas Turbines.

LODESTAR
Turbine Parts Management

FREE Presentation
Sign up to learn more and see LODESTAR in action.

First Name*

Last Name*

Email*

Request a Free Presentation

Ideal for fleets and operators with multiple gas turbines no matter the model or maker.

Predictive Maintenance Software Designed for Component Life & Outage Tracking of Gas Turbines Parts

Lodestar automates the capture and presentation of historical data and calculation of remaining critical parts life into a user friendly interface.

TURBINE TECHNOLOGY SERVICES CORPORATION

Cost-Benefit Review for Vintage Gas Turbine Modernization

The modernization of vintage gas turbines to meet the new market demands has plenty of upside for operators.

There is a lot of overlooked performance potential in retrofitted new technology into the installed base of gas turbines. Retrofitting existing generation units with a combination of new hardware and software solutions can improve output, ramp rates, heat rates, turndown. And most importantly, reliability.

Cost-Benefit Review
Turbine Technology Services has produced a simple cost-benefit review for improving gas turbine vintage unit reliability. We are publishing our findings in a table that

So, the question is what to do to make vintage gas turbines more reliable?

If any of these drivers apply to your vintage unit(s) then download our Vintage Evaluation Table for a Cost-Benefit Review

- Decreasing Reliability
- Unreliable System Obsolescence
- Increased Equipment Failure
- Poor starting reliability
- Slow Starts
- O/M/A Quality Issues
- Increased Emissions
- Lack of operational flexibility

TURBINE TECHNOLOGY SERVICES CORPORATION We Know Gas Turbines.

Flexibility Enhancements for Gas Turbines

FAST START PROGRAM

Stabilizing the Grid Has Its Challenges

Gas turbine generators must consider using **Fast Start** techniques to respond to the volatility of renewable energy output.

The business of power production is changing.

In the not too distant future, all electricity generation, with the exception of nuclear and renewable energy sources, will need to be run on a completely flexible basis, responding rapidly to stabilize the grid. Here are some of the causes for this paradigm:

Download Our FREE Presentation
Discover how **Fast Start** can help you meet demand.

Name*

Email*

Get Your FREE Presentation Now!

TTS **Global EPC Partnership**

Commissioning Services | Balance of Plant Controls | Control Matrix

27MM KW and Counting

In our major history, TTS has managed or served in a leadership role in the commissioning of more than 27MM KW of power generation and gas compression equipment.

In addition to your power plant's stationary or mobile to a base, we offer a broad range of front-end and on-site services for new facility start-ups or unit re-qualification. Our employees provide the technical leadership and personnel needed to commission:

- Generator Controls
- Gas Turbine Control Systems
- Gas Compression Station Commissioning including Station Control Programming
- BOP and Compressor Start-up and Commissioning
- Auxiliary Systems

Our start-up commissioning services lower the risk of equipment failure while increasing the efficiency of your gas turbine operations.

Not Just Turbines

Reprocuring Technology Services (RTS) is part of the TTS Energy Services portfolio of companies. We are an all-inclusive repair resource - no matter the brand. The common bond in our family of companies is a deep understanding and extensive experience in servicing a wide range of rotating equipment. In summation, we have the experience and technologies to optimize your facility and bring your equipment online.

TMOS USERS GROUP Home | About Us | Events | Services | How We Help | Login/Sign up

TMOS is the human machine interface solution designed specifically for the Power Generation Industry.

For the Owners/Operators of General Electric generators using Mark IV, V and VI operating systems, this website provides user-driven communication, engagement and discussion regarding the HMI technology called Turbine Monitoring System (SCADA) TMOS.

Sponsors for this site are TTS and TTS' and only participate with technical support.

KEY DESIGN ASPECTS

LANDING PAGES

TTSLodestar.com
VintageTurbineReliability.com
TTSFastStart.com
EPCGlobalPartner.com
TMOSUsers.group

Web pages dedicated to specialty products and services.



VIDEOS

<https://www.youtube.com/channel/UC7DIpO80L9o1bI9XN2ZvZwQ>

BRANDING



Trademarked Sub-Brands for Specialty Products
Infographics
Messaging/Tagline



Strategic Rationale:
TTS Energy Services
Stands By You™

- TTS/ES is a service company; the brand should feel like it.
- Focused on the new demographics. 57%+ Millennials.
- Open to trademark.

PRINT



We know gas turbines

“The single biggest threat out there, is cyber.”

Cybersecurity has become an increasingly important issue for turbine operators, with concerns about the vulnerability of industrial control systems to malicious hackers. This has led to requirements from both the North American Electric Reliability Corporation (NERC) and Federal Energy Regulatory Commission (FERC) to assess existing plant systems and improve their protection from attacks.

Over the last 2 decades cybersecurity has grown to be one of the nation's most important issues. Dealing with cyber crime has proven to be a difficult challenge necessitating the need for new laws and new ways of enforcement.

Cybersecurity, as it pertains to industrial control systems (ICS) has been a particularly unique challenge: Many owners and operators have, in the past, focused very little on security and staying current with their cyber assets. This means that a large portion of the control systems and HMI's in use today are non-compliant with standards set forth by NERC-CIP.



Compliance Standards

Cybersecurity has been a concern for several years, but from a compliance and regulation point of view, it is still very new. And, hackers are becoming well funded and very creative. As a result, the governing entities and the rules are sometimes vague and unclear. Consultants are often engaged to make the standards more clear and create strategic plans for upgrades and compliance.

Governing Entities

- NERC** North American Electric Reliability Council
- Originally Formed in 1968 and reformed in 2006 under the same name as a non-profit corporation.
 - Mission: “ensure the reliability of the North American bulk power system”.
- FERC** Federal Energy Regulatory Commission
- Independent agency that regulates the interstate transmission of electricity, natural gas, and oil.

NERC Compliance and Options to Consider

Whether driven by obsolescence or other factors, upgrading is an opportunity to achieve NERC compliance. Considerations:

- Retain existing controls:
 - o Spare parts become harder to find and costs increase with demand.
 - o Connected interfaces such as Human Machine Interfaces need to maintain compliance. (GAP options)
 - o Potential significant security weaknesses.
- HMI strategic upgrades:
 - o Server/client configured HMI systems compatible with MK IV, MKV, and MKVI controllers.
 - o Plug and play replacement systems are available such as Turbine Monitoring Systems (TMO5). Designed to replace existing OEM and aftermarket turbine and BOP control system interfaces on most turbine applications.
 - o Provides a direct replacement for OEM supplied HMI and offers all OEM functionality and in some instances more.
 - o Easily configured to meet NERC requirements as well as satisfy customer's unique cybersecurity needs.
 - o Hardware Replacement
- Complete controls upgrade:
 - o While expensive initially, the benefits of a complete system upgrade will pay off over time.
 - o As a whole, the benefits are regulatory compliance, reliability and availability.
 - o Extensive non-OEM options are available.
 - o OEM options typically mean high price tag and limited customization.

Cyber Emergency Response Team

The Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) works to reduce risks within and across all critical infrastructure sectors by partnering with law enforcement agencies and the intelligence community and coordinating efforts among Federal, state, local, and tribal governments and control systems owners, operators, and vendors.

Why should I care about Malware?

Malware attackers receive direction and support from a national government. Whether their mission is to steal data, disrupt operations, or destroy infrastructure, these threat actors tenaciously pursue their goal using a wide range of tools and tactics.

Malware breaches in the energy and utilities industry...

27%

CYBERSECURITY



Brownfield Commissioning Case Study

Dynamics on the pipeline infrastructure necessitated... Flexibility.

SITUATION

Like virtually everyone in the distribution and transmission sector, the South American leader in the gathering, transportation, processing and storage of natural gas, was very busy in 2017 with significant system modifications and project development to effectively manage the rapidly changing production base. (Production and control, as well as the associated energy metering systems at distant centers (Industrial hub and LNG export). The dynamics on the pipeline infrastructure necessitated that existing network become more accommodating with gas flow and/or customer needs throughout various times of the year.

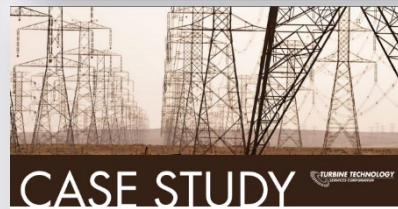
As a result, many pipeline companies in the long-haul natural gas business, undertook several projects focusing on increasing its backhaul capability. The pipeline company will be able to move 2 to 3% of the Gulf Coast and Midwest markets via bidirectional flows in 2017, while retaining 3d capacity to deliver to Northeast markets when needed.

Achieving these bidirectional flows requires that the existing compressor stations along the pipeline be modified with valves and piping that will enable the option of compressing gas north or south of the existing compressor units. Once pipeline becomes fully bidirectional, metered outages flows will command the guidance of flow at these flexible locations.

The natural gas compressor station featured in this case study is South Central Facility and one of the many compressor stations that underwent the flow direction upgrade. After the valves, piping and piping has been modified, an engineering firm needs to be engaged to commission the drive units and coordinate bringing the facility back online.

Turbine Technology Services (TTS) has a great deal of experience and expertise in this area and received the contract to manage and execute the commissioning. The following case study details TTS' responsibilities and scope of work.

TTS/tdt.com



CASE STUDY

Condition Monitoring Network to the Extreme...

Integrate 13 sites, 51 turbines, 3 OEMs, 9 turbine models generating 3,311.8 Mw with 11 different types of controls into one seamless condition monitoring system.

SITUATION

Today, the Ministry of Electricity (MoE) is in a long process for both the purchasing and the electricity supply throughout the country in 2006, the responsibilities also included the generation, operation, maintenance, transmission, and distribution of electricity throughout the country.

The power generation fleet included several fossil, combustion turbine and hydropower plants of various types and sizes. The MoE was tasked to improve power plant availability. To this end, the MoE delivered a request to the Central Monitoring Center for several of the combustion turbine units. In addition to the central monitoring system, the MoE also required four combustion turbine training simulators to be installed at its new Central Training Facility in the Ministry's office of Baghdad.

The Iraq Group of Engineers and the MoE contracted the Saudi Group (SGE) and its training partners to accomplish the above. SGE supported by resources by training with engineering and professional service firms who specialized in remote monitoring, information technology system integration, the support services, and physical security services.

Turbine Technology Services was selected as the Turbine Monitoring System Integrator responsible for the engineering, design, and integration of the Remote Monitoring and Training Simulator Solution. TTS provided 70% of the System. It also provided the scope of work and the functional requirements for the central monitoring system.

TurbineTech.com



TECHNICAL BULLETIN

ADJUSTABLE PEAK FIRING
Increase Gas Turbine Output and Revenue with Adjustable Peak Firing

PURPOSE

TTS TR-012 provides customers with information regarding how they can increase the output of their gas turbines. Please note, adjustable peak technology is not new; however, the need for this capability has become more important due to the emergence of modernizing vintage equipment to be more reliable and the hot weather we are experiencing.

SITUATION

Reports say that June was the hottest month ever in Texas, however, August may have blown that record away. An example, ERCOT reported that on Tuesday, August 22, over 73,000 MWe were generated largely in support of every air conditioner in the state running full out. For a short period that day, Reuters reported real-time prices briefly soared to \$9,000 per megawatt-hour.

PRODUCE MORE MW AS NEEDED BY MARKET AND WEATHER CONDITIONS

Depending on their power purchase agreement, gas turbine operators may receive payment based on their maximum generation capacity, or they may need to hold a certain amount of generation in reserve as a percentage of their maximum capacity. For these reasons, adding peak firing capability to both single and combined cycle units can bring economic benefits without a substantial impact on maintenance costs when the peak fire capability is used strategically at times of high demand.

ADJUSTABLE PEAK FIRING KEEPS NOX EMISSIONS IN CHECK

Adjustable peak firing is a valuable tool in cases where emission values exceed allowable limits before the unit reaches its standard peak firing limit. It allows the operator to increase the load to take advantage of periods of high electricity prices while staying within the maximum allowable NOx emissions dictated by their emissions permit. This mode is especially useful for merchant plants with simple cycle units or with combined cycle units with SFC.

With TTS' adjustable peak option, operators slowly and incrementally increase output in steps of 0.1-0.2 MW, monitoring NOx emissions as load increases.

Line Cards
Case Studies
Brochures
Training Manuals
Technical Bulletins

TRADE SHOW

TTSEnergyServices.com
TTSMidstream.com
TTSPowerGen.com

TTS
ENERGY SERVICES

Stands by you™

Leading high-value engineering expertise to improve unit reliability and performance. Our focus on economic operational results ensures your success.

PowerGen
Midstream

Daniel Harris

TTS
ENERGY SERVICES

8'X10'

PRESENTATIONS

TURBINE TECHNOLOGY SERVICES
MARKETING PLAN

2020 LOADING...



**Internal
Corporate
M&A
Product/Service**

Strategy

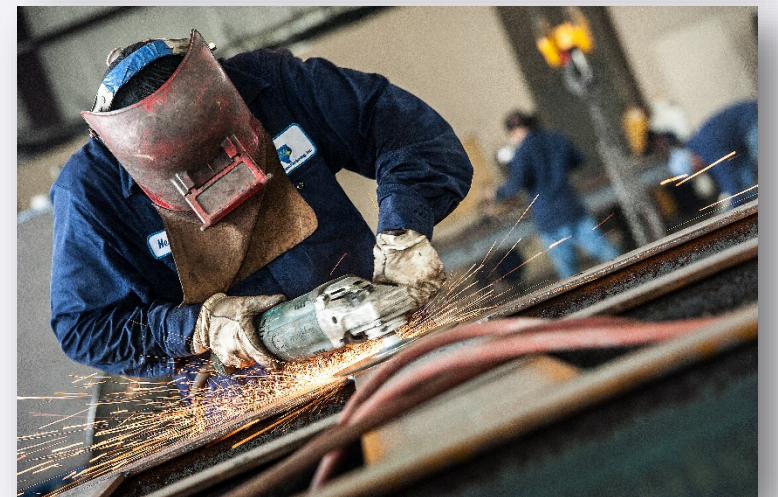
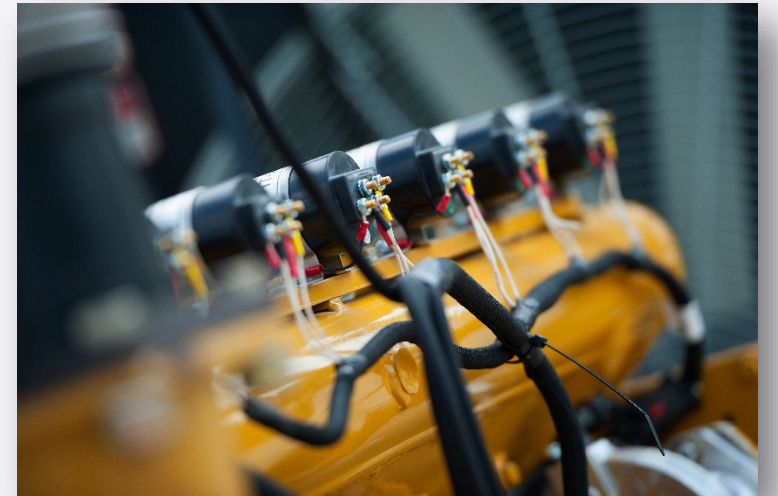
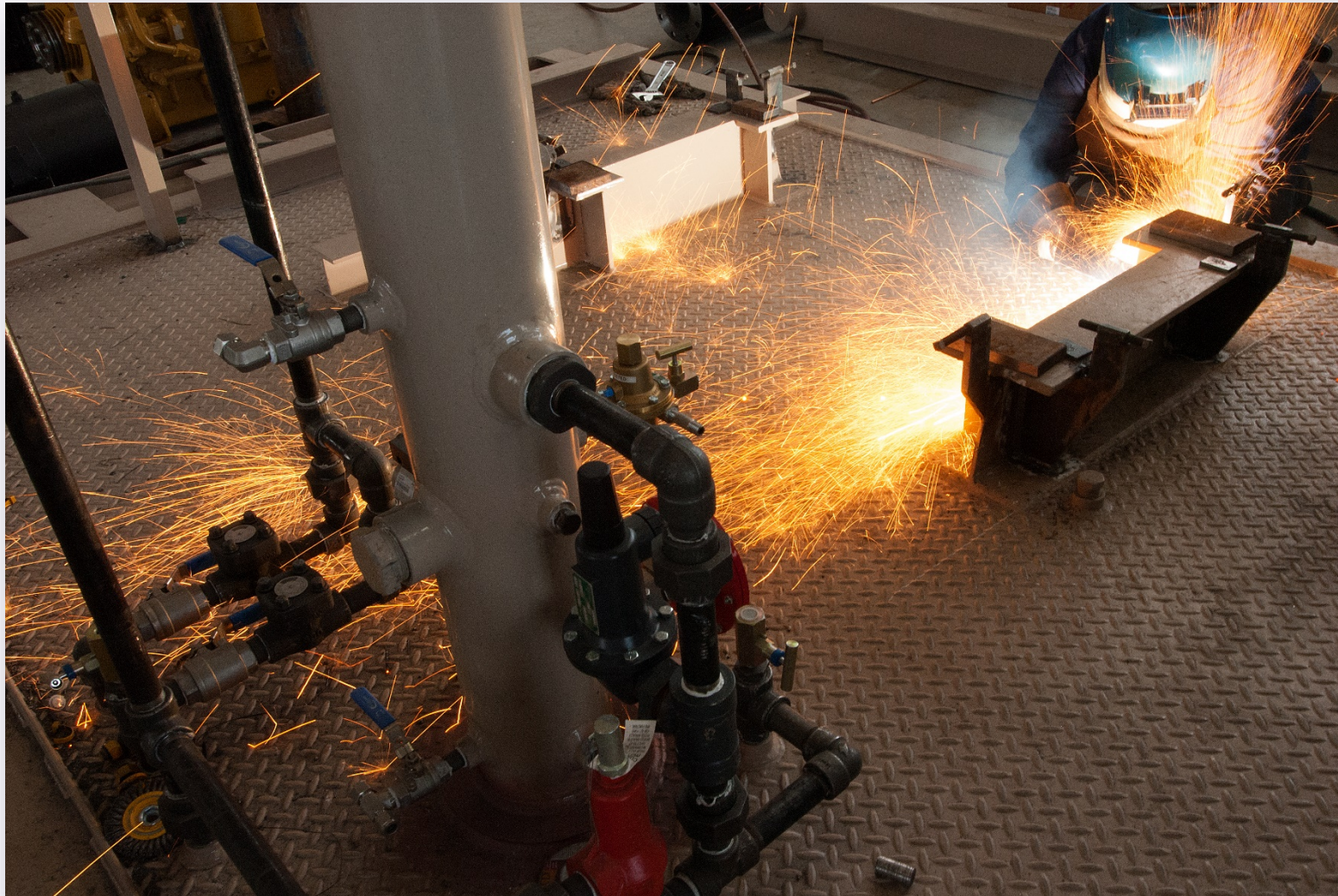
Its our move.

DLN-1 and DER Applications/Services

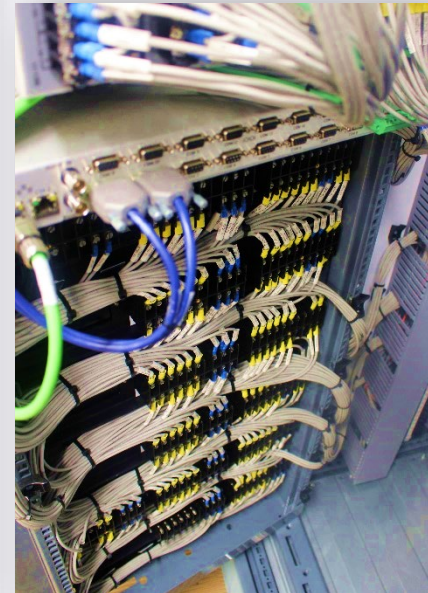


We know gas turbines.

PHOTOGRAPHY



PHOTOGRAPHY



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