

Analytical Expertise

GTI Energy has the knowledge and experience to do the job right



Since 1941, GTI Energy has contributed to the strengthening of energy systems and the communities they serve. As a leading research and training organization, we are focused on developing, scaling, and deploying energy transition solutions that improve lives, economies, and the environment. GTI Energy leverages the expertise of our trusted team of scientists, engineers, and partners to deliver impactful innovations needed for low-carbon, low-cost energy systems worldwide. We embrace systems thinking, open learning, and collaboration to bring solutions from concept to market, with more than 1,000 patents secured in our 80-year history.

In that time, GTI Energy Testing Laboratories have given the energy industry a depth of customized support unavailable in commercial laboratories. Our multi-disciplinary staff of experienced scientists, engineers, and technicians can provide you with the same full spectrum of comprehensive testing services using many of the latest developments in analytical instrumentation. From compositional determinations to root cause failure analysis, we have the know-how and experience to do your job right. Our comprehensive approach to analytical needs delivers accurate and insightful analysis, supplying you with the information to make the right and best decisions.



Accredited Lab

Since 2004, GTI Energy Testing Laboratories has been ISO 17025 accredited by A2LA, an accreditation organization that provides formal recognition of the competence of a laboratory to manage and perform specific tests listed in their scope of accreditation. The ISO 17025 accreditation process is based on regular audits of the facility, the Quality Management System, and the accredited test methods. The current scope can be found on certifications 2139-01 (materials) and 2139-04 (chemical). With this world-renowned



accreditation, you can be sure you are dealing with an experienced, reputable testing laboratory.



Fuels Analysis

GTI Energy's range of fuel analytical services covers the spectrum of chemical, molecular, and atomic analysis techniques. We provide complete analytical services for natural gas, renewable natural gas (RNG), biomethane, biogas, coal, solid fuels, liquid fuels, and other materials for the natural gas and power generation industries as well as for numerous





municipalities and utilities. We continually review and add more testing capabilities to accommodate the needs of the energy market. Our experts have contributed to and written many ASTM standard methods that are used today. They are knowledgeable in developing validated test methods for unique and client specific applications.

Gaseous Fuels Analysis

GTI Energy's Environmental and Chemical Research Services (ECRS) laboratory offers analyses from major components with gas property calculations (including heat content and Wobbe Number) down to trace level constituent detection, plus a suite of natural gas odorant compounds. Power generating companies requiring stationary source emission reporting use GTI Energy's ECRS Laboratory to accurately monitor carbon, nitrogen, and sulfur levels in their feed gas.

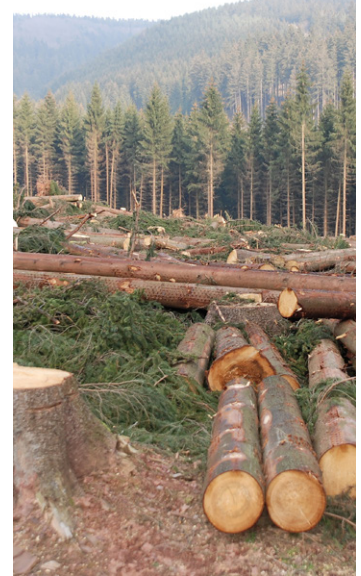
Our capabilities incorporate modern instrumental techniques and traditional referee methods, providing you with highly accurate determinations. The chromatography lab contains an extensive collection of gas chromatographs coupled to a variety of specific detectors. Advanced analytical capabilities include gas chromatography coupled with atomic emission (GC-AED) and mass spectral (GC-MS) detectors. These specialized techniques and advanced equipment permit characterization of elemental specific compounds such as chlorinated hydrocarbons and organosilicon (siloxanes) compounds, and analysis of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) in biomethane and biogas.

Renewable Natural Gas

Renewable natural gas (RNG or biomethane) is pipeline quality gas derived from raw biogas that is fully interchangeable with natural gas. Once biogas has been processed to remove carbon dioxide, sulfur, and other trace constituents, the resulting RNG is typically >90% methane. Biogas is recognized as a

valuable resource which, when appropriately upgraded to acceptable pipeline quality levels, becomes an interchangeable carbon-neutral product.

GTI Energy has over 20 years of experience testing raw biogas and upgraded RNG from a diverse set of feedstocks. Our [guidance documents](#) are available to help you understand the wide variety of constituents and typical levels found in raw and upgraded gas. We are available to help you start the process through RNG Guidance workshops. Our gas analysis goes beyond the routine determination of major and minor constituents as found in typical natural gas tariffs and can include all reasonably expected trace constituents based on the specific feedstock.



Solid Fuels Analysis

The ECRS lab also specializes in solid fuels analysis. We provide highly accurate proximate and ultimate elemental analysis following ASTM methods—both traditional and the latest instrumental techniques. In conjunction with elemental analysis, we also offer physical testing of feedstock, such as measuring bulk and loose density as well as water displacement density. Heating value determination rounds out the comprehensive list of solid fuels analyses. Our high performing technical instrumentation delivers quality accredited data to our customers.

Liquid Fuels Analysis



GTI Energy performs four accredited ISO 17025 tests for liquid hydrocarbon analysis. Elemental analysis (carbon/hydrogen/nitrogen and oxygen), Karl Fischer water, and

total acid number are used to support the work being done at GTI Energy to advance biomass conversion technologies allowing production of bio-diesel fuels from renewable sources, one of GTI Energy's successful areas of research. Simulated distillation testing is available to quickly and accurately determine



the true boiling point distribution of hydrocarbons by gas chromatography from samples as diverse as bio-diesel, natural gas pipeline condensates, and compressor station oil carryover.

Fourier-transform infrared analysis (FTIR) identifies functional groups and compares different oil types.

Microbiologically Influenced Corrosion (MIC) Testing

GTI Energy's Environmental and Microbiology Laboratory offers solutions to many energy industry problems through state-of-the-art microbiological research and testing services by integrating molecular genetics techniques to areas such as pipeline microbial corrosion prevention and treatment, microbial characterization, molecular biology, and anaerobic digestion studies. Our microbiologically influenced corrosion (MIC) testing service uses quantitative polymerase chain reaction (qPCR) testing to directly detect and quantify (without prior growth) corrosion-causing microorganisms typically found in pipes, production wells, and other equipment used in the natural gas, petroleum, chemical, water, produced water and wastewater industries.



qPCR technology has been widely recognized in the industry as superior to traditional microbial growth methods of testing for detection and quantification of various microorganisms. This qPCR testing is the first MIC analytical service accredited by A2LA. GTI Energy was a pioneer in applying molecular technology to MIC detection, and the first one to use qPCR techniques, starting back in 2002.

Materials Analysis

GTI Energy's Materials Analysis and Characterization Laboratory (MACL) has built its success by focusing on the fundamental properties and characteristics of materials. Forensic analysis of polymers, metals, and composites



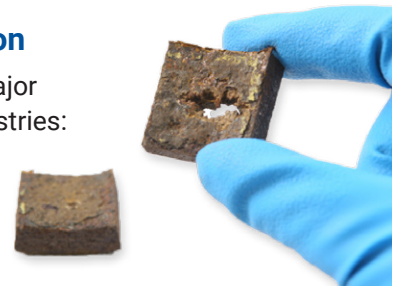
gives our clients the ability to better understand materials and their potential failure mechanisms before they become much larger problems. Standard and customized tests are conducted to determine density,

thermal properties, tensile strength, compression, mechanical properties, and other characteristics. Advanced equipment such as a Scanning Electron Microscope (SEM) coupled with an energy dispersive x-ray fluorescence analyzer (EDX) is used for microstructural examinations and chemical composition determination.



Chemical Corrosion

Corrosion is also a major concern in many industries: natural gas and petroleum products transmission and distribution, water and electrical utilities, building construction, railroads, steel manufacturers, and the automotive industry, to name just a few. Corrosion testing and prevention is essential to the future of the natural gas industry. A variety of chemical and electrochemical techniques can provide you with the necessary information about a substance's resistance to corrosion.



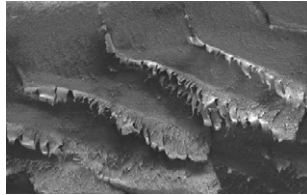
Plastics Testing

GTI Energy Testing Laboratories also has a world-class plastic and metal pipe testing facility. A series of environmentally controlled large-bay (25' high) labs with 5-ton overhead cranes offers the capability to fully evaluate metallic, polymer, and composite piping systems. This includes full-scale burst, hydrostatic, cyclic, and accelerated testing. The same testing can be applied to evaluate all applicable join systems and appurtenances.



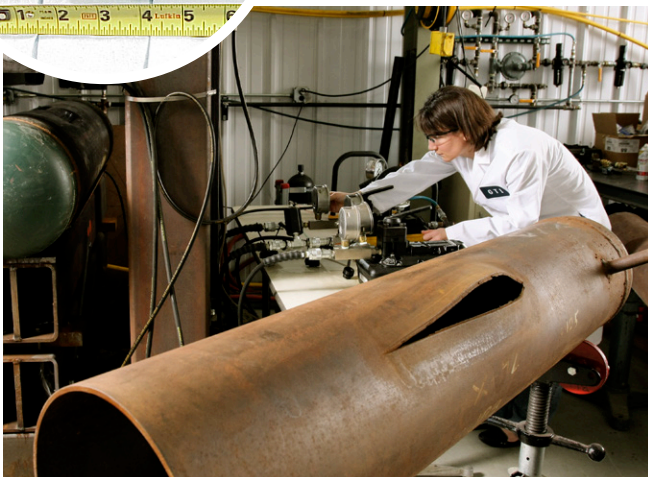
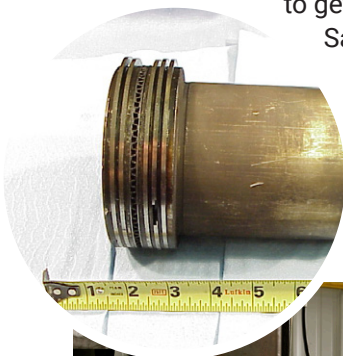
Failure Analysis

Failure analysis is the process of collecting and analyzing data to determine the cause of a failure. No matter what the industry, failures in the field can be costly and dangerous. The risks of explosion, property damage, and human injury mean that when components fail, you need to know why, and you need to know quickly. GTI Energy Testing Laboratories' scientists and engineers can help you determine the how and why of field failures. Our goal is to provide you with a clear understanding of the circumstances leading to the failure and the steps necessary to prevent it from happening again.



Failure investigations typically focus on operating parameters, system, and component design, as well as considering condition and maintenance history. With these processes in mind GTI Energy Testing Laboratories uses a multi-layered analysis process to get to the heart of the problem.

Samples of failed components are subjected to rigorous scrutiny, starting with visual inspection, photography, and then moving on to a variety of analyses, depending on the progressive act of



discovery, until the final failure mode can be determined.

Once we discover the root cause, we relay your results so that you thoroughly understand how

and why the failure occurred. We will also recommend both corrective and preventative actions to reduce future risk of failure and optimize performance.



GTI Energy Testing Laboratories Follows Good Laboratory Practices

It is the consistent policy of GTI Energy Testing Laboratories that good laboratory practices (GLP) and quality assurance/quality control (QA/QC) procedures are implemented to comply with client and contractual obligations. Our management policies, objectives, principles, organization responsibilities and standard operating procedures were developed with the goal of providing quality control from receipt of samples at the laboratory to generation of final reports. Our highly qualified staff uses state-of-the-art and well-maintained equipment and follows recognized standard test methods such as NACE, ASTM, EPA and GPA Midstream whenever possible. Standards traceable to NIST are used for instrument calibration if they are available. A networked laboratory information management system (LIMS) is employed to enable rapid and precise sample status tracking, accurate accounting and data reporting, and vital controls of quality and cost.

If the test you need is not listed, or if you are not sure what kind of test you need, please do not hesitate to contact us for more information. Put our scientific and engineering expertise to work for you.

For More Information

Karen Crippen, Director, Analytical Services
847-768-0604 kcrippen@gti.energy

Tony Kosari, Industrial Testing Manager
847-768-0998 tkosari@gti.energy

gtilabs@gti.energy
www.gti.energy/gtilabs