

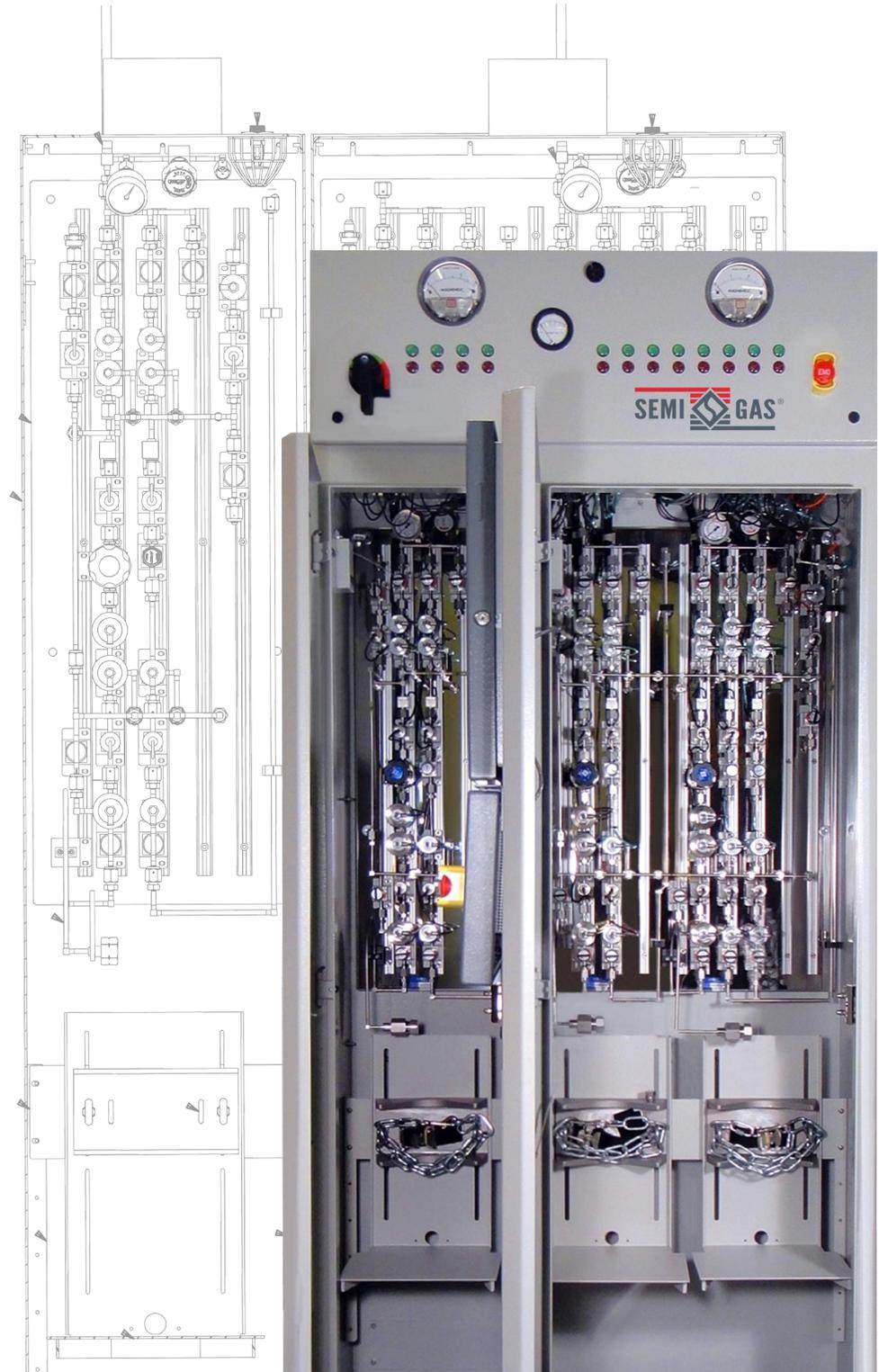
APPLIED SOLUTIONS

THE APPLIED SOLUTIONS PROCESS:

Applying Engineering Innovation to Create Custom Gas Delivery Solutions

How AES adapts our proven equipment to your distinct:

- ⊕ Process Demands
- ✓ Regulatory Requirements
- ⊞ Environmental Realities



Equipment Innovation, Applied to Serve Your Needs

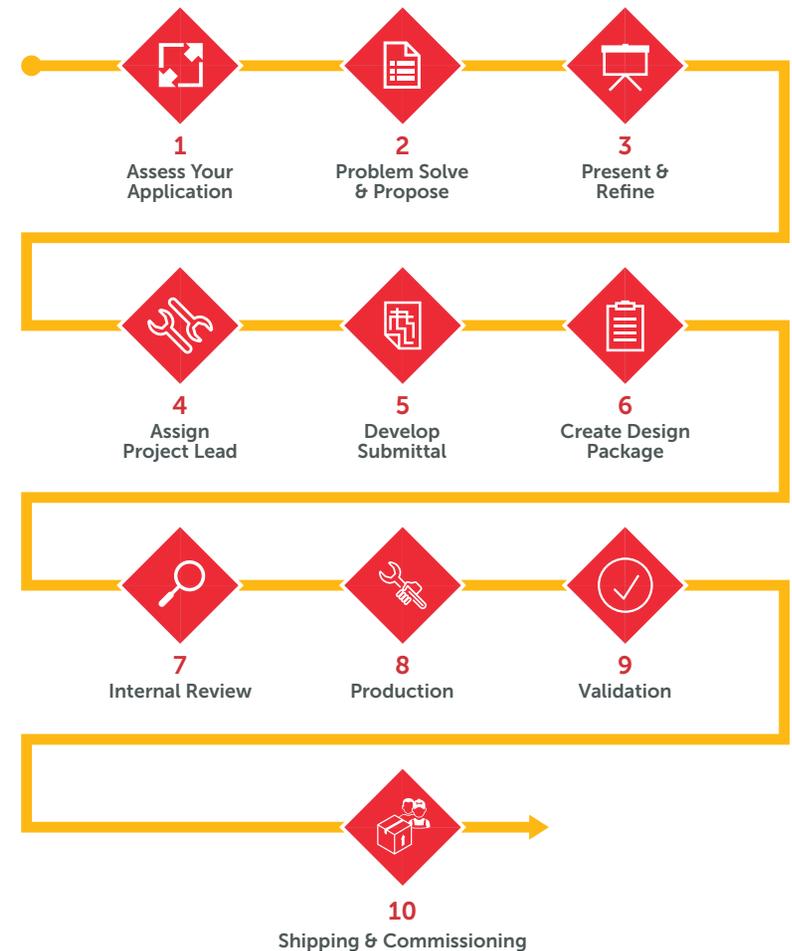
No two industries or companies are exactly alike and as the complexity of gases and specialty processes increases, customers are in need of customized solutions fit for their evolving industry demands. Standard gas delivery systems are not always ideal as certain customers require specialty product capabilities to solve their unique challenges. Whether looking for a specific safety or monitoring feature, equipment that can handle multiple, highly complex gases, or solutions to fulfill industry or regulatory requirements, customization is the missing piece to achieving optimal results.

As a provider of innovative gas delivery solutions for nearly 50 years, Applied Energy Systems (AES) has worked with various companies spanning numerous industries and sizes, each with their own unique gas delivery challenges. We are dedicated to leveraging the insights gained from those experiences to provide best-of-breed solutions, and offer what we call 'Applied Solutions' to customize and deliver equipment that meets each of our customers' unique application needs.

Combining decades of equipment engineering expertise, robust core product offerings, and a proven track record of innovation, AES' Applied Solutions process will facilitate the creation of a system custom-tailored to enable seamless, safe, and precise gas delivery, every time.

In this eBook, we will take you through the Applied Solutions customization process and demonstrate the power of the offerings developed through real-life examples of customer case studies.

APPLIED SOLUTIONS





It Starts with Assessment

To begin, we need to understand your gas delivery challenges and your unique business needs. We first assess your application to gain a full understanding of your process requirements as well as any regulatory demands your gas delivery system must uphold. As part of this process, we offer an Engineering Consultation where we discuss these specific needs in detail with your team. The dialogue is productive and directly influences our approach to your solution. In this phase, we highly value your input and questions.

Based on the information gathered from this assessment and our value engineering practices, our team makes a recommendation for a system design. The solution encompasses all of your performance needs as well as any applicable regulatory or statutory requirements. We then present the solution to you in a collaborative session to gain critical feedback. Lastly, we fine-tune the approach and design until the solution is completely optimized.

Applied Solution in Action: SEMI-GAS® Xtursion™ Adaptable Source System

CHALLENGE

A Tier 1 semiconductor company was seeking a simplified way to deliver various gases at different delivery flow rates. They needed a premier and flexible solution suited for a fast-paced R&D environment. In an effort to achieve these goals, the company had previously implemented many different gas systems, dramatically increasing costs and limiting flexibility.



SOLUTION

Building from our premium, standard SEMI-GAS® one cylinder source system, AES custom-engineered the Xtursion™ Adaptable Source System with four separate, self-contained one cylinder enclosures to enable flexible delivery of a wide range of gases within one single solution.

INDUSTRY SERVED:

Semiconductor

APPLICATION FOCUS:

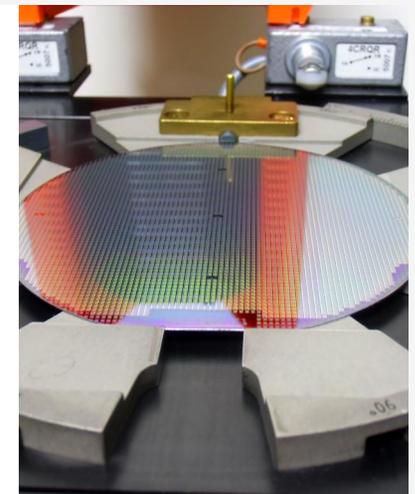
Process Tool Experimentation

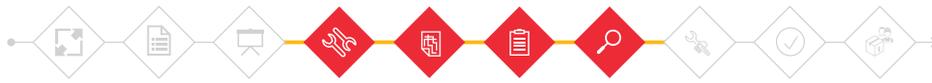
KEY REQUIREMENT(S):

Adaptability to Support
Diverse R&D Demands; Safety

GASES DELIVERED:

Hazardous, Nonhazardous,
Compressed, Liquefied





Setting a Strong Foundation with Design & Configuration

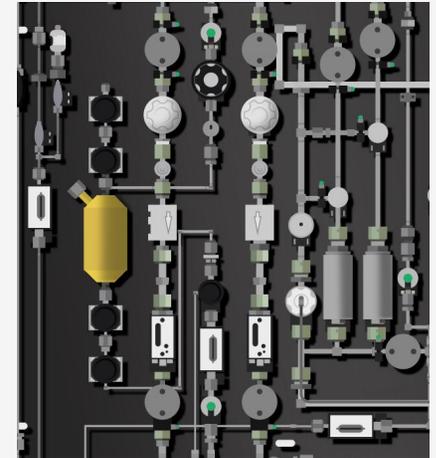
Once the proposal is agreed upon, an experienced Project Engineer is assigned to your project as your main point of contact throughout the process, and ensures that development runs smoothly from start to finish. Our engineering team then begins to generate submittal drawings based upon specifications established during the Engineering Consultation. Once the submittal package is finished, we perform a hazardous gas safety review of the solution. Upon passing, we present it to you and focus on collaborating to refine the design.

After your review and approval, the engineering team starts to develop bills of materials, detailed drawings, and supporting documentation, culminating in the creation of an Engineering Design Package. The package is internally reviewed and verified by our mechanical engineering and controls managers and is peer reviewed by another engineer to ensure the highest possible accuracy.

Applied Solution in Action: Activity Tester Cabinet

CHALLENGE

A global leader in sulfuric acid plant technology was looking for a partner that fully understood the complex nature of the industry's analytical testing environment. The client needed a solution with the capability to maintain specific gas delivery conditions and provide accurate and consistent analytical results.



SOLUTION

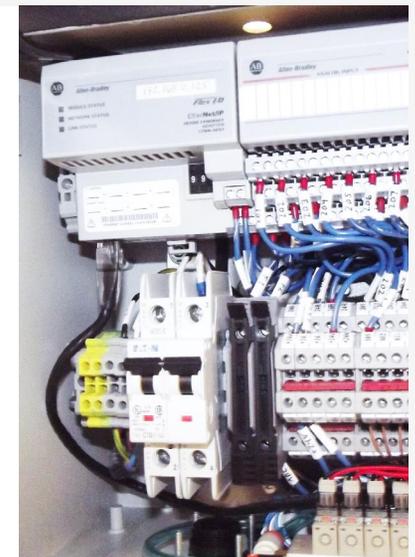
Leveraging many of the components used in our standard SEMI-GAS® line of premier ultra high purity gas delivery cabinets, AES custom-engineered an Activity Tester Cabinet for sulfuric acid to include a one cylinder SO₂ source gas cabinet and a gas mixing cabinet.

INDUSTRY SERVED:
Industrial Manufacturing

APPLICATION FOCUS:
Chemical Testing and Analysis

KEY REQUIREMENT(S):
Specificity to Sulfuric Acid Testing; Safety

GASES DELIVERED:
Hazardous





Putting Our Engineering Expertise into Action through Production

To ensure a streamlined production process, the approved Engineering Design package is handed off to our Production Control team who uses that information within our material requirements planning (MRP) system to develop a manufacturing release package including make jobs, bill of materials, and project travelers. Using this package, we then integrate the project into our capacity plan to ensure the proper resources are allocated to keep production on schedule.

During the actual production stage, our engineering concepts come to life. Leveraging nearly 30 years of manufacturing expertise, we apply lean manufacturing principles and built-in quality practices to ensure a seamless and efficient production process. Our highly skilled, ASTM-certified technicians and ASME-certified welders are adept and trained to assemble, weld, test, and validate your custom gas delivery system as designed and specified.

The entire process, from system design to fabrication and validation, is conducted in-house for a turn-key equipment solution in AES' state-of-the-art facilities, which have been built to adhere to the stringent cleanliness, precision, and testing standards

of the semiconductor industry. AES' 32,000+ square foot campus includes a 17,000 sq. ft. Equipment Technology Center, Controlled Assembly Area, Quality Assurance Department and a high-tech, 16,000 sq. ft. Semiconductor Equipment and Manufacturing Technology (SEMAT) Center. These centers include certified Class 100 and Class 10,000 cleanrooms where we provide precision welding services for ultra high purity applications.

AES' extensive production teams encompass engineering, manufacturing, software development, controls, and Quality Assurance to deliver a fully integrated, complete equipment solution.





Ensuring Equipment Integrity through Validation

Following the production process, we adhere to comprehensive and strict validation and factory acceptance testing protocols to confirm that your gas delivery system is designed to uphold your requirements. Validation is critically important in the Applied Solutions process and functions as a fluid extension of our production process. We aim to ensure that the equipment is safe and effective to deliver a best-in-class customized solution, guaranteed.

In addition to performing functional testing and completing full operational checklists, all of our systems are helium leak tested to 1×10^{-9} atm-cm³/sec and pressure tested at 110% maximum operating pressure for 4 hours. For ultra high purity systems, we also complete 10% sample validation testing for moisture (less than 100 ppb), oxygen (less than 100 ppb), hydrocarbons (less than 100 ppb), and particles (0.1-0.3 μ m less than 5 particles/ft³).

All testing is done to user-specified requirements and can be customized to your specific analysis needs. We understand that your gas delivery system is required to meet rigorous, industry-specific standards and our quality assurance testing methods are tailored to those specifications. Our ASTM-certified team of QA specialists combines sophisticated, high-tech analytical instrumentation with technical know-how to validate system integrity and performance with dependable, accurate results.

Applied Solution in Action: Toxic Gas Detection System

CHALLENGE

Using a complex gas handling system to support its beamline experimentation, a research laboratory required a comprehensive safety system for monitoring their toxic and hazardous process gases. The solution had to be easily and intuitively operated as well integrate seamlessly with their Facility Monitoring System.



SOLUTION

AES developed a standalone Toxic Gas Detection System that monitors 13 different gas detectors and provides visual and audible warning in the event of a toxic gas release. The system was fully integrated into the customer's Facility Monitoring System, featured a 12" color touchscreen, and an eWON VPN router to enable remote monitoring and data/alarm logging.

INDUSTRY SERVED:

Research Laboratory

APPLICATION FOCUS:

Additional Safety Measure for Monitoring Hazardous/Toxic Gases

KEY REQUIREMENT(S): Local and Remote Safety Monitoring; Visual and Audible Alarms

GASES DELIVERED:

Toxic and Hazardous





Bringing Your Solution to Life with Shipping & Commissioning

Once fully validated, your custom gas delivery system is carefully packaged and shipped to your location. But our job does not end there; we also help ensure that your solution gets up and running optimally in your environment.

From installation support to manual reviews, system confirmations, site acceptance testing, and operator training, we deploy our specialized Applied Services team to efficiently commission and validate your gas delivery system at your facility. With this final step, your team will be using the solution and realizing its benefits in no time.



Complex Processes Call for Custom Measures.

Delivering, distributing, and monitoring hazardous and toxic gases requires specific design and safety features. We recognize that many customers have unique business and gas delivery challenges and believe their solutions should be as customized and unique as those requirements.

PROVEN AND PREMIUM PRODUCTS, CUSTOMIZED.

Through Applied Solutions, AES provides clients with the customization they need and deserve to ensure safe and pure gas delivery. Leveraging almost 50 years of ingenuity and expertise, AES has a solution for even the most complex gas delivery challenges, in every industry. Built on our high-quality line of SEMI-GAS® and VERSA-GASTM products, the Applied Solutions process gives our customers the flexibility to enhance proven systems with features and functionality tailored to their specific application.

We are your partner, from needs assessment through hands-on equipment training, and we pride ourselves on delivering best-in-class gas delivery solutions that are tailored to your unique needs.

Don't accept a one size fits all solution for your complex gas delivery needs. Customize your system today with expert help from the AES team.

Visit www.aes.com/applied-solutions to learn more, or contact us directly at **610.647.8744** to discuss your needs.



180 Quaker Lane
Malvern, PA 19355

PHONE: 610.647.8744

FAX: 610.640.4548

Brought to You By Applied Energy Systems

Singularly focused on excellence in gas delivery, customers turn to Applied Energy Systems (AES) for high-value systems engineering – including design, manufacturing, testing and field services. Our excellence permeates our products, services, solutions and every industry we touch, to power process innovation for thousands of organizations worldwide.

To learn more, visit www.appliedenergysystems.com today.