

THE INNOVATION CENTER



CUSTOMIZED TESTING SOLUTIONS

Testing offers a host of invaluable information, allowing you to gain critical data on your material, work out process variables, and develop a recipe for process scale-up. The Innovation Center is a unique facility that offers comprehensive testing options for both agglomeration and thermal processes. Our process experts can work with you to develop a customized testing program around the answers you're looking for. Depending on your needs, we offer testing services in four categories:

1. Feasibility/Proof of Concept - An initial, non-witnessed batch testing phase in which the possibility of creating a product is explored.

2. Proof of Product - A more in-depth batch testing phase in which more time is spent determining whether a product can be made to desired specifications.

3. Proof of Process - A continuous testing phase that aims to establish the equipment setup and parameters required for continuous production of your specific material.

4. Process/Product Optimization - An in-depth study to optimize your specific material's characteristics and/or production parameters in an industrial setting.

TESTING EQUIPMENT

Whether you need to test a single piece of equipment, or you're looking to try various configurations of multiple pieces, the FEECO Innovation Center is well equipped to suit small batch tests, as well as continuous process loops. The following equipment is available for testing in the Innovation Center:

AGGLOMERATION

- Disc Pelletizer 24"
- Disc Pelletizer 36"
- Disc Pelletizer 4' 6"
- Rotary Granulator 36" x 9'
- Paddle Mixer/Pug Mill 14" x 6'
- Batch Pin Mixer 8"
- Batch Pin Mixer 15"
- Continuous Feed Pin Mixer 10"
- SC Roll Compactor / Briquetter
- Hammer Mill
- Rod Mill
- Prater Mill
- Rotex Screen – 2 deck
- Circular Screen 18" & 36"
- Pipe Reactor
- Littleford Day Mixer
- Coating Drum 2' x 6'

THERMAL

- Rotary Batch Kiln 18" x 24"
- Continuous Rotary Kiln 30" x 20'
- Indirect Batch Kiln 10.5" x 24"
- Indirect Continuous Kiln 6.5" x 84"
- Rotary Dryer 3' x 20'
- Rotary Dryer 20" x 8'
- Fluid Bed Dryer, Cooler
- Flight Simulator

SUPPORT

- Muffle Furnace
- Batch Walk-In Oven
- Fluid Bed Sample Dryer
- Steam Generator with Steam Tanks
- Tray Oven

MATERIAL HANDLING

- Steep Incline Conveyor
- Bucket Elevator
- Belt Conveyor
- Various Feeders

ON-SITE SUPPORT

In addition to the equipment listed here, we are capable of making on-site, large-scale modifications to our facility in order to accommodate your testing needs, without the hassle of bringing in external contractors.

ADVANCED PARTICLE ANALYSIS

FEECO utilizes a 3D Dynamic Image Analysis tool to provide advanced particle analysis during testing. A number of characteristics, including size, shape, thickness, surface roughness, density, transparency, and more, can all be measured without disrupting the testing process. Results are recorded with precision accuracy in real-time, with data comparison and trending available through the integrated software program. Advanced particle analysis systems are also available as part of a system purchase.



AGGLOMERATION TESTING

Agglomeration testing in the Innovation Center will tell you if your material is capable of agglomeration, as well as what equipment will be required to achieve the results you're looking for. We can convert dusts, bulk powders, and sludges into free-flowing pellets for dust-free handling, or to improve product characteristics. We can also test a complete, continuous process with agglomeration, drying, particle sizing, and product recycle capabilities to create a highly efficient process. We can record operating data to assist in process scale-up and design a full-scale production plant.

WE CAN TEST THE FOLLOWING METHODS OF AGGLOMERATION:

Non-Pressure

- Pelletizing (Disc)
- Pelletizing (Drum)
- Conditioning
- Mixing
- Coating
- Micro-Pelletizing

Pressure

- Briquetting
- Compaction Granulation

MATERIAL CHARACTERISTICS

There are a variety of particle characteristics that can be measured and adjusted during processing to produce a product with ideal characteristics. The following properties can be measured and fine-tuned:

- Attrition
- Bulk Density
- Compression
- Crush Strength
- Flowability
- Green/Wet Strength
- Moisture Content
- Physical Characteristics
- Particle Size Analysis
- Solubility
- Temperature

Questions That Can Be Answered Through Agglomeration Testing:

- Will my material agglomerate?
- Can agglomeration solve my material problem?
- Which method of agglomeration will best suit my material?
- What equipment configuration will be required to produce the results I'm looking for?
- What binder, if any, will work best for my material?
- Can my product be improved?
- How can I optimize my existing process?



Fly ash pellets created in the FEECO Innovation Center

THERMAL TESTING

The Innovation Center offers testing for both high temperature applications, as well as drying processes; whether you're looking to enhance product characteristics, test the feasibility of a new process, or improve upon an existing process, the Innovation Center is well-equipped to serve your thermal testing needs.

Thermal testing in the Innovation Center allows you to test small samples of material, while simulating process conditions of a continuous, commercial size rotary unit (kiln or dryer). Testing can be conducted at both batch and pilot scale, and can also be carried out as part of a larger agglomeration or granulation process.

FEECO gathers a multitude of data during testing, including both process data points and material characteristics to ensure the process is meeting expectations.

FLIGHT/LIFTER DESIGN & PATTERN

When it comes to drying bulk solids, flight (lifter) design and pattern are commonly customized in order to maximize drying efficiency. For this reason, it is common to test a variety of flight designs and patterns when designing a rotary dryer. The Innovation Center offers a flight simulator that can be utilized to test various configurations, confirming the most ideal design and pattern combination for the material to be processed.

PROCESS TESTS AVAILABLE

- Drying
- Calcination
- Catalyst Activation
- Desorption
- Heat Setting
- Metal Recovery
- Organic Combustion
- Reduction
- Sintering
- Thermal Desorption
- Upgrading of Ores

OPTIONAL TESTING CONDITIONS & EQUIPMENT

- Baghouse
- Combustion Chamber
- Direct- or Indirect-Fired
- Parallel (Co-Current) or Counter Current Flow
- Reducing Atmosphere
- Removable Flights, Dams, and Bed Disturbers
- Thermal Oxidizer
- Water Quench Tower
- Wet Scrubber

DATA GATHERED

- Feed & Product: Physical and Chemical Analyses
- Burner Fuel Usage
- Drum Slope
- Emissions
- Fan Speed
- Feed Rate
- Gas Sampling & Analysis
- Residence Time
- Rotational Speed
- Screen Analysis of Feed & Product
- Temperature Profiles



WASTE TRANSFORMATION

The FEECO Innovation Center also works extensively in helping customers to transform waste materials and process by-products into value-added products through agglomeration and other processing methods. The list below looks at some of the waste transformations FEECO has performed in recent years, as well as what processing methods were used to transform the material.

Beginning Material	Final End Product	Agglomeration	Drying	Blending	Thermal	Compaction Granulation
Sulfur Stack Emissions	Granulated Fertilizers	●	●			●
Calcium Sulfate	Fertilizer Pellets	●	●		●	
Ash (Wood, Fly)	Fertilizer Pellets	●	●			
Bentonite Clay	Cat Litter Granules	●	●			●
Calcium Chloride	Ice Melt Pellets	●	●			
Calcium Carbonate	Fertilizer Pellets	●	●			
Carbon Black Dust	De-dusted Pellets	●	●			
Cement Kiln Dust	Calcium Fertilizer Pellets	●	●			
Cell Phone Batteries	Lithium, Zinc Metal Recovery				●	
Clay	Cat Litter, Oil Dry Granules, Encapsulate Seeds	●	●	●		
Coal Dust	De-dusted Coal Pellets	●	●			●
Composts (Yard Waste)	Fertilizer Pellets	●	●	●		
Copper Dust	Metal Recovery Pellets	●	●	●		
Corn Cobs	Cat Litter, Oil Dry Pellets	●	●	●		
Clay	Proppants				●	
Dredge Sludges	Non-leaching Granules	●	●	●		
Electric Arc Furnace (EAF) Dusts	Metal Recovery	●	●	●		
Ethanol Plant Waste (DDG)	Animal Feed	●	●	●		
Foundry Dust	Metal Recovery	●	●	●		
Gold Ore Dust	Precious Metal Recovery	●	●	●		
Grain Dust	Non-explosive Pellets	●	●	●		
Gypsum Wallboard Waste	Fertilizer, Cat Litter Pellets	●	●	●		
Humate	Fertilizer Pellets	●	●	●		
Iron Oxide	Metal Recovery Pellets	●	●	●		
Lime (Waste Water Treatment Sludge)	Calcium Fertilizer Pellets	●	●	●		
Limestone	Calcium Fertilizer Pellets	●	●	●		
Talc Ore	Sterilized Baby Powder				●	
Manure – Cattle / Chicken / Hog	Fertilizer Pellets	●	●	●		
Soda Bottles	Recycled Plastic				●	
MAP Fertilizers	Fertilizer Pellets	●	●	●		
Municipal Wastes	Fertilizer, Fuel Pellets	●	●	●		
Nitrogen Fertilizers	Fertilizer Pellets	●	●	●		
NPK Blends	Fertilizer Pellets	●	●	●		●
Paper Sludge	Fertilizer, Cat Litter	●	●	●		
Petroleum Coke Dust	Fuel Pellets	●	●	●		●
Phosphates Powder	Fertilizer Pellets	●	●	●		
Potassium Chloride	Fertilizer Pellets	●	●	●		●
Saw Dust	Cat Litter, Fuel Pellets	●	●	●		●
Soy Flour	Animal Feed	●	●	●		
Steel Dusts and Sludges	Metal Recovery Pellets	●	●	●		●
Sugar	Sugar Pellets	●	●	●		
Sulfur Dust	Non-explosive Pellets	●	●	●		
Tar Sands Waste Sludge	Substitute Fuel Pellets	●	●	●		
Titanium Metal Shavings	Metal Recovery	●	●	●		
Iron Ore	Metal Recovery Pellets	●	●			
Glass Batch	Glass Blend	●	●	●		
Ceramic / Aluminum	Refractory	●	●			
Paper Sludge	Bright White Clay				●	
Gypsum	Fertilizer Pellets	●	●			
Zinc Oxide	Metal Recovery Pellets	●	●			●
Nickel Ore	Metal Recovery Pellets	●	●			
Kaolin Clay	Coating Paper	●	●			
Tungsten Oxide	Metal Recovery Pellets	●	●			●
Raw Coal	Purified Coal				●	
Bone Meal	Fertilizer	●	●			
Ammonium Sulfate	Fertilizer					●
Diatomaceous Earth	Filter Agent	●	●			
Titanium Dioxide	Pigment Pellets	●	●			●

Agglomeration: Drum, Disc Pelletizer, Pin Mixer

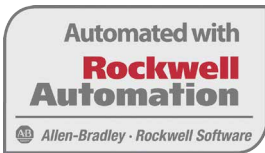
Drying: Rotary Drum Dryer, Fluid Bed Dryer

Blending: Ribbon Mixer, Pug Mill

Thermal Process: Rotary Kiln

Compaction Granulation: Compactor

AUTOMATION AT ITS BEST



FEECO is a Rockwell Automation partner, providing integrated process control solutions, both as a service in the Innovation Center, and as part of a system purchase. FEECO and Rockwell Automation process control solutions are provided with current technology, motor control centers, programmable logic controllers, and data collection systems with advanced technologies for reporting. The FEECO Innovation Center features a Rockwell Automation PLC/MCC system, which utilizes current technologies for optimizing testing operations.

DATA IN REAL-TIME

Our system allows you to monitor, trend, and adjust various data points in real-time, all from a single interface or mobile device. This includes:

- Current (Amps)
- Feed Rate
- Flow Rates/Product Flow
- Fuel Usage
- Horsepower
- System Pressure
- Temperature
- Torque
- Gas Sampling & Analysis (Oxygen, Carbon Monoxide, Nitric Oxide, Nitrogen Dioxide, Sulfur Dioxide, and combustibles discharged from various thermal processes)

UNPARALLELED REPORTING CAPABILITIES

A control system from Rockwell Automation provides state-of-the-art data collection and reporting capabilities. Our system allows you to select only the variables you want to report on, from the exact time frame you're looking for. This is especially beneficial in the Innovation Center, allowing returning customers to pick up exactly where they left off.

FEECO can integrate third party equipment into your control system, giving you complete process tracking and visualization.

Secure remote access to the system provides unparalleled troubleshooting capabilities.



BENEFITS TO TESTING WITH FEECO

Testing in the FEECO Innovation Center provides an invaluable opportunity to test in a controlled environment, allowing you to gain a familiarity with your material, while reducing the chance for unforeseen problems after process scale-up. Some of the many advantages to testing in the FEECO Innovation Center include:

MATERIAL EXPERIENCE FEECO has been a pioneer in material processing since the 1950s, and has extensive knowledge around thousands of materials and material samples. This experience allows us to better understand your project on both a micro and macro level and deliver a custom processing solution that contributes to your company's bottom line.

COMPLETE PROCESS KNOWLEDGE As experts in process design, FEECO is familiar with each aspect of a process, from agglomeration and kiln processing, to drying and cooling, allowing us to look at how the process will function as a whole, instead of each individual portion.

PROCESS SCALE-UP Once the process configuration has been defined, FEECO can aid in process scale-up, as well as manufacturing the custom equipment needed to get the job done.

VIRTUAL LAB FEECO offers a unique Virtual Lab: a secure portal customers can log into and view their material being tested in real time, without having to come to the FEECO facility.

INTERESTED IN TESTING?

It's easy! Simply follow the steps listed below.

- 1 Fill out some **paperwork**
- 2 Send us a **sample**
- 3 We'll run some **tests**
- 4 We'll mail you the **results**



READY TO GET STARTED?



1.800.373.9347



[FEECO.com/get-started](https://www.feeco.com/get-started)

ON-SITE TESTING

FEECO also offers a variety of rental equipment to accommodate your in-house testing needs.

Potash before and after agglomeration in the FEECO Innovation Center

THE FEECO COMMITMENT TO QUALITY

With 65+ years of experience, FEECO International has provided full-scale process solutions for thousands of satisfied customers (including some of the world's largest corporations, engineering firms, and start-ups). Cited in over 250 US patents, the name FEECO has become synonymous with innovation and the reimagining of efficiency. As the leading manufacturer of processing and handling equipment in North America, no company in the world can move or enhance a concept from process development to production like FEECO International, Inc.

The choice to work with FEECO means a well-rounded commitment to quality. From initial feasibility testing, to engineering, manufacturing, and aftermarket services, we bring our passion for quality into everything we do. FEECO International is in the process of working towards ISO 9001:2015 quality management system compliance, with the goal of achieving ISO 9001:2015 Certification within the next calendar year.

