

SOUTHERN RESEARCH

*Environment and Energy
Technology Assessment,
Development and Research*

Durham, North Carolina



**DEVELOPING TOMORROW'S CLEAN ENERGY AND
TRANSPORTATION SOLUTIONS TODAY**

TECHNOLOGY DEVELOPMENT, DEMONSTRATION, AND ASSESSMENT AT SOUTHERN RESEARCH IN NORTH CAROLINA



Advanced Energy Technology Development and Deployment

- High-bay, advanced energy process lab currently developing gasification, syngas cleaning, gas to liquids, acid hydrolysis, materials processing, biomass to energy, and bio-products technologies
- Wet lab; dry materials lab; gas lab; fuel analysis
- Design, erect, operate, and optimize advanced energy pilot plants
- 24/7 operations; full infrastructure support; lab/bench/pilot-scale capabilities; all necessary permits
- Field teams that plan, manage, and execute field deployments and demonstrations of advanced energy, transportation, and other technologies
- Over 50 engineers, technicians, chemists, scientists, and support staff

Transportation Technology Assessment

- Real-world evaluation of vehicle emissions (NO_x, CO, CO₂, THC, PM) using portable emissions monitoring system (PEMS) and portable activity monitoring system (PAMS)
- Evaluation of light-duty, heavy-duty (on-road, off-road, locomotive, and marine), hybrid, fuel cell, and alternative fuel vehicles
- Emission testing protocol and duty cycle development
- EPA fuel economy technology feasibility, evaluation, and demonstration
- Emission-control technology performance and durability strategy planning

Greenhouse Gas Mitigation

- GHG mitigation technology performance verification
- Independent third-party testing and verification
- In-field or laboratory evaluation
- GHG inventories and mitigation strategy planning
- Technology assessment and feasibility analysis

Other Areas

- Catalyst and membrane technology development
- Bioenergy technology development and analysis
- Feasibility studies
- Survey and assessment studies
- Techno-economic analyses
- Industrial air pollution control technology assessment
- Independent due diligence support



FACILITIES AND CAPABILITIES IN DURHAM, NORTH CAROLINA



Durham, NC Site

- Over \$30M invested since 2007
- 28 acres in rural and picturesque Treyburn Corporate Park
- 42,000ft² lab, office, conference, and other space
- Air, water, solid waste, and operating permits in place
- Site access security; 24/7 operations as required

Process Development Facility

- 30,000ft² of multi-story space for pilot facility development
 - Two 80' x 150' high-bay pilot plant labs
- Selected infrastructure components
 - Utilities: process steam, electric power, natural gas, and industrial water
 - Bulk gases: O₂, N₂, CO, H₂, and compressed air (process and instrument)
 - Bulk simulated syngas (CO₂, H₂, trace grasses)
 - High pressure H₂/syngas compressor (2000 psig)
 - Cooling systems: cooling tower, hot/cold well, and chiller
 - Two thermal oxidizers for off-gas destruction
 - Wastewater treatment/management
 - Feed material shredding, drying, and short-term storage
 - Four 5-ton bridge cranes
 - Two control rooms with full SCADA and video monitoring
- Pilot Plant Programs and Equipment
 - Bench-scale (4") fluidized bed gasifier
 - High-temperature municipal solid waste gasification
 - Biomass gasification with syngas cleanup scrubbing
 - Hot/catalytic gas cleanup for bio-syngas
 - Fischer-Tropsch conversion of bio-syngas to diesel and paraffins
 - Catalytic conversion of syngas to mixed alcohols
 - Biomass pretreatment and coal-biomass, co-feed system
 - Acid hydrolysis conversion of biomass/other into sugars

On-Site and In-Field Analytical Laboratories and Capabilities

- Wet lab; dry materials lab; gas lab
- Gas chromatography (lab and in-process continuous)
- Liquid chromatography
- Fourier-Transform Infrared Spectroscopy (lab and in-process continuous)
- Portable emissions monitoring systems (PEMS) for on-road/in-use vehicle, truck, train, and emissions testing
- Portable activity monitoring systems (PAMS) for monitoring vehicle activity, duty cycles, etc.
- Suite of coriolis meters for direct fuel consumption measurement on vehicles, boats, trains, etc.
- Portable data logging, gas analysis, electrical quality, and other field systems
- In-process particle and heavy organics sample collection systems
- In-line multi-gas analysis
- Automated elemental analysis
- Surface area analysis
- Carbon determination
- Thermal gravimetric analysis
- Inductively coupled plasma analysis
- Deionized water system
- Other (e.g., impingers, sonic and thermal baths, potentiometric titrator, balances, and fume hoods)

Relevant Capabilities at Southern Research in Alabama

- Materials chemistry, physics, mass transport, non-destructive evaluation, and thermal properties
- Environmental scanning electron microscope
- Precision metrology



SOUTHERN RESEARCH, NORTH CAROLINA

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SOUTHERN RESEARCH
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