# Energy Technology R&D and Services at RTI International

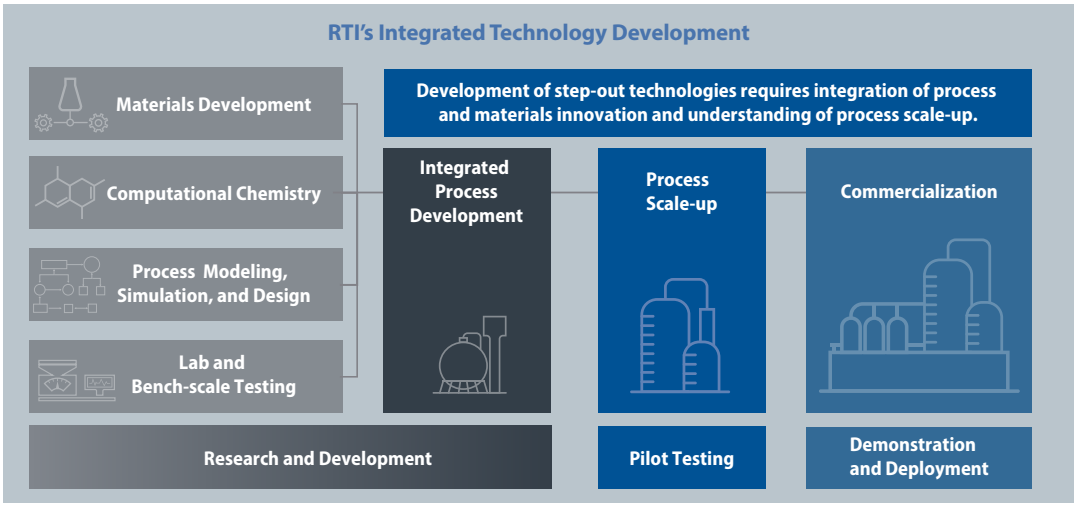
**RTI develops advanced process technologies in partnership with leadersin the energy sector**

- Full alignment with industry objectives
- Concept to demonstration
- Defined commercialization pathways
- Flexible intellectual property arrangements
- Leveraging government R&D funding with industry-focused development

## What We Do

RTI International develops innovative process technologies in the areas of green chemicals production, reneweable energy storage, $CO_2$ capture and utilization, direct air capture, water treatment, and biomass conversion for industrial and government clients. Our research and development supports national and worldwide goals of reliable, sustainable, economically viable, and secure energy supplies.

Our engineering team offers end-to-end capabilities to help our clients design, develop, evaluate, integrate, scale, and demonstrate new energy technologies through rigorous and objective approaches that accelerate new technology development to market opportunities.




Our engineers and scientists address some of the most challenging energy-related problems faced by the chemical, petrochemical, manufacturing, gas processing, and transportation fuel and electric power industries. Whether we are designing pilot-scale technology demonstration systems or conducting laboratory-scale reactor testing on innovative catalysts, RTI engineers and scientists perform applied R&D to deliver high-quality results and add value for our clients.

# Clean Energy Research

## Carbon Capture, Utilization, and Conversion

- Power and industrial applications
- $CO_2$ utilization for chemicals production
- Direct air capture
- Blue hydrogen

## Biomass Conversion

- Catalytic and reactive fast pyrolysis
- Biocrude fractionation and upgrading
- Renewable diesel and sustainable aviation fuel
- Bioproducts such as specialty chemicals, polymers, and natural fibers

## Renewable Energy Storage

- Sector coupling using green hydrogen and ammonia for long-duration energy storage and agriculture
- Bench- and pilot-scale field demonstration platform
- Advanced Haber-Bosch catalyst for renewable ammonia

## Blue and Green Chemicals Production

- Syngas cleaning and conditioning
- Syngas conversion and utilization
- Distributed natural gas and biogas conversion to syngas
- Modular production technologies for sustainable aviation fuels, methanol, and ammonia
- Process electrification

## Advanced Materials

- Catalyst, sorbent, and membrane development
- Advanced characterization and scale-up
- Metal-organic framework synthesis and applications
- Advanced coatings and encapsulation development
- Core competence in fixed and fluidized bed materials

## Wastewater Treatment and the Environment

- Technologies to treat contaminants in water (PFAS, heavy metals)
- Rare earth elements recovery
- Anti-biofouling/corrosion technology
- Anaerobic membrane bioreactor technology
- Greenhouse gas emissions control


# Our Services

## Materials Development

### Catalysts and Sorbents

- Novel formulation and surface chemistries
- Metal organic frameworks synthesis and application-specific engineered forms
- Comprehensive screening and characterization tools
- Advanced coating and encapsulation methods
- Spray dried particles and extruded materials
- Scale-up with commercial catalyst suppliers

### Membranes

- Novel formulations and testing for water treatment applications

### $CO_2$ Solvents

- Solvent screening
- Comprehensive vapor-liquid equilibrium and reaction calorimetry capabilities
- Scale-up to ton quantities with network of manufacturers

## Process Modeling, Simulation, and Design

### Aspen Plus, HYSYS, and ProMax

- Heat and material balances
- Design specifications
- Sensitivity analyses and process optimization

### Preliminary Design Packages

- Mechanical design and 3D modeling
- Equipment and system design

### Techno-Economic Analyses and Life Cycle Analysis

- Industry standard tools
- Consistency with established federal baselines
- Third-party verification with industry partners

## Process Development and Design

Strong competencies in developing, designing, constructing, and operating bench- and pilot-scale systems for novel applications

- Absorption towers for $CO_2$ cpature
- Regenerative units for high effciency and low energy
- Rotating packed beds
- Fixed and fluidized sorbent beds
- Novel reactor designs
- Life cycle testing under real flue gas conditions
- Emissions profiling
- Carbon capture measurement from real flue gas combustion unit

Available reactor systems operate over wide ranges of pressures, temperatures, and gas flows with real and simulated feed gas mixtures representative of actual commercial operation

## Scale-up and Implementation

RTI works with industry partners to perform engineering-scale design and testing as the final development step before the technology is ready for commercial deployment

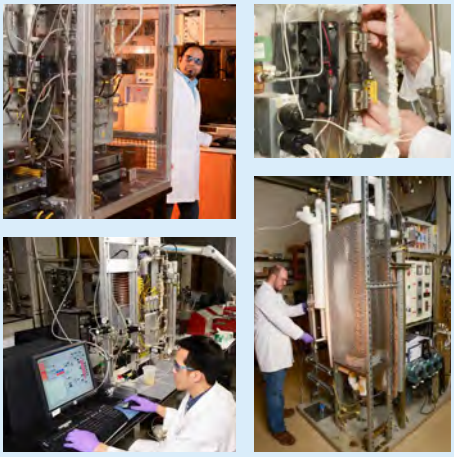
- Bench- to pilot-scale process design, construction, and testing
- Basic engineering design packages
- Partnerships with toll manufacturers and engineering, procurement, and construction (EPC) firms
- Technical consulting and large-scale project management

## Unique Facilities

over 30,000 square feet of laboratory space dedicated to advanced technology development on RTI's main campus in Research Triangle Park, North Carolina, is often used for co-research projects with industry partners or testing and evaluation services.

- Over 17,000 square feet of analytical and materials chemistry laboratories and high bay process development laboratories
- 13,000-square-foot pilot development facility, which includes customizable and expandable process bays

*Materials Screening*



*Process Development*

*Process Scale-up*

### Intellectual Property

RTI takes a pragmatic approach to managing intellectual property (IP) throughout the commercialization process. We realize that all clients are unique and so are their IP requirements.

We adapt our technology licensing approach to meet the specific needs and strategies of our clients.

RTI provides rigorous, objective R&D and engineering services to help accelerate the market readiness of technology.


### More Information

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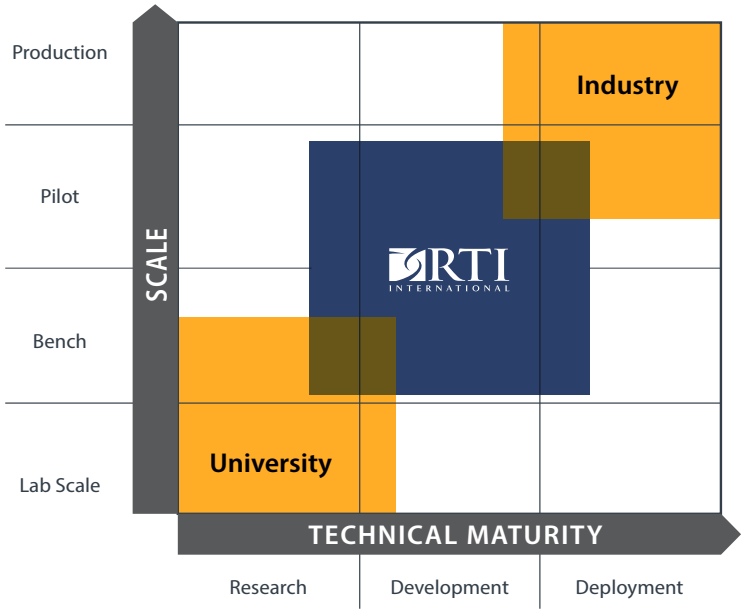
## How We Do Business

RTI develops advanced process technologies, from concept to large-scale demonstration, in partnership with leaders in energy.




## Doing Business with RTI

Through decades of advanced energy R&D, RTI has developed extensive capabilities, expertise, and a track record of moving technologies from concept to large-scale demonstration. We leverage government funding to fuel our technology innovation pipeline and cooperate with universities and industry partners in all stages of technology development to accelerate commercial deployment. RTI is responsive to our clients' needs while maintaining a focus on energy technology areas that align with our core competencies and capabilities to provide the most efficient and cost-effective R&D services possible.

**www.rti.org/energy**

RTI International is an independent, nonprofit research institute dedicated to improving the human condition. Clients rely on us to answer questions that demand an objective and multidisciplinary approach—one that integrates expertise across the social and laboratory sciences, engineering, and international development. We believe in the promise of science, and we are inspired every day to deliver on that promise for the good of people, communities, and businesses around the world. For more information, visit www.rti.org.



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