www.rti.org/energy

RTI INTERNATIONAL

Center of Technology for Energy, Environment and Engineering at RTI International

RTI develops advanced process technologies in partnership with leaders in energy

Full alignment with industry objectives

Concept to demonstration

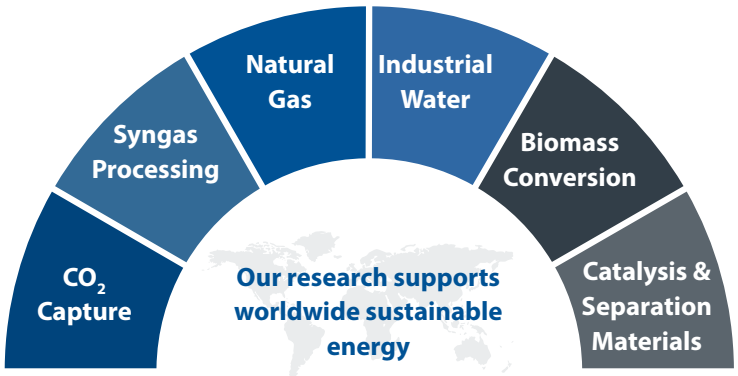
Defined commercialization pathways

Flexible intellectual property arrangements

Potential leveraging of industrial R&D funding with government-provided funding

What We Do

RTI International develops innovative process technologies in the areas of gas separations, water decontamination, syngas processing, catalysis, CO_2 capture and utilization, natural gas, industrial water, and biomass conversion for industrial and government clients. Our research supports national and worldwide goals of reliable, sustainable, economically viable, and secure energy supplies.



Our researchers address some of the most challenging energy-related problems faced by the chemical, petrochemical, gas processing, and transportation fuels and electric power industries. Whether we are designing pilot-scale gas cleaning systems or conducting laboratory-scale reactor testing on novel catalyst formulations, RTI researchers perform applied R&D to deliver high-quality results and add value for our clients.

Clean Energy Research

Syngas Processing

- Syngas cleaning and conditioning
- Syngas conversion and utilization
- Warm gas desulfurization process technology licensed through Casale
- 50 MW technology demonstration in Florida power plant

Natural Gas

- Micro-reformers for distributed gas-to-liquids
- Hybrid coal-to-liquids process technology
- Methane storage

Advanced Materials for Catalysis and Separations

- Catalyst and sorbent development
- Core competence in fluid-bed materials (highly attrition-resistant and active)
- Metal organic frameworks
- Membrane development

Carbon Capture and Utilization, Gas Separations

- Oxygen separation
- Solid sorbents
- Non-aqueous solvents
- Membranes
- CO_2 utilization for chemicals production

Industrial Water Treatment

- Technologies for biofouling prevention and remediation
- Integrated forward osmosis and membrane distillation
- Solvent-based desalination
- Water decontamination

Biomass Conversion

- Waste to energy
- Catalytic fast pyrolysis
- Bio-crude stabilization / upgrading
- Hydrocarbon intermediates
- Bio products

Materials Development

Catalysts and Sorbents

- Novel catalyst and sorbent materials
  - Fundamental understanding of catalysis and surface chemistry
  - Spray-dried particles and extruded materials
  - Metal organic frameworks (MOFs)
- Comprehensive screening and characterization tools

Membranes

- Innovative membrane materials for CO_2 capture, acid-gas separations, H_2 separation, and water treatment applications
- Gas permeation and gas sorption testing
- Water treatment applications

CO_2 Solvents

- Solvent screening
- Comprehensive vapor-liquid equilibrium and reaction calorimetry capabilities

Fluid-Bed and Transport Reactor Applications

Capabilities range from catalyst and sorbent development, specifically for fluid-bed processes, to "hot" testing on reactive feed mixtures over a wide range of operating conditions

- Optimized chemical activity and attrition resistance
- Scale-up with commercial catalyst suppliers
- Fluid-bed process designs
  - Syngas desulfurization
  - Methanation
  - Water-gas-shift
  - Chemical looping

Process Development and Design

Strong competencies in developing, designing, constructing, and operating reactor systems for novel applications

- Fixed beds
- Fluidized beds
- Transport reactor systems
- Novel reactor designs

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

Process Modeling, Simulation, and Design

Aspen Plus, HYSYS, and ProMax

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

Mfix and Fluent CFD Modeling

- Gas-solid interactions
- Heat and mass transfer characteristics of fluidized beds
- Reactor scale-up

Preliminary Design Packages

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

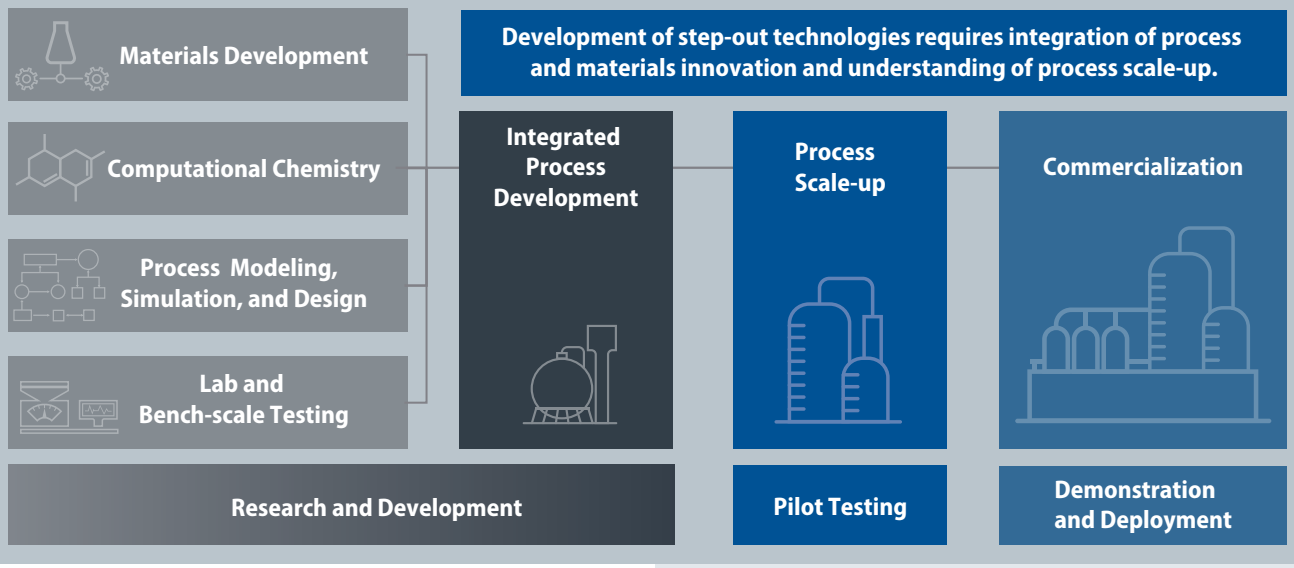
Design of Experiments

- Design of large multidimensional studies
- Statistical analysis

Techno-Economic Analyses

- Often in collaboration with partners

RTI's Integrated Technology Development



Intellectual Property

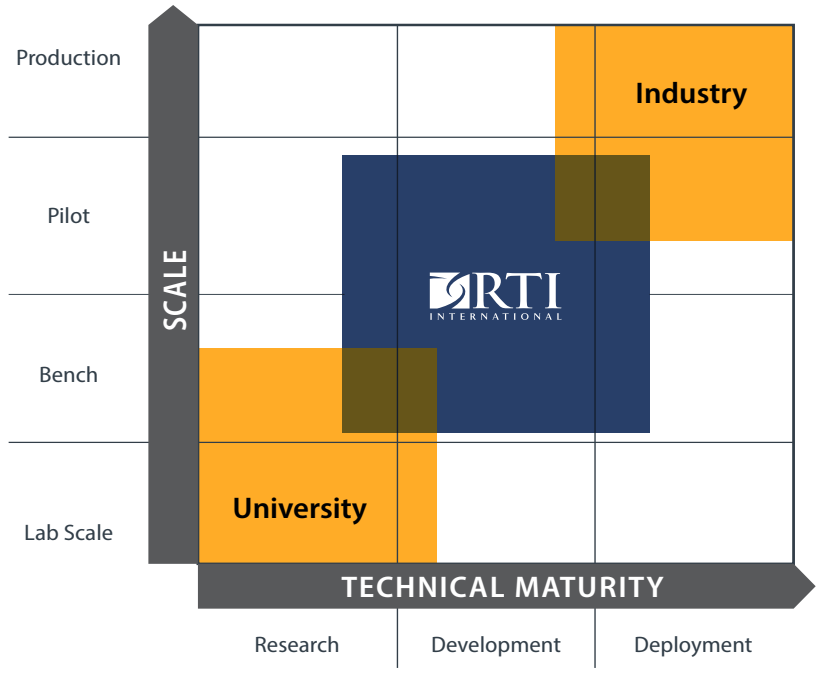
RTI takes a pragmatic approach to managing intellectual property (IP) along this pathway to commercialization. We realize that all clients are unique and so are their IP requirements. We have the ability to

- License our patented technologies
- Enter joint development and licensing arrangements with particular clients
- Divest technologies as opportunities present themselves.

RTI does not subscribe to the "one size fits all" approach to dealing with our clients on IP matters.

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

For a nonprofit research organization like RTI, our scientists and engineers are our most valuable assets. RTI has a track record of moving technologies from concept to large-scale demonstration. We rely on creativity and innovation to keep our technology pipeline primed with new ideas, and we manage our project portfolio to maximize the probability of commercial deployment. In all stages of technology development, we are capable to leverage government funding and cooperate with universities and industry partners 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.

For more information, contact us at
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