

RTI International Annual Report

State Fiscal Year 2023–2024 Report of Program Activities, Objectives and Accomplishments, and Itemized Expenditures and Fund Sources

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REPORT SUMMARY

- For the 2023–2024 fiscal year (FY), RTI received a State appropriation of \$1,050,000 (\$800,000 recurring, \$250,000 non-recurring) to invest in clean energy research and development and match U.S. Department of Energy research and development funds. To meet state requirements for utilization of these funds, and to even go beyond those requirements as good stewards of the state investment made in us, RTI has committed to:



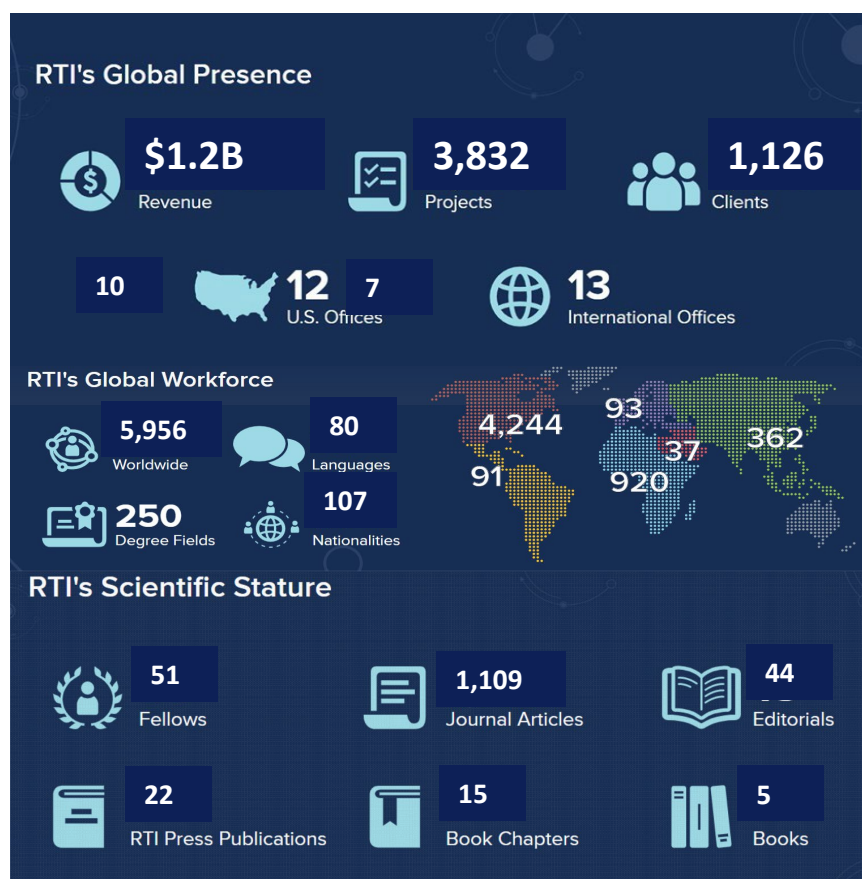
- This past fiscal year, RTI utilized the full \$1,050,000 of the State's investment in this program, allowing RTI to attract **\$13,178,288** in direct matching federal energy research funds.
- Thus, **for every \$1 in State FY 2023-2024 funds utilized by RTI, North Carolina attracted \$12.55 in direct matching federal investment** to support its economy.
- When considering industry co-investment in FY 2023-2024 DOE projects and its corresponding additional federal funds leverage, **North Carolina attracted \$17,529,948 million in total new technology investment** (from both industry and federal sources) to support its economy or **\$16.7 for every \$1 in State funds** utilized by RTI in FY 2023-2024.
- Regarding the FY2024-2025 state appropriation, RTI anticipates utilizing the entire State investment to match federal energy research investment for a return of at least \$4 in corresponding federal investment for every \$1 in State funds utilized by RTI in FY2024-2025.

ABOUT RTI

RTI International is an independent, nonprofit research institute dedicated to improving the human condition. We combine scientific rigor and technical expertise in social and laboratory sciences, engineering, and international development to deliver solutions to the critical needs of clients worldwide.

In 1958, the idea of Research Triangle Park (RTP) was born with the guidance and support of government, education, and business in North Carolina. Located in the rolling hills of the Piedmont, the Research Triangle is defined by outstanding universities in the Triangle's three cities: North Carolina State University in Raleigh, Duke University and North Carolina Central University in Durham, and the University of North Carolina at Chapel Hill. RTI was the original anchor tenant in RTP.

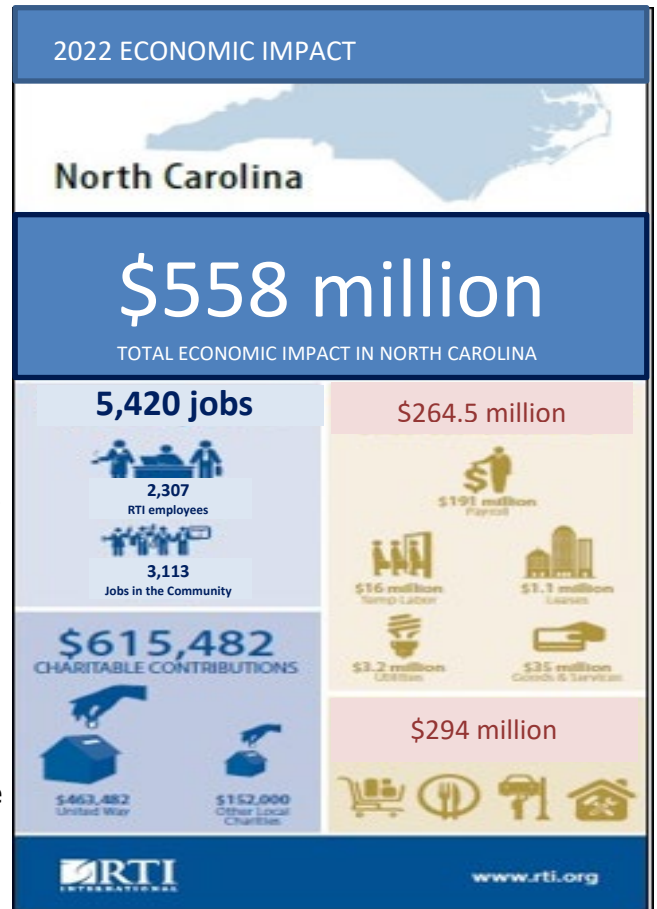
Since our founding, we've grown into one of the world's leading research institutes by remaining focused on our mission to improve the human condition by turning knowledge into practice. Our activities both mirror and support national priorities and policies as well as diverse commercial, industrial, and academic endeavors.



As our mission affirms, we are dedicated to improving the human condition by turning knowledge into practice through cutting-edge study and analysis in health and pharmaceuticals, education and training, surveys and statistics, advanced technology, international development, economic and social policy, energy and the environment, and laboratory and chemistry services.

We are proud of our scientific stature and our reputation for innovation. By continuing to conduct impartial, reliable, multidisciplinary research and by helping to develop and broker new technologies for our clients, we seek to be the world's preferred resource for turning knowledge into practice.

At RTI, we are also proud of the contributions to and economic impacts in our home State of North Carolina and in the communities in which our employees live and work. The estimated economic impact of RTI in the State of North Carolina in 2022 exceeded half a billion dollars, as did also the total contributions to local and state charitable organizations.



ENERGY RESEARCH AT RTI

RTI's innovative energy research is geared toward solving national and global concerns by developing efficient, economic, and sustainable energy solutions. Our scientists and engineers address challenges across the power, chemical, petroleum, gas processing, and transportation industries to produce novel technologies from ideation to pilot scale to commercialized systems. Our team's expertise includes biomass conversion to products and fuels, carbon capture and utilization, natural gas conversion and utilization, industrial water and reuse, syngas and clean coal processing, and other advanced energy applications.

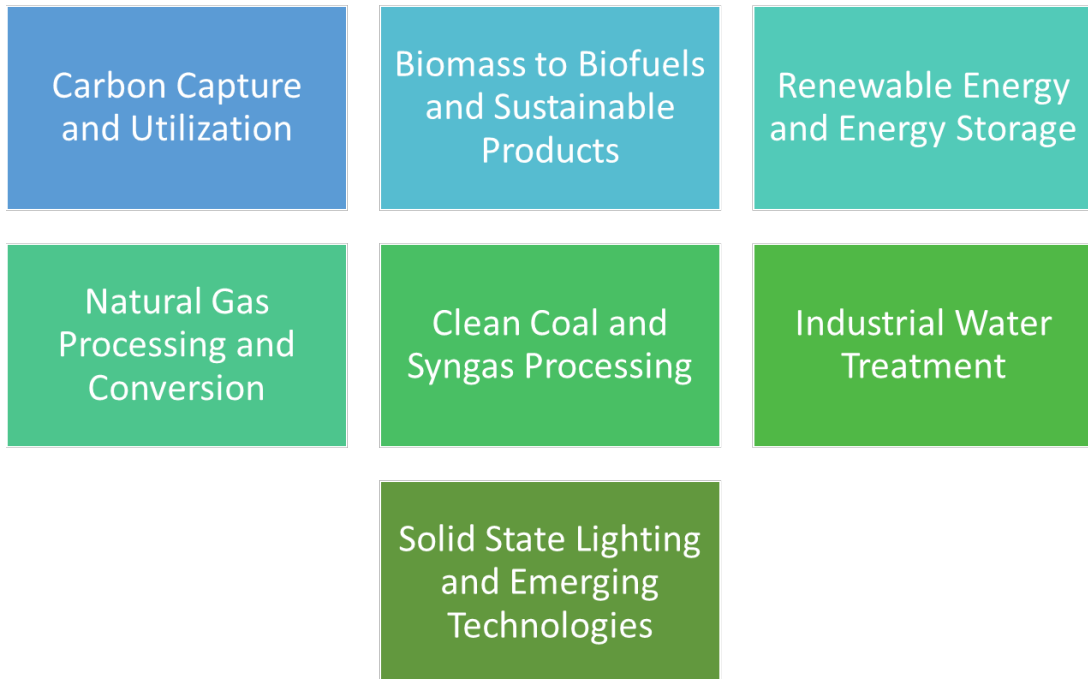
We partner with the largest energy and chemical companies in the world and leverage our state and federal support to enter new R&D areas, build new technology platforms, and build a technology base for future commercialization of new energy technologies. RTI is unique in North Carolina, with a world class reputation in the energy sector.

RTI develops advanced technologies for energy applications from concept to large scale demonstration, with a focus on applied research. Our state-of-the-art facilities and laboratories are equipped to provide high-quality R&D for process technology licensors, gas processing companies, oil refiners, chemical manufacturers, clean-fuels developers, electric power generators, catalyst manufacturers, and other commercial clients, as well as for the U.S. Department of Energy (DOE), Department of Defense, and other government agencies. Our capabilities range from lab- and bench-scale experiments to pilot plants and large-scale pre-commercial demonstration plants.

Our energy R&D programs are focused into seven primary areas, all of which are important for the production and utilization of clean, secure, and safe domestic energy in our state and in our nation:



Pilot unit for biomass conversion to biofuels in RTI's Energy Technology Development Facility in Research Triangle Park, NC

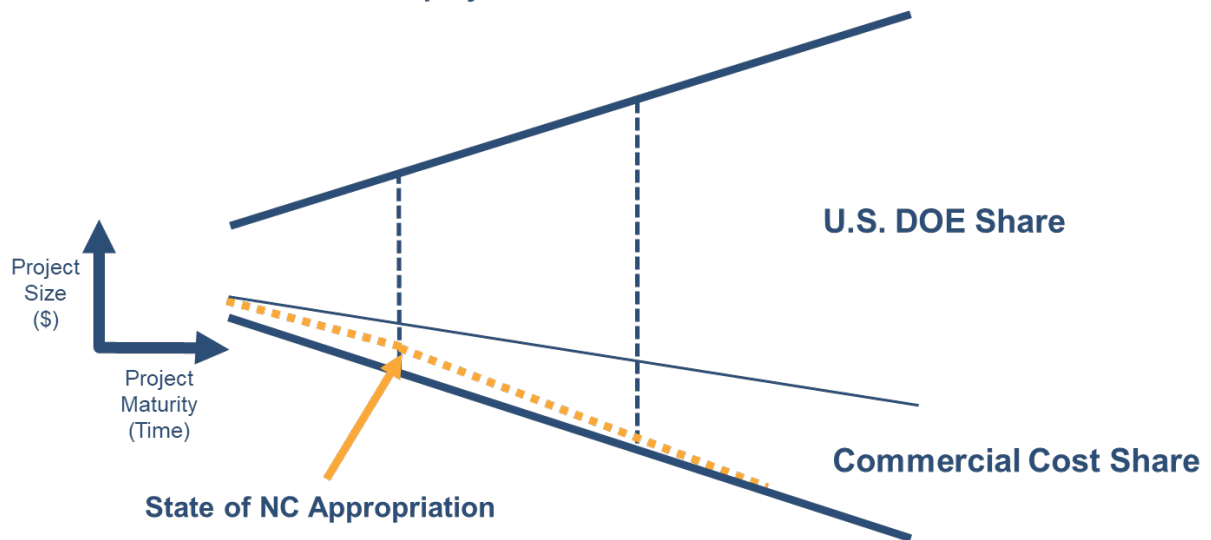


IMPORTANCE AND VALUE OF THE GRANTS APPROPRIATED TO RTI IN THE STATE BUDGET

North Carolina State Funding as an Investment in Energy Technology Development

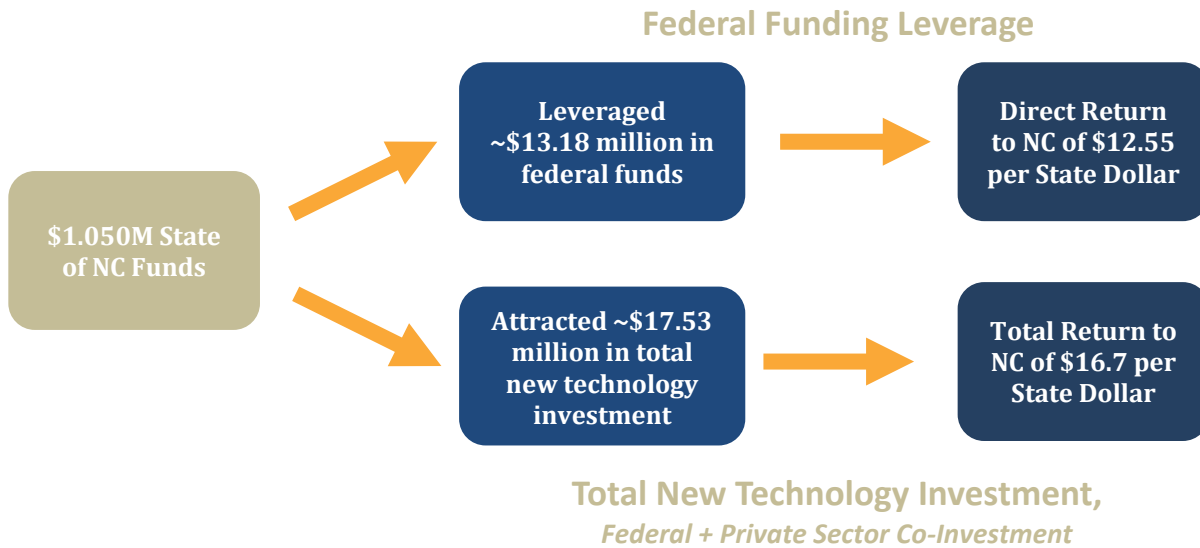
RTI develops advanced energy technologies mainly under funding from the U.S. DOE. These federal research awards require a cost share or match from non-federal sources, typically 5% to 20%, depending on the funding program. RTI's first priority is to develop partnerships with industry that can attract this cost share match from the private sector, and RTI has a successful track record for building these industry alliances. However, the development of new technologies often makes it difficult to attract such cost share requirements until the technologies are sufficiently proven to attract private sector investment (often referred to as the "Valley of Death" for R&D programs). State matching funds allow RTI to cover this early cost share gap and to demonstrate the viability of new technologies – and then attract private sector investment as they mature. As projects are further advanced, industry often picks up the full funding load for U.S. DOE cost share requirements.

State of NC funds are **critical** because much of the other funding depends on the NC funds as cost share to kick-start the projects. State of NC funds serve as our "seed corn."



The State Budget approved by the legislature for Fiscal Year (FY) 2023–2024 included an \$800,000 recurring grant to assist RTI in winning federal energy research grants that require cost share or match, plus a \$250,000 non-recurring grant to provide the cost share required to support an increase in federal grants focused on clean energy and innovation. The goal of this grant is to help RTI advance energy research in North Carolina and create jobs in this important and growing part of the state's economy. The key points of how RTI utilized the grant and benefits to the State can be summarized as follows:

- Together with U.S. DOE funding and in partnerships with leading industrial companies, RTI is leveraging these state funds to build a pipeline of innovative technologies addressing the energy challenges of our state and of our nation.
- The state funding helps RTI to initiate development of at least three to five additional energy technology projects per year. This past year, a total of thirteen development projects have benefited from the state funding.
- Based on the great success of the initial funding (\$500,000 annual allocation), the annual allocation was raised in FY 2016 to \$800,000 and made recurring.
- This fiscal year RTI utilized the full \$1,050,000 of the state's funding to attract \$13,178,288 in direct matching federal energy research investment. Thus, **for every \$1 in State FY 2023-2024 funds utilized by RTI, North Carolina attracted \$12.55 in direct matching federal investment** to support its economy.

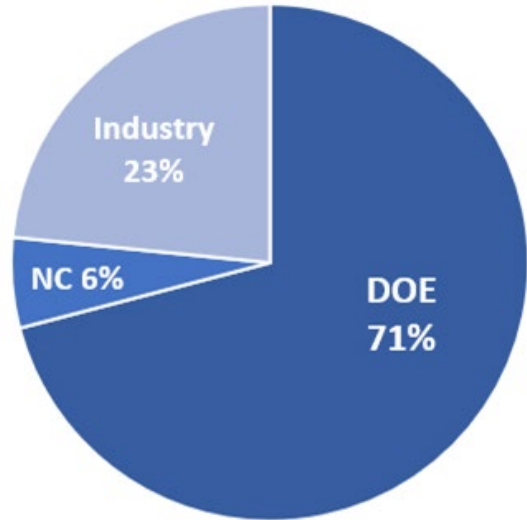


Total FY2023-FY2024 RTI Total Energy Funding Breakdown

- When considering industry co-investment in these FY 2023-2024 projects and its corresponding additional matching federal investment, North Carolina attracted **\$17,529,948 million in total new technology investment** to support its economy or **\$16.7 for every \$1 in state funds utilized by RTI in FY 2023-2024**.

- Since 2010, the State of North Carolina has **cumulatively invested slightly over \$11.26 million** to help RTI attract federal and private funding for energy technology development in North Carolina. This **total state funding to date has leveraged \$72.8 million in direct matching federal energy investment (return of \$6.47 for every \$1 of state funding).**

Leveraging of FY2023-FY2024 RTI State Energy Funding



- Since 2010, **private industry has cumulatively invested an additional \$20.77 million** in cash and in-kind services to the RTI energy projects supported with state funding, and **these industry investments have enabled the leveraging of \$39.9 million in additional matching federal energy investment.**

- If one considers this additional private sector investment in RTI energy projects and the resulting combined (state plus industry) matching federal energy investment that has been leveraged, **North Carolina's funding of RTI energy research has helped attract over \$133 million in total new technology investment** to aid NC's economy, including investments made by the federal government, industry, and RTI for a **total return of \$11.85 for every \$1 of state funding.**

- Investment in new technologies leads to increased economic competitiveness. It creates high-paying jobs, typically attracting talent from outside of the state and resulting in significant economic input to the state of North Carolina. Since North Carolina began investing in RTI's energy research in FY 2010-2011, RTI has created or supported approximately 70 or more high-tech jobs associated with this research.

- In addition to jobs, RTI estimates that for every dollar in state funds invested in RTI energy research, North Carolina has received substantially more than a dollar back in state and local taxes. Considering the fact that if RTI does not commit any portion of the received State funds in the year they were granted those uncommitted funds are returned to the State, the State cannot lose on this investment in RTI.

- State-supported research at RTI regarding solid-state (LED) lighting has also directly benefited the N.C. State Construction Office, the Department of Environmental and Natural Resources, the Department of Public Health, UNC-Chapel Hill, and N.C. State University and other agencies.

STATE FISCAL YEAR 2023–2024 PROGRAM ACTIVITIES, OBJECTIVES, AND ACCOMPLISHMENTS

In this past state fiscal year, utilization of the full \$1,050,000 of the state's RTI energy funds has greatly assisted in building RTI's technology development pipeline, successfully retaining and creating high technology jobs in North Carolina. The use of the state funds succeeded in attracting \$13,178,288 in direct matching federal research investment (12.55:1 federal leverage ratio), along with approximately three quarters of a million dollars in corresponding industry cost share and over \$4.35 million in additional federal research dollars leveraged by this industry funding (total leverage ratio of 16.7:1). The table below shows the direct leveraging of federal investment associated with the State funding for this past fiscal year.

Project/Proposal	NC Funds	Federal Dollars Leveraged
Engineering-Scale Test of a Water-Lean Solvent for Post-Combustion Capture BP2	\$77,294	\$306,048
REFUEL Scale-Up BP2	\$150,000	\$7,095,045
Ammonia for Concentrated Solar Power	\$4,852	\$19,408
Clean Hydrogen Production	\$187,108	\$762,245
CCS for Flexible power Generation Phase 2	\$219,529	\$3,129,422
VTO Co-optimization of Engines and Fuels BP3	\$35,598	\$341,006
Sensors BP3	\$51,333	\$150,000
Bench-Scale Testing of Optimized Direct Air Capture Integrated Processes	\$206,737	\$874,854
Scale-Up of Integrated Biorefineries and Greenhouse Gas Reduction in First Generation Ethanol Production-Scale-Up	\$25,049	\$100,200
DAC to Green Methanol	\$92,500	\$400,000
Totals Allocated	\$1,050,000	\$13,178,228

Specific projects benefiting from State of NC funds in FY 2023-2024 and the goals of and accomplishments within those projects are highlighted below:

- 1. GEN2NAS Solvents for CO₂ Capture from NGCC Plants.** RTI used the state funding to conduct a chemical screening to produce the 2nd generation non-aqueous solvent for CO₂ from the natural gas derived flue gas application in 2023. The fund was also used to conduct the down-selected solvent performance evaluation in our bench-scale CO₂ absorption system in 2024.

2. REFUEL Scale-Up. RTI is leading an effort to develop and demonstrate a Technology Integration Platform (TIP) for next-generation green hydrogen and ammonia production and utilization technologies for three sectors: power generation, fuel, and fertilizer. Funds in this FY were used to develop a bench-scale green NH₃ production system in RTI's laboratories. The results of the bench-scale system supported the design of a 1 metric ton per day green ammonia production facility that will be integrated at a site with 3.5 MW of wind and solar. The team completed a detailed design of the facility and reviewed it with several authorities having jurisdiction for permitting. The team is now in the procurement and fabrication phase of the project.

3. Ammonia for Concentrated Solar Power. RTI continues to support a team of leading universities by developing next-generation ammonia-based energy storage systems for concentrated solar power. As part of its effort in this FY, RTI completed screening ideal catalysts for high temperature applications. RTI is also supporting market analyses, supply chain analysis, and developing technology transition plans for next-scale development and demonstration.

4. Hydrogen Production from Modular CO₂ Assisted Oxy-Blown Gasification of Waste Blends. This new FECM project was started in May 2023 to develop a novel process to produce hydrogen from blended feedstock that includes legacy waste coal, forest residues, and organic-rich fraction of municipal solid waste (OFMSW) via carbon dioxide (CO₂) assisted oxy-blown gasification as a sub-awardee to Auburn University. State funding was leveraged to verify the performance of RTI's sulfur removal sorbent in a bench-scale testing system to determine the effect of tar, moisture, sulfur, chlorine, and other contaminants on sorbent working capacity. The experimental results form the basis of a detailed process design for integrating RTI's syngas cleanup and conditioning unit operations with a 1 kg/hr gasifier.

5. Advanced CO₂ Capture Solvent Systems for Dynamic Power. RTI leveraged \$219,529 in state funding to receive \$6,258,843 in DOE funds to carry out this project that is focused on de-risking and scaling up a CO₂ capture technology that can be applied to natural gas combined cycle (NGCC) power plants that have dynamic load profiles to balance fluctuations from renewable power on the grid. In the past year, the project team has optimized the packing material used in the rotating packed bed absorber that is the key enabling technology of the system. The optimization was completed with lab testing at the bench scale at RTI. The team has also completed the detailed design of a 100 t-CO₂/day rotating packed bed to evaluate the new technology at large scale in dynamic operation.

6. VTO- Co-optimization of Fuels and Engines. RTI used state funding to support the production of a bio-blendstock for engine testing. Catalytic biomass pyrolysis was used to produce a biocrude intermediate that was upgraded into a hydrocarbon product rich in naphthenes. The hydrotreated product was distilled to recover a bio-blendstock that was blended with conventional diesel and tested in a medium-duty compression ignition engine. A techno-economic analysis and lifecycle assessment were conducted to determine the economic feasibility and environmental benefits of the advanced biofuels pathway.

7. DOE Sensors. RTI continues to support a team of leading universities and National Laboratory by developing next-generation Microsensor Encapsulations for annulus monitoring of CO₂ injection using wireless autonomous distributed sensor networks. The microsensors measure CO₂, pH, and temperature with surface coatings to facilitate survival, transport, and emplacement. As part of its effort in this FY, RTI continue to develop coating formulations for microsensor systems to enable their survival and facilitate their physical emplacement near the formation.

8. Bench-Scale Testing of Optimized. RTI used state funding to support the final design of a new engineering-scale Direct Air Capture (DAC) Contactor system to capture CO₂ from air. A detailed engineering design was completed, and a tooling design for production is ongoing. Furthermore, using the state of NC fund, RTI was able to synthesis 15kg of solid sorbent that will be integrated to the DAC Contactor system via coating. DAC Contactor fabrication is underway, and it's expected to be ready for testing by the end of Q2 2025.

9. Corn Stover to Sustainable Aviation Fuel. This new EERE funded project will leverage existing capabilities to develop and demonstrate an integrated process to convert preprocessed corn stover into sustainable aviation fuel (SAF) through a catalytic fast pyrolysis (CFP), biocrude intermediate upgrading pathway. RTI used state funding to successfully complete the initial verification of the project. Laboratory experiments were conducted to determine the process improvements realized by using preprocessed feedstock measured as increased biocrude intermediate yields. The experimental results verified the information provided in the original proposal and met the Go/NoGo decision criteria to move the project into the next budget period.

10. DAC to Green Methanol. RTI is leading an effort to develop an approach for demonstrating carbon-neutral methanol (MeOH) produced from carbon dioxide (CO₂) removed from air by direct air capture (DAC) and green hydrogen (H₂) from water (H₂O) electrolysis using renewable electricity. The project will include completing a feasibility study that informs a conceptual design of an integrated process that meets technical and economic targets set forth. The state of NC funds was used to complete the DAC system design to capture 25kg of CO₂ per day. The team is now focusing on developing a process design that demonstrates heat integration between process steps (e.g., DAC and MeOH synthesis), as well as process intensification strategies.

STATE FISCAL YEAR 2023-2024 ITEMIZED EXPENDITURES AND FUND SOURCES

The \$1,050,00 in appropriation funds used by RTI were applied to labor costs inclusive of indirect overhead charges. See **Appendix A** for details of the expenditure of RTI state funds for this past fiscal year.

OUTLOOK FOR STATE FISCAL YEAR 2024-2025

For the state fiscal year 2024-2025, RTI plans to continue to utilize State of NC funding to further strengthen its energy program. A significant portion of the funds are anticipated to be used to leverage federal funds for the following technology development projects for which RTI has already received award notices and for which contract negotiations are currently under way:

1. GEN2NAS Solvents for CO₂ Capture from NGCC Plants. RTI will continue Solvent performance evaluation in our bench-scale system until Sep 2024. The techno-economic assessment of the GEN2NAS will also be conducted before the project ends in March 2025.

2. REFUEL Scale-Up. In the next FY, we plan to continue with the fabrication and installation of the 1 metric ton per day pilot-plant that can reduce the cost of green ammonia by up to 45% compared to the state-of-the-art.

3. Ammonia for Concentrated Solar Power. In the next FY, we will be completing technology risk registers, and technology maturation plans.

4. Hydrogen Production from Modular CO₂ Assisted Oxy-Blown Gasification of Waste Blends. RTI will use state funding to support the design and fabrication of a syngas cleanup train to be integrated with the gasification unit owned and operated by our project partners at Auburn University. RTI will provide input for the design of a packed bed sulfur removal and tar cracking unit and support a process safety review and fabrication installation, and commission of the system.

5. Advanced CO₂ Capture Solvent Systems for Dynamic Power. RTI will oversee the 100 t-CO₂/day rotating packed bed fabrication and testing in the next year. Through the testing, RTI will be evaluating and optimizing the rotating packed bed mass transfer performance under dynamic conditions to assess the viability for this technology to address the challenges of capturing CO₂ from variable flue gas flow rates.

6. Integrated Separations to Improve Biocrude Recovery for Biofuels and Bioproducts. RTI used state funding to support pilot plant modifications to redesign the quench system and integrate separations unit operations into the existing biomass pilot plant. Engineering designs of the proposed modifications will be developed and reviewed for any safety concerns. System modifications will begin pending approval of the proposed modifications.

7. DOE Sensors. RTI will continue the formulation screening effort in FY24 through March 2025. One hermetic coating formulation will be down selected and move forward with pilot testing at Devine Test Site.

8. Bench-Scale Testing of Optimized. RTI will use state funding to support the fabrication, commissioning, and operation of a new engineering-scale DAC contactor system that consists of four low-pressure drop core contactors that alternate adsorption/desorption cycles for continuous, steady-state operation for at least 1 month, CO₂ removal from ambient air.

9. Corn Stover to Sustainable Aviation Fuel. RTI will use state funding to support the pilot plant operations to produce biocrude from raw and preprocessed corn stover and biocrude upgrading to biofuels. Samples will be shared with project partners to determine the comprehensive molecular-level understanding of the chemical composition of the feed and upgraded materials. The objective is to clarify the benefits of feedstock preprocessing on biocrude composition and the impact of that composition on upgrading catalyst performance.

10. DAC to Green Methanol. RTI will use state funding to support the dynamic green MeOH process from CO₂ from DAC, which has high conversion efficiencies and low production costs while minimizing on-site storage of H₂. The process includes a novel catalyst for one-step conversion of CO₂ to MeOH in a state-of-the-art plate-cooled isothermal reactor configuration that allows for load-following dynamic operation using patented process controls.

CONCLUSION

All of the funds received by RTI have been utilized for the purposes for which they were granted. Financial data for all funded projects have been provided for FY 2023-2024. The line item budget for the FY 2023-2024 use of funds is attached in Appendix A.

We appreciate the State's support of our clean energy technology projects and the continued opportunity to hire and retain high technology jobs in the State of North Carolina.

Please direct questions regarding technical matters to Dave Dausch, Vice President, Technology Advancement and Commercialization, RTI International, dausch@rti.org or 919-248-1412.

Please direct all questions regarding contractual matters to Shonta Holloway, Senior Contracting Officer, RTI International, sholloway@rti.org or 919-316-3424.

**APPENDIX A: STATE OF NORTH CAROLINA COST SHARE FUNDING, FY 2023-2024
Summary for State of NC Funding \$1,050,000 – Grant ID 27964**

Project Name	Start Date	Total Cost	DOE Amount	FY24 Spend	Obligated NC Funds	Total NC Funds Spent and Obligated	Total Industry Spend
Engineering-Scale Test of a Water-Lean Solvent for Post-Combustion Capture BP2	4/26/2021	\$ 383,342	\$ 306,048	\$ 16,651	\$ 60,643	\$ 77,294	\$ -
REFUEL Scale-Up BP2	7/25/2024	\$ 7,245,045	\$ 7,095,045	\$ -	\$ 150,000	\$ 150,000	\$1,418,810
Ammonia for Concentrated Solar Power	10/1/2022	\$ 24,260	\$ 19,408	\$ 4,852	\$ -	\$ 4,852	
FECM - Clean Hydrogen Production	3/1/2023	\$ 952,806	\$ 762,245	\$ 48,102	\$ 139,006	\$ 187,108	\$2,832,095
CCS for Flexible power Generation Phase 2	9/19/2023	\$ 3,348,951	\$ 3,129,422	\$ 61,240	\$ 158,289	\$ 219,529	\$ -
RTI Sub - VTO Co-optimization of Engines and Fuels BP3	3/1/2019	\$ 376,604	\$ 341,006	\$ 18,501	\$ 17,097	\$ 35,598	\$ 81,330
DOE Sensors BP3	4/1/2023	\$ 201,333	\$ 150,000	\$ -	\$ 51,333	\$ 51,333	\$ -
Bench-Scale Testing of Optimized Direct Air Capture Integrated Processes	6/15/2023	\$ 1,081,591	\$ 874,854	\$ 206,738	\$ -	\$ 206,737	\$ 11,925
Scale-Up of Integrated Biorefineries and Greenhouse Gas Reduction in First Gen	10/1/2023	\$ 125,249	\$ 100,200	\$ 25,049	\$ -	\$ 25,049	\$ -
DAC to Green Methanol	12/20/2023	\$ 492,500	\$ 400,000	\$ 36,632	\$ 55,868	\$ 92,500	\$ 7,500
Categories Needed	TOTAL	\$ 14,231,681	\$ 13,178,228	\$ 417,765	\$ 632,236	\$1,050,000	\$4,351,660

	Federal Only	Including Industry Spend
Total Leverage Ratio	12.55	16.70

Funding Breakout – by Project by Quarter

7/01/223- 6/30/24 = Actuals

	Q1	Q2	Q3	Q4	Total
	\$ 8,072.40	\$ 20,022.00	\$ 24,566.40	\$ 24,278.40	\$ 76,939.20
Engineering-Scale Test of a Water-Lean Solvent for Post-Combustion Capture BP2	7/1/23 - 9/30/23	10/1/23 - 12/31/23	1/1/24 - 3/31/24	4/1/24 - 6/30/24	Total
Labor (w/Fringe)	\$ 6,727	\$ 16,685	\$ 20,472	\$ 20,232	\$ 64,116
Travel, Services, Etc.					\$ -
Equipment, Materials, Subcontractors	\$ 85,560	\$ 298,942	\$ 501	\$ 570,130	\$ 955,133
Overhead (Indirect) Costs	\$ 15,995	\$ 31,571	\$ 32,217	\$ 42,146	\$ 121,929
Total	\$ 108,282	\$ 347,198	\$ 53,190	\$ 632,508	\$ 1,141,178
Labor (fully loaded)	\$ 22,722	\$ 48,256	\$ 52,689	\$ 62,378	\$ 186,045
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ 3,700	\$ 12,951	\$ 16,651
REFUEL Scale-Up BP2	7/1/23 - 9/30/23	10/1/23 - 12/31/23	1/1/24 - 3/31/24	4/1/24 - 6/30/24	Total
Labor (w/Fringe)					
Travel, Services, Etc.					
Equipment, Materials, Subcontractors					
Overhead (Indirect) Costs					
Total	\$ -	\$ -	\$ -	\$ -	\$ -
Labor (fully loaded)	\$ -	\$ -	\$ -	\$ -	\$ -
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ -	\$ -	\$ -
Ammonia for Concentrated Solar Power	7/1/23 - 9/30/23	10/1/23 - 12/31/23	1/1/24 - 3/31/24	4/1/24 - 6/30/24	Total
Labor (w/Fringe)			\$ 9,995		\$ 9,995
Travel, Services, Etc.					\$ -
Equipment, Materials, Subcontractors					\$ -
Overhead (Indirect) Costs			\$ 14,265		\$ 14,265
Total	\$ -	\$ -	\$ 24,260	\$ -	\$ 24,260
Labor (fully loaded)	\$ -	\$ -	\$ 24,260	\$ -	\$ 24,260
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ 4,852	\$ -	\$ 4,852
FECM - Clean Hydrogen Production	7/1/23 - 9/30/23	10/1/23 - 12/31/23	1/1/24 - 3/31/24	4/1/24 - 6/30/24	Total
Labor (w/Fringe)			\$ 20,601	\$ 45,943	\$ 66,544
Travel, Services, Etc.				\$ 1,295	\$ 1,295
Equipment, Materials, Subcontractors			\$ 9,815	\$ 34,013	\$ 43,828
Overhead (Indirect) Costs			\$ 33,343	\$ 76,340	\$ 109,683
Total	\$ -	\$ -	\$ 63,759	\$ 157,591	\$ 221,350
Labor (fully loaded)	\$ -	\$ -	\$ 53,944	\$ 122,283	\$ 176,227
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ 14,800	\$ 33,302	\$ 48,102
CCS for Flexible power Generation Phase 2	7/1/23 - 9/30/23	10/1/23 - 12/31/23	1/1/24 - 3/31/24	4/1/24 - 6/30/24	Total
Labor (w/Fringe)		\$ 50,518	\$ 45,738	\$ 35,688	\$ 131,944
Travel, Services, Etc.		\$ 758	\$ 1,032	\$ 1,155	\$ 2,945
Equipment, Materials, Subcontractors		\$ 8,082	\$ 141,048	\$ 281,583	\$ 430,713
Overhead (Indirect) Costs		\$ 79,514	\$ 75,235	\$ 59,950	\$ 214,699
Total	\$ -	\$ 138,872	\$ 263,053	\$ 378,376	\$ 780,301
Labor (fully loaded)	\$ -	\$ 130,032	\$ 120,973	\$ 95,638	\$ 346,643
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ 11,101	\$ 27,937	\$ 22,202	\$ 61,240

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<u>RTI Sub - VTO Co-optimization of Engines and Fuels BP3</u>	<u>7/1/23 - 9/30/23</u>	<u>10/1/23 - 12/31/23</u>	<u>1/1/24 - 3/31/24</u>	<u>4/1/24 - 6/30/24</u>	<u>Total</u>
Labor (w/Fringe)	\$ -	\$ 93	\$ 1,085	\$ 12,799	\$ 13,977
Travel, Services, Etc.					\$ -
Equipment, Materials, Subcontractors					\$ -
Overhead (Indirect) Costs	\$ -	\$ 146	\$ 1,702	\$ 19,916	\$ 21,764
Total	\$ -	\$ 239	\$ 2,787	\$ 32,715	\$ 35,741
Labor (fully loaded)	\$ -	\$ 239	\$ 2,787	\$ 32,715	\$ 35,741
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ -	\$ 18,501	\$ 18,501

<u>DOE Sensors BP3</u>	<u>7/1/23 - 9/30/23</u>	<u>10/1/23 - 12/31/23</u>	<u>1/1/24 - 3/31/24</u>	<u>4/1/24 - 6/30/24</u>	<u>Total</u>
Labor (w/Fringe)		\$ 6,477	\$ 134	\$ 705	\$ 7,316
Travel, Services, Etc.			\$ 1,143		\$ 1,143
Equipment, Materials, Subcontractors					\$ -
Overhead (Indirect) Costs		\$ 10,167	\$ 463	\$ 1,011	\$ 11,641
Total	\$ -	\$ 16,644	\$ 1,740	\$ 1,716	\$ 20,100
Labor (fully loaded)	\$ -	\$ 16,644	\$ 597	\$ 1,716	\$ 18,957
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ -	\$ -	\$ -

<u>Bench-Scale Testing of Optimized Direct Air Capture Integrated Processes</u>	<u>7/1/23 - 9/30/23</u>	<u>10/1/23 - 12/31/23</u>	<u>1/1/24 - 3/31/24</u>	<u>4/1/24 - 6/30/24</u>	<u>Total</u>
Labor (w/Fringe)	\$ 31,892	\$ 53,015	\$ 105,420	\$ 67,405	\$ 257,732
Travel, Services, Etc.	\$ 1,616	\$ -	\$ -	\$ -	\$ 1,616
Equipment, Materials, Subcontractors	\$ 6,396	\$ 90,418	\$ 79,737	\$ 149,733	\$ 326,284
Overhead (Indirect) Costs	\$ 52,780	\$ 84,228	\$ 162,850	\$ 102,901	\$ 402,759
Total	\$ 92,684	\$ 227,661	\$ 348,007	\$ 320,039	\$ 988,391
Labor (fully loaded)	\$ 84,672	\$ 137,243	\$ 268,270	\$ 170,306	\$ 660,491
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ 15,050	\$ 123,648	\$ 68,040	\$ 206,738

<u>Scale-Up of Integrated Biorefineries and Greenhouse Gas Reduction in First Generation Ethanol Production-Scale-Up+</u>	<u>7/1/23 - 9/30/23</u>	<u>10/1/23 - 12/31/23</u>	<u>1/1/24 - 3/31/24</u>	<u>4/1/24 - 6/30/24</u>	<u>Total</u>
Labor (w/Fringe)	\$ -	\$ 36,564	\$ 101		\$ 36,665
Travel, Services, Etc.					\$ -
Equipment, Materials, Subcontractors					\$ -
Overhead (Indirect) Costs	\$ -	\$ 57,390	\$ 37		\$ 57,427
Total	\$ -	\$ 93,954	\$ 138	\$ -	\$ 94,092
Labor (fully loaded)	\$ -	\$ 93,954	\$ 138	\$ -	\$ 94,092
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ 25,048	\$ -	\$ -	\$ 25,048

<u>DAC to Green Methanol</u>	<u>7/1/23 - 9/30/23</u>	<u>10/1/23 - 12/31/23</u>	<u>1/1/24 - 3/31/24</u>	<u>4/1/24 - 6/30/24</u>	<u>Total</u>
Labor (w/Fringe)	\$ -		\$ 10,134	\$ 39,324	\$ 49,458
Travel, Services, Etc.					\$ -
Equipment, Materials, Subcontractors				\$ 251	\$ 251
Overhead (Indirect) Costs			\$ 3,746	\$ 12,645	\$ 16,391
Total	\$ -	\$ -	\$ 13,880	\$ 52,220	\$ 66,100
Labor (fully loaded)	\$ -	\$ -	\$ 13,880	\$ 51,969	\$ 65,849
Labor (fully loaded) towards State Cost Share Funds	\$ -	\$ -	\$ 6,290	\$ 30,342	\$ 36,632