



E-BRIEF



**NORTHWEST OHIO
INNOVATION CONSORTIUM**

POWERING INNOVATION TOGETHER

APRIL 2026

PROGRESS OVERVIEW: WHAT WE'VE BEEN UP TO

At nearly a year and a half of operation, the Consortium's beginning momentum is rapidly transforming into tangible results. The Glass Center of Excellence has welcomed several collaborative events, many research initiatives are underway, and UToledo's glass expert, Dr. Zhao, has been fully integrated into NOIC projects. The UToledo glass lab completion is expected later this year, and the NOIC cullet lab equipment has been installed to support various recycling initiatives.

With progress snowballing and updates in every pillar, below we'll highlight each program's advancements and accomplishments over the past several months.

RECYCLING OPTIMIZATION

The Recycling pillar works to increase efficiency and effectiveness of regional recycling streams through partnerships with local organizations, the expansion of Lucas County Materials Recovery Facility (MRF), and community education. The pillar consists of three working teams, each addressing a key focus area affecting recycled materials and reusability. This pillar aims to position Northwest Ohio as a national model for an applied usable cullet system.

MRF Optimization: This project recently streamlined its focus to the core technology potential of sorting and handling done at the drop off, process, and pick up points of a MRF glass handling system. The team works in partnership with the upcoming Lucas County MRF to determine optimal sorting technology and processes to increase the amount of reusable glass in the recycling stream.

The team has advanced MRF technology specifications through research, audits, supplier interviews, and a sorting technologies market study from UToledo. This data has aided in determining optimal implementation of technology in the new MRF. The team recently completed phase I of development of a glass-industry wide cullet quality, sizing, and testing specification and sampling process with support from CelSian, UToledo, and BGSU.

Consumer Education: This project handles the re-launch of an updated GRIT (Glass Recycling in Toledo) brand and capabilities, along with several educational pathways aimed at increasing community participation in glass recycling. Educational resources currently underway

include a three-part docu-series about the lifecycle of glass, recycling content for summer camps in partnership with the Talent Development pillar, and a glass recycling youth engagement program. Educational content aims to teach consumers of all ages about proper recycling methods and the importance of community participation in glass recycling efforts.

Alternative Cullet Sources

Optimization: This team was recently created to address the niche focus areas of solar and industrial sources of soda lime silicate cullet. The team will also lead the implementation of the GRIT Separated Collection System for bars and restaurants.

The project recently commissioned its first study regarding C-Si solar panel glass handling. Additional research will soon launch with a focus on windshield recycling methods.



O-I Brockway & Crenshaw Cullet Testing

TALENT DEVELOPMENT

The Talent Development pillar works to develop long-term talent pipelines to increase the qualified workforce pool across all levels of industry, consisting of five working teams, each addressing a key focus area to ensure lasting impactful change in our regional workforce development pathways. Focus areas include STEM summer programming, skilled trade, undergraduate internships, graduate and PhD research, and curriculum modification that strengthens education-to-industry pathways.

K-12 Summer Academy: This project focuses on getting young students interested in STEM topics and fostering that interest into career paths in the glass and solar industries through engaging materials science summer programming.

Last summer this team sponsored seven regional STEM camps, all of which reached capacity, impacting 130 students. Over the past few months

this team has approved 21 student programs for summer 2026, with a capacity of over 500 students!

To bolster materials science content in the camps we sponsor, the team selected experiment kits provided by the Ceramics and Glass Industry Foundation to include in this year's camps for supplemental materials science curriculum.

The team has also begun supporting professional development pathways for K-12 teachers, as training educators can impact exponentially more students than we can reach through summer camps directly. Two materials science educator programs will occur this summer, where in-depth glass and solar industry knowledge will empower teachers to implement the materials science experiment kits with their students and build upon those concepts in classrooms across the region.



TPS Manufacturing Summer Camp Tour

Skilled Trades & Workforce

Development: This project seeks to create pathways from education into the skilled trades through apprenticeships programs, learn and earn models, and customized training programs for manufacturing companies. A primary focus of creating sustainable trades pathways is attracting enough qualified instructors, as ongoing shortages of trades professionals has impacted the ability to staff training programs.

This team recently created and deployed an instructor survey to over 100 regional skilled trades educators to gather insights into the instructor shortage and determine the best way to proceed with recruiting, training, or advertising to ensure an adequate number of instructors for programs. Interviews have also been held with previous managers of local learn and earn programs to determine if and how we may be able to successfully relaunch such a program locally.

Internships & Co-Ops: This project focuses on the creation of undergraduate internship and co-op positions in STEM fields throughout our industry partners. The team sponsors 90 positions per year to increase the amount of regional engineering students with access to experience in the glass and solar industries. The program has been extremely popular and had to be increased from 60 to 90 positions to better meet demand, which still exceeds capacity.

Over the past several months, this program completed its first full year of sponsored interns with a total of 108 interns across four of the five participating companies. Beginning in January 2026,

all five companies now host sponsored interns. Due to demand continuing to exceed capacity, 2026 positions were allocated to each company to ensure the project adheres to the allotted budget.

Graduate & PhD Assistantships: This project sponsors the immersion of graduate, PhD, and post-doctoral research assistants in glass and solar industry problem-solving and facilitates the creation of glass-specific academic tracks at UToledo.

Under the guidance of UToledo's glass expert, Dr. Zhao, up to six students pursuing advanced studies in engineering, materials science, physics, chemistry, and adjacent fields will receive in-depth experience on NOIC research initiatives to prepare the next generation of innovative industry scientists. Dr. Zhao has already extended three offers, with two research assistants slated to begin work this summer. The first two undergraduate level glass courses will launch this upcoming school year through UToledo's Physics department: Foundations of Glass Science and Glass Technologies.

Educational Architecture: This project focuses on curriculum modification that strengthens education-to-industry pathways, ensuring students the opportunity to learn applicable skills that industry hiring professionals value most highly. This requires industry and educators to work together to bridge gaps in workforce preparedness, as identified by industry personnel, by implementing curriculum reform in the classroom.

The team recently completed phase one of interviews, gathering insights from 11 regional manufacturers about the most valuable skillsets to improve in the entry-level workforce. Additional, more in-depth interviews have been determined based on this data.

A pilot program born from this initial analysis is underway and anticipated to launch regionally next school year. The program incentivizes high school students to participate in a two-year curriculum focused on programmable logic controllers (PLC) and Ladder logic, paired with leadership development instruction.

SURFACE TREATMENT

This pillar focuses on enhancing glass strength, thermal and infrared management, reflectivity, surface durability, and moisture resistance, among other performance criteria. Advancements in these areas will enable the development of lighter, stronger, and more cost-effective glass products. These improvements also have the potential to create long-lasting benefits across the supply chain by reducing manufacturing and transportation costs for multiple adjacent industries. Research centers around two core end-user industries interested in stronger glass for different purposes: the solar industry, and the container industry.

Glass Strengthening for the Solar Industry: This project centers on strengthening glass to counteract assembly factors that weaken glass panels used in solar modules. Hail causes

significant damage to solar installations, and as the frequency of severe weather increases, so does the need for stronger, weather-resistant solar glass. Research in this area will address glass edge strengthening and laser/glass interaction, led by First Solar in collaboration with UToledo and BGSU.



UToledo Student Research Participation

Glass Strengthening & Lightweighting for the Container Industry: This focus area seeks to reduce breakability of consumer packaging throughout its lifecycle. Research will also address lightweighting glass packaging to reduce energy consumption and raw material costs, while maintaining strength and integrity. Lighter packaging also reduces carbon emissions during product transportation. Technical innovations under this umbrella will include the chemical strengthening of soda-lime silicate glass led by UToledo, alternative methods to prevent weathering of containers led by O-I and UToledo, and the pursuit of an unbreakable glass bottle led by PepsiCo.

AI PROCESS CONTROL

The AI pillar seeks to use AI process control and machine learning to optimize automation in glass melting furnaces. The initiative also includes the development of a glass expert AI chatbot to assist industry professionals with in-depth glass- and furnace-related problem solving.

Furnace Process Consistency

Optimization: This project uses AI process control and machine learning to optimize AI-based model control and energy efficiency with the goal of reducing energy use by four percent per melted ton of glass. Other improvements include raw material quality control, data management, asset life extension, and labor optimization. The team is nearing completion of AI application development for the first test furnace and development is underway for the second test furnace.

Glass Science & Furnace Expert

Chatbot Development: The recent addition of the IRIS Expert Chatbot project seeks to develop a supplemental tool that will provide specific, in-depth information and problem-solving assistance to glass engineers and furnace operations professionals. The team has already completed phases one and two of development. The bot has been tested among a pilot group of engineers and been validated by a third-party AI review team. Reviews have found that the chatbot has not yet “hallucinated,” or pieced together a non-factual answer, which is highly important for its use as a professional tool. The

chatbot will begin deploying to member companies this quarter.

FURNACE IMPROVEMENT

The Furnace Improvement pillar focuses on enhancing glass furnace efficiency, longevity, and overall performance. Its scope includes melter design optimization, burner efficiency characterization and improvement, enhanced heat transfer from the burner flame to the melt, and energy efficiency gains through insulation optimization. This initiative also advances refractory monitoring systems for predictive failure analysis, supporting longer furnace life. Five sub-projects have been identified, and the team has begun work in three areas of technical innovation.

Melter Performance Enhancement: This focus area centers on improving furnace efficiency, reducing heat loss and air emissions, and maintain the structural integrity of the furnace through advanced modeling and natural gas additives. Libbey and BGSU are leading a Multiphysics modeling and insulation design project, while UToledo and O-I are investigating flame radiative heat transfer in glass melting furnaces via fuel chemistry and additives.

Burners Efficiency Characterization & Improvement: This project focuses on enhancing the burners used in glass melting furnaces, with the dual objective of improving energy efficiency and increasing heat transfer from the burner flame to the glass melt, while avoiding localized high-temperature zones that can prematurely age furnace refractories. UToledo has begun working toward flame reshaping and crown protection technology for regenerative glass furnaces. Evaluation and implementation of flat flame variable impulse burners is being led by NSG, and oxy-fuel burners comparison is being led by O-I.



Dr. Zhao & Dr. Heben Consulting on NOIC Research

Melter Refractory Wear Monitoring: This research focuses on improving furnace longevity through refractory monitoring systems. These systems will provide operating teams with valuable information to adjust preventative maintenance activities and schedule furnace rebuilds more accurately. Libbey and BGSU are collaborating on the in-house melter sidewall wear monitoring system. Refractory embedded temperature sensor innovation is being led by Owens Corning.

ALTERNATIVE FUELS

This project focuses on implementing alternative, sustainable energy sources that could be utilized in the glass melting process instead of natural gas, such as hydrogen, ag waste methane, and bio-fuel.

This research has been modified to focus on safety analysis for forehearth heating with hydrogen. This focus area has never been studied and requires thorough understanding before implementation to ensure safe operations.

The team has recently recalibrated their scope to align with the industry's shifting need for alternative fuel conversion solutions. O-I is leading the determination of proper burners for testing, and the team is collaborating with CSA Laboratory to develop protocols for the hydrogen research.

ELECTRIFICATION

The electrification pillar centers on converting multiple major parts of the melting process to be powered by electricity, with main focuses being forehearths and annealing lehrs. Benefits of electric conversion include decarbonization, energy savings, and quality optimization.

Libbey will pilot forehearth electrification and evaluate system performance in terms of decarbonization, energy efficiency, functionality,

operability, and glass quality. O-I will lead annealing Lehr electrification and evaluate the modification for decarbonization and energy efficiency.

ECONOMIC IMPACT

The tables below show the current economic impact achieved across NOIC projects, as well as our progression toward the projected total impact since inception, per Implan analysis.

THE NOIC COMMUNITY

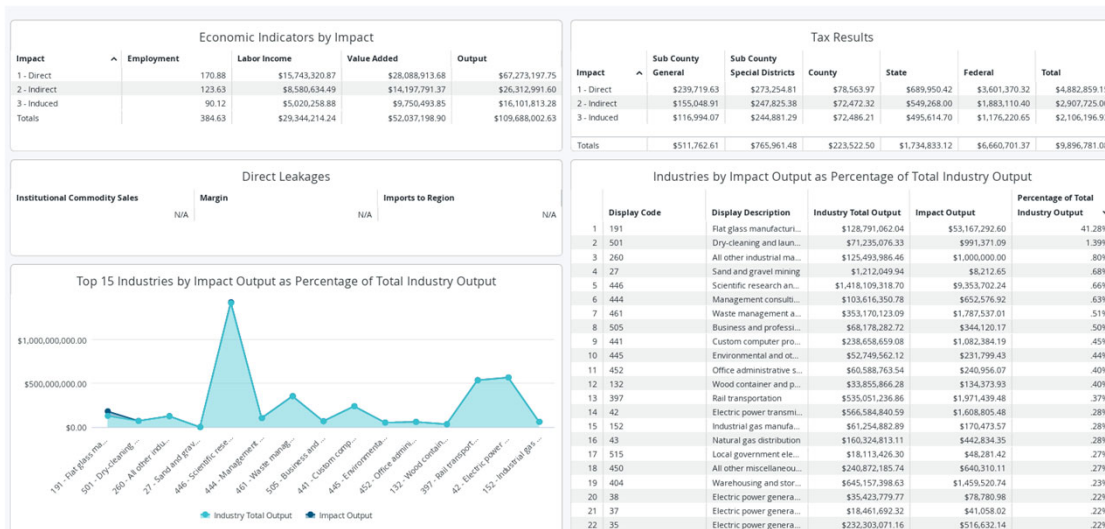
As NOIC's mission to foster collaboration between industry partners, higher education institutions, and economic development organizations continues to flourish into tangible results, we look forward to more regularly updating our community on our exciting progress. Thank you to all who collaborate with us as we work toward a more innovative, sustainable future.

Sincerely,
The NOIC Team

* Implan Generated

NOIC Innovation Hub Metrics: Q4 2024-Q1 2026

Metric:	Description:	Target Value	Progress Total	% Complete:
NEW FTE JOB CREATION	Focus on middle tier suppliers, university researchers, and manufacturing R&D Engineers	1,600	162	10.13%
TOTAL ECONOMIC IMPACT	This is defined as New Catalyzed Investment, New Research Dollars, and Outside Capital.	\$284,000,000	\$109,688,002*	38.62%
NEW STATE TAX REVENUE	This is new company taxes for corporate activity (CAT), new employee income tax, new Ohio resident tax, New Ohio Sales Tax, New Gas & Excise Tax	\$25,000,000	\$1,176,220*	4.70%
NEW STEM GRADS	This is for completion within 5 years, covering Associates, Baccalaureate, and Graduate degrees	230	62	26.96%



If you want to go fast, go alone. If you want to go far, go together.