EXHIBIT N

PUBLIC EDUCATION FOUNDATION

Proposal To: CO2 Cy Pres Settlement Fund

Expanding eLabs to Broaden Hands-On Environmental Education

Increasingly, students need opportunities to engage in hands-on learning with advanced technology as they develop the skills needed to address the complex challenges associated with clean energy, environmental sustainability, and engineering in the 21st century. The eLabs piloted in Hamilton County, TN, have emerged as an innovative model that is transforming how we prepare students in **environmental education, remediation,** and **engineering.** These digital fabrication labs are integrated into K-12 schools where specially trained teachers blend advanced manufacturing and physical computing technology (like 3D printers, laser cutters, and CNC machines) with environmental education concepts (like sustainability and waste reduction) to empower students to solve complex problems. The Public Education Foundation (PEF) has led the development of this initiative and has been identified as a global leader for effectively integrating engineering and environmental design into the education experience for K-12 students. The unique model PEF has cultivated to embed eLabs in schools has resulted in 100% of the eligible labs earning full *Fab Lab* status as determined by the Fab Foundation from MIT (www.fablabs.io). Additionally, in 2020, the model was highlighted by *Hundred.org* (a Finland-based non-profit organization that vets top innovations in education globally) as a top innovation in education that is primed for scaling.

Over the past five years, while pioneering this innovative model, PEF has developed a vetted, comprehensive solution that provides the necessary supports to successfully embed sustainable, environmentally focused eLabs in K-12 schools. Specifically, our team provides (1) a competitive selection process to identify schools that are ready to thrive with a lab, (2) customized purchasing and procurement services to outfit the labs, (3) extensive, research-based professional development for teachers and administrators, and (4) ongoing technical professional development for teachers to ensure they embrace best-practices with advanced manufacturing and environmental engineering technology. Since establishing the pilot lab in 2014 and growing the network since 2017, PEF has worked with numerous corporate and community partners to refine the model. Increasingly, the labs have strategically shifted to embrace a sharp focus on environmental education as the teachers and leaders design carefully crafted projects around the *National Academy of Engineering's Grand Design Challenges*. These are 14 global challenges for the 21st century, including, "Make solar energy economical, restore and improve sustainable urban infrastructure, provide global access to clean water, provide energy from fusion, manage the nitrogen cycle, and develop carbon sequestration methods."

Locally, Hamilton County Schools has realized the impact of digital fabrication, thanks in large part to the $1m catalytic investment from Volkswagen Group of America in partnership with the State of Tennessee and PEF in 2017. As the eLab network has grown and scaled across our region over the past five years, the impact on student development has garnered national interest from school districts and corporate and philanthropic partners alike, with more than 1,800 leaders from 41states and nine countries touring the labs since 2018. In addition to leading the eLab network in our region, Michael Stone, vice president of innovative learning at PEF, has led the development of 17 labs in Milwaukee Public Schools and in rural regions around Bloomington, IN. This effort has uniquely positioned Mr. Stone as a leading expert in eLab integration in schools and the model has been recognized and supported by Volkswagen Group of America, the G.E. Foundation, and Regional Opportunities Initiative of Central Indiana. Since 2019, Mr. Stone has presented the model at more than 20 national and international convenings including giving a U.S. Senate Briefing, delivering the keynote speech at

the IPGKBA STEM Colloquium in Malaysia, FabLab BootUp in Portugal, and at the U.S. National Governor's Association National Convention.

The effort to scale eLabs in schools serving students from economically disadvantaged backgrounds has been central to the model since the beginning. We continue to work to mitigate and ultimately eliminate the well documented gender, racial, and socio-economic gaps in STEM fields. Exposing students from underserved communities to the kinds of hands-on, technology-enhanced learning that is pervasive in eLabs, helps bridge opportunity gaps and supports students as they work to identify their unique interests and aptitudes in STEM fields. Since 2017, 41 of the 47 labs we have established have been opened in Title I schools that predominately serve economically disadvantaged students in rural and urban communities. Embedding rich learning experiences in labs where students use advanced technology to have authentic experiences with environmental engineering, artificial intelligence systems, and physical computing is transforming how we prepare *all* students for success.

Building on our extensive experience developing and refining the model, PEF is uniquely situated to manage the entire process, working in close collaboration with partners and school districts. While the technology in the labs improve the quality of products/solutions students can produce, community members and corporate partners play a vital role in ensuring the labs are relevant and maintain a high degree of rigor. As teachers engage in our professional development model, they are trained to cultivate relationships with corporate and community volunteers who can provide critical mentoring for students and guidance for development of projects.

We are eager to continue to scale the model across our region and expand into other regions around the country. PEF proposes a $5.3m investment to expand access to environmental education, remediation, and engineering through the labs to 17 schools in the Hamilton County, TN region and to 17 schools in the Fairfax County, VA region (or another community upon mutual agreement). The team will place a specific emphasis on selecting Title I schools in both regions to ensure access is provided for students from economically disadvantaged communities.

PEF and our partners have the capacity to **expand the eLabs in up to five more targeted communities** across the country if additional funding is made available.

Under the proposed investment, PEF will work with the specified school districts and our partners to provide the comprehensive support necessary to effectively embed eLabs in 34 schools, providing approximately 25,000 more students access to innovative learning in eLabs in public schools. As noted above, this support includes: (1) a competitive selection process to identify schools, (2) customized purchasing and procurement services, (3) instructional professional development, and (4) ongoing technical professional development. PEF will serve as the fiscal agent providing financial compliance and oversight for the entire investment. PEF has a 33-year history as a 501c3 without audit findings while managing multiple multi-million-dollar contributions and partnerships from a range of partners including Volkswagen Group of America, Bill and Melinda Gates Foundation, Carnegie Corporation of New York, G.E. Foundation, National Science Foundation, AmeriCorps, and the U.S. Department of Education.

Proposed Budget

TOTAL PROPOSED CONTRIBUTION: $5,321,000

DELIVERABLES

- **34 total labs** outfit to qualify for Fab Lab certification through the Fab Foundation from MIT (17 in Hamilton County Schools and 17 in the Fairfax County, VA region or another community upon mutual agreement)
- Strategic curricular modules and learning strategies designed around **environmental education**, **remediation**, and **engineering**
- Three years of **professional development** and support for up to 5 teachers and two administrators per school (total of 238 professional educators fully trained)
- Three years of annual reports from **research** and **documentation**
- Three years of **Chattanooga Fabrication Institute** available to teachers to highlight and share the impact and expand interest in the lab model

COST PER LAB

- $70,000 Equipment and Supplies
- $10,000 Facilities updates/retrofitting
- $35,000 Initial professional development and three years of ongoing support
- $25,000 Professional services, procurement, and technical support for three years

PROGRAM SUPPORT

- $200,000 Three years of support for the expansion of a secure, web-based student portfolio and mobile companion application used to track student development in the labs (the alpha version of the app is currently under development with initial backing from ESSER funding awarded through Hamilton County Schools and the State of Tennessee)
- $225,000 Three years of support for the continuation and expansion of the Chattanooga Fab Institute that exposes teachers across the country to the innovative work in the labs (the past three years of the Fab Institute have attracted more than 150 teachers each from year from more than 30 states)
- $160,000 Three years of support for research and documentation of the model to ensure efficacy is maintained throughout the scaling process and to identify and report on key performance indicators throughout the process

Appendix A – Environmental Focused Curricular Examples

The eLabs are designed to expose students to rich learning opportunities in environmental education, remediation, and engineering through hands-on engagements with advanced manufacturing and rapid prototyping equipment. The lab teachers work through professional development provided by PEF and our partners to develop units that are uniquely designed to empower students to develop a deep understanding of environmental education, remediation, and engineering. These units cover a wide range of topics from Kindergarten through 12th grade with several examples listed below:

- 8th grade physical science students created and tested solar powered boats that used solar cells to power micro-controllers to empower the boats to navigate aquatic mazes autonomously. The students measured the voltage requirements and physics forces at play on the boat to analyze the potential for solar power use at full scale.
- Grade 6 through 10 students conducted an English Language Arts project in partnership with their science courses. The unit began with students reading "The Boy Who Harnessed the Wind" and then watching the TED Talk by William Kamkwamba. They analyzed his unique windmill design and engaged in a unit that challenged them to create their own windmills capable of moving predetermined masses. The project focused on wind energy, dynamics, and the basics of clean energy engineering and circuitry.
- 10th and 11th grade biology students were challenged to use the labs to create a prototype solution for a current environmental problem. One of the teams developed a hydro-electric simulator that used 3D printed scale model turbines and microcomputers to create a wave tank that could test innovative turbine designs in an effort to optimize turbine design for maximum electrical output. The group worked in partnership with local electric power providers to assess their designs and work through iterative feedback loops to improve their understanding of fluid mechanics in the context of sustainable energy.
- Each of the labs were privileged to work in partnership with two female students who visited from Kenya. The two high school seniors from Kenya facilitated a project with students in the labs based on a model they had invented in their village. Students used cow urine to catalyze oxidization in dead C and D-cell batteries to bring new power from the dead cells. The Kenyan students discovered this method in their village and, after winning a national award, brought the project to our students who began experimenting with alternative catalytic sources to make alkaline batteries a more sustainable and equitably distributable form of electric energy.
- Since 2018, middle school and high school students have participated in the national Green Prix competition in which they build and modify derby-style electric go-karts as they work with engineering partners to create clean energy solutions to power the vehicles. The students create the exterior for the car using as many recycled materials as possible and they learn how to charge the batteries for their car using renewable energy from solar power and other sustainable sources. The students spend the fall semester building, testing, and modifying their vehicles. Then, in the spring, they work participate in regional, state, and national competitions where student teams drive their cars and work the pit to constantly improve their designs.