

**A. Project Summary:** The Bethel School District (BSD) *Green STEM* program will develop curriculum and a network of STEM partners to engage at-risk and traditionally underserved populations of high school students in a project-based, interdisciplinary STEM program focused on the growing ‘green energy’ sector. The *Green STEM* program will use traditional and green energy issues and production concepts (drawing on scientific inquiry, engineering principles, social and environmental issues, and embedded mathematical principles) in a multi-year program which will expose and prepare students for high-skill career and college pathways. Students will develop individual career pathway plans and begin their transition from high school to postsecondary career pathways through pre-apprenticeship programs, college coursework, and internships.

Students will complete the classroom and field portions of the program (earning credit in math, science, applied, art, and social studies) in a team-taught, interdisciplinary program within a cohort of fifteen students. The small class sizes and STEM focus will increase engagement in relevant learning experiences that will improve student success in school. Program partners will host workshops, field studies, pre-apprenticeships programs in the energy related industries, energy related job shadows, and long-term internships (in the public and private sector). This program will increase enrollment, through Lane Community College, in career pathways and two and four-year degree programs requiring science, technology, engineering and math skills.

**B. Project Narrative:** *Rationale:* The Bethel School District (BSD) serves approximately 5,700 students in Northwest Eugene, one of two Promise Neighborhoods in Lane County targeted for social and educational services. The district includes many “voucher motels,” a women’s shelter, transitional housing for released prisoners, and proposed homeless camping sites. Many Bethel students are raised in households with no family history of college attendance.

To increase achievement for all students on statewide assessments, meet the 40-40-20 goal, and serve the needs of economically disadvantaged and minority youth, there is a critical need to create STEM/STEAM and CTE courses that integrate science, technology, engineering, and mathematics. The Green STEM program will be appropriately situated at Kalapuya High School (KHS) in the Bethel School District. Kalapuya serves the most at-risk students in the Bethel district; 100% of the students in this school are ‘at-risk,’ nearly 80% qualify for free or reduced lunch, and the student body includes 23% special education and 30% minority students. Bethel passing rates for the Essential Skill of mathematics roughly mirrors Oregon’s results statewide – only 58% of economically disadvantaged students and 40% of African-American students have met or exceeded the 11<sup>th</sup> grade benchmark. Minority and economically disadvantaged students lag behind their peers in science scores and advanced level science and mathematics courses. The Green STEM program will directly confront this achievement deficit and support through a comprehensive, standards and proficiency- based STEM program, additional learning time, and targeted academic enrichment and support, and will matriculate students into dual credit math (MTH 095), science (SUST 101), and technology (RTEC 101) courses in high school.

**C. Project Plan:** *Objectives:* The Bethel *Green STEM* program will specifically target at-risk and underserved populations in a place-based, issue-oriented, and project-centered interdisciplinary program. Each student will create an individual career pathway plan which they

will follow as they matriculate through integrated high school STEM courses, complete dual credit college courses, and participate in field experiences, internships and pre-apprenticeship programs. *(See attached objectives for further detail)*

The *Green STEM* program will include a repeating 2-year engineering and design curriculum that fully integrates math, science, and engineering in a dedicated all-day program. This program will be required for all students at the school. By creating this program as part of our standard curriculum, Kalapuya will not only offer, but will require exposure to STEM principles and practice to hundreds of at-risk students in our district over time. The classroom portion of this program will engage students in the complete design cycle of needs assessment, design, testing, refinement, and implementation. An example of this approach is demonstrated by the Biomass stove project. During this portion of the program students will use global and regional data to assess the need for superefficient wood burning stoves. During the research phase of this project, student will learn the physics and chemistry of biofuels and combustion. Using computer software and air quality monitoring equipment they will discover the makeup of particulate pollution and how emissions are created during combustion. Students will then visit the rocket stove labs of StovTec and Aprovecho Research Center (both global industry leaders in developing this technology) to investigate design principles inherent in efficient stove production. Students will then begin the designing, creating, monitoring, and refining process while gaining meaningful quantitative math skills. Students will be trained to use industry protocols to measure air quality resulting from the burn, and will modify their designs to maximize efficiency while minimizing air pollutants. Local extensions will include a visit to the Seneca Biomass plant, coupled with a panel debate delivered by advocates for and against the local biomass plant. Students will then use air quality testing equipment to record and monitor

particulate levels in the local Bethel Area. Using GPS and Global Information Systems (GIS), students will create spatial data ‘layers’ to analyze the variables affecting air quality in their own neighborhood. Students will develop hypotheses about particulate variables and conduct field studies and analysis. Results will be shared with Lane Regional Air Protection Agency (LRAPA), the Bethel School Board, and the Eugene City Council.

Finally, the program will guide students in choosing from a number of personal extensions to pursue STEM related college (Lane Community College Energy Management Program, Regional Technical and Early College classes), and career fields (through Sheet Metal or Electrical Pre-Apprenticeship Programs and energy related internships).<sup>1</sup>

*Equity Lens:* The Bethel *Green STEM* program is specifically designed to support the 40/40/20 goal by engaging students at risk of not graduating. 100% of youth in this program will be ‘at-risk,’ and we will specifically target girls, minority and economically disadvantaged students. In particular, *Green STEM* creates a financial motivation to succeed for students from low socio-economic backgrounds by giving them real access to prosperous economic career tracks.

*Evidence Based Practices:* Kalapuya High School received a three-year School Improvement Grant (SIG) in 2011. Significant instructional and structural changes and a major staff initiative to increase family involvement raised the number of graduates with full diplomas from an historical average of fewer than six students per year (2009-11), to eleven graduates within the first year of the grant (2012), to thirty-three graduates in the second year (2013)<sup>2</sup>.

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<sup>1</sup> This typical unit demonstrates an example of the integrated, community-based, hands-on and authentic way in which students will access STEM content in the *GreenSTEM* program. Similar units will explore the contemporary issues, locally and globally, associated with hydro, wind, and solar power energy production.

<sup>2</sup> The increased number of graduates coincided with more rigorous graduation requirements in 2012 and 2013.

The *Green STEM* program will capitalize on the SIG achievement growth. In transitioning from SIG work to the work of the Green STEM program, teachers will continue to build on best practices through participation in Professional Learning Communities (PLCs), which will focus on successful STEM integration and instructional practices. Additionally, through close collaboration with real-world STEM community partners, teachers will improve authentic instruction and engagement.

*Challenge and Motivate Students:* The *Green STEM* program will require every participant to earn college credit before he or she graduates. Students will complete MTH 095, SUST101, and RTEC classes as part of the program, earning college credit and passing prerequisite courses for career fields before they graduate from high school. This program will work to eliminate financial barriers to higher education, as students will matriculate through a ‘transitions’ class (already in place at KHS), in which they will fill out financial aid forms, write scholarship applications, and complete placement exams. Through *Green STEM’s* network of community partners, the program will be able to provide multiple opportunities for every student to apprentice, as well as opportunities for some to begin trade programs that will lead directly to work in the green design and energy management fields.<sup>3</sup>

*Timeline:*

<i>Feb/March 2014</i>	College course articulation work; Syllabus and curriculum development
<i>April/May 2014</i>	Cohort 1 – Enrolls in RTEC 101; Develop STEM partnership agreements
<i>June – Aug 2014</i>	Final articulation of SUST 101; Curriculum finalized
<i>September/Oct 2014</i>	Cohort 1 – Enrolls in RTEC 101; Engaged in Internships Cohort 2 – Design/Build/Test Wind Turbines; MTH 095, SUST 101

<sup>3</sup> We are currently working with the Green Trades Association which offers work experience in the wind industry and related sheet metal and electrical trades. *Kalapuya currently places every senior in an internship or college class and has several STEM placements established.*

<i>November/Dec 2014</i>	Design/Build Rocket Stoves, test efficiency; Learn and use air quality testing protocols, mapping
<i>January/Feb 2015</i>	Cohort 2 enters transition program, RTEC 101, and college classes Cohort 2 begin internships & pre-apprenticeship programs Design/Build Hydrogen Fuel Cell & Solar Cell model cars, test efficiency
<i>March/April 2015</i>	Energy Audit training; Conduct Energy Audits for district buildings
<i>May/June, 2015</i>	Students Develop Energy Policy & District Recommendations Cohort 2, high school graduation and college matriculation

**D. Evaluation Plan:** The Bethel *Green STEM* program will be evaluated using multiple objective measurements including: Increased Mathematics Proficiency; increased passing rates for Oregon’s Essential Skills; dual college credit; Increase in number of students on STEM career pathways; attendance, credit attainment, and graduation rates; a robust pre- and post-assessment system which will measure changes in students’ awareness of, attitude towards, and sense of self-efficacy regarding green energy and STEM/STEAM career opportunities; and the number of students involved in field experiences, career fairs, and college and vocational site visits. (*See program objectives appendix for detailed measurement criteria*).

**E. Project Sustainability:** The Green STEM program will be sustained beyond the initial funding period of this grant. STEM funds will be used to *completely* develop curriculum, articulate college courses, establish long-term program partners, purchase necessary equipment, and develop internship sites that will be self-sustaining beyond the term of this grant. *The BSD will continue to support 2.0 FTE teachers and a .5FTE Education Assistant* to ensure the continuation of the Bethel *Green STEM* program. Bethel is also an integral part of the regional STEM Hub and Kalapuya will work with the regional CTE consortium to continually improve and expand services to students. (*Please see letters of support from long-term and new program partners that demonstrate ongoing support of the Green STEM program*)