

Hawaii's Pre-Engineering Education Collaborative (PEEC) for Renewable Energy and Island Sustainability (REIS)

Hawaii State Energy and Engineering Needs: University of Hawaii Response

According to the Energy Information Administration (EIA), nearly 90% of Hawaii's energy comes from petroleum, the highest rate of dependency in the nation, which contributes to Hawaii's highest overall energy prices. On January 28, 2008, Linda Lingle, Hawaii's Governor, and Alexander Karstner, Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy, signed an historic Memorandum of Understanding to establish the Hawaii Clean Energy Initiative (HCEI). HCEI aims to transform Hawaii into one of the world's first economies based primarily on clean energy sources. To accomplish HCEI goals, Governor Lingle has committed to transition Hawaii's energy infrastructure to 70% renewables by 2030. This commitment is the most ambitious clean energy goal in the nation, and possibly in the world, as renewables currently make up only five percent of Hawaii's energy consumption. Fortunately, Hawaii has an abundance of renewable assets including wind, wave, solar, geothermal, ocean thermal, and hydrogen renewable energy. Indeed, the Big Island of Hawaii generates a substantial portion of its power using wind and geothermal sources. However, the island of Oahu, the state's dense population center, has a much smaller percentage of power generated from renewable energy sources. Solutions to Hawaii's energy sustainability must have roots on Oahu and the other Neighbor Islands and the ten campuses of the University of Hawaii system aim to play a leading role in the education and research that will drive this endeavor.

To achieve these energy goals and to solve the difficult engineering, science, economic, and social problems that will be encountered, Hawaii must develop an educated workforce. Recently completed UH System Strategic Planning for 2008-2015 emphasizes the responsibilities of Hawaii's seven community colleges in training and transforming Hawaii's new energy workforce. The UH System Office of the Vice President of Academic Planning and Policy (OVPAPP) has been leading efforts to expand the existing best practice articulation and transfer process from two Oahu based community colleges, Kapiolani and Leeward, to the entire UH system, and supporting all community college students seeking baccalaureate engineering and all STEM degrees at UH Manoa, UH Hilo, and UH West Oahu.

Participants in a fall 2009 OVPAPP summit agreed to support a UH system effort to develop, in priority order: 1) online and distance learning capabilities supporting access for students on all islands to engineering and its prerequisite courses; 2) a plan for engineering, engineering technology, and technology education across the entire UH system that is appropriately articulated among campuses in order to maximize efficient and effective use of limited resources while addressing statewide needs; and 3) a commitment to improved student retention, thus providing a stronger pipeline (AA and AS degrees) to the UHM College of Engineering and increasing the number of engineering graduates (BS, MS, and PhD).

Of particular interest to the UH OVPAPP is the successful matriculation of Native Hawaiian students into STEM fields, and specifically into engineering, as the State confronts a deteriorating transportation, harbor, bridge, water and sewage infrastructure, beach erosion, rising sea levels, climate change, and the need for new mass transit and alternative energy systems. According to Linda Johnsrud, Vice-President, OVPAPP, "Our island state is caught in a confluence of resource shortages, insufficient local engineering talent, and the rapid deterioration of our island ecosystem and infrastructure. The new UH Strategic Plan for 2008-2015 recognizes the urgency of ecological and economic challenges confronting the State of Hawaii and places special emphasis on the role of Native Hawaiian students and communities in overcoming them." Dr. Johnsrud and Dr. Joanne Itano, Director of Academic Affairs, strongly support this Hawaii PEEC proposal, and will work closely with the campuses to develop, evaluate and sustain a multi-campus Pre-Engineering Education Collaborative (PEEC) beyond the grant period.

All the Hawaii PEEC community colleges are designated as "Native Hawaiian Serving" by the U.S. Department of Education's Title III program. On these five campuses, Native Hawaiian students currently comprise between 13 and 30 percent of total student enrollment. This PEEC project will enable the

community colleges to transfer more Native Hawaiians to UHM where Hawaiians remain significantly underrepresented.

Hawaii PEEC Program: Organization

Lead Campuses

Kapiolani Community College, one of ten campuses in the University of Hawaii (UH) system, and a leading TCUP institution, is proposing the development of a “Pre-engineering Education Collaborative” that will support 125 Native Hawaiian students pursuing and completing baccalaureate degrees at the UH Manoa College of Engineering (UHM COE). The Kapiolani STEM program has a strong NSF track record and will be leading the consortium with the UHM College of Engineering to support the development and sustainability of a multi-campus collaborative to produce more Native Hawaiian baccalaureate-degree engineers “for a global economy and growing interest in invention and production of green technologies and sustainable energy production.”

Kapiolani Community College and the UHM College of Engineering have been collaborating for more than a 15 years on a “Pre-engineering” articulation and transfer program. In fall 2005, Kapiolani received a Tribal Colleges and Universities Program award to develop four transfer pathways for Native Hawaiian students. One of these is the “Engineering and Space Science” pathway within the college’s ASNS Degree in Physical Science leading to the UHM COE. Between 2005 and 2008, 50 Kapiolani students have entered the UHM COE baccalaureate degree program, and ten of these students are Native Hawaiian. As of December, 2009, 257 Native Hawaiians were served by the KCC TCUP program and 203 of these students are trackable using the UH Banner Information System. Of these 203, 29 transferred to a UH baccalaureate campus, 16 graduated with an associate’s degree or a certificate, and 130 are still enrolled in colleges in the UH system. More than two-thirds (67.49%) are successful as transfers, graduates, and/or currently enrolled students.

The college currently employs 14 full-time faculty teaching in this Engineering pathway and many of these faculty integrate undergraduate research and community service into their Chemistry, Physics, Information and Computer Science, and Engineering courses. Kapiolani also has a full-time STEM Outreach Coordinator and a state of the art STEM Learning Center to support the academic success of Native Hawaiian and other talented STEM students. Kapiolani has implemented eight successful four-week, nonresidential, summer bridge programs to prepare Native Hawaiian students for STEM success. The College is an active partner in the NSF-LSAMP Islands of Opportunity program and is leading the Diversity, Education, and Workforce Team in the recently funded Hawaii EPSCoR program. Substantial funding from the U.S. Department of Education and the Hawaii State General Fund has also advanced the college’s STEM program.

The UHM COE offers degrees in civil, electrical and mechanical engineering. In civil engineering the focus includes seismic and wind engineering for structural design. Electrical engineers are breaking new ground in areas such as coding and information theory, computer communications, satellite communications and error control systems for space communications. In mechanical engineering, technologies are studied to provide pure water and plentiful alternative energy -- creating power from geothermal, deep ocean water and biomass sources. Other prominent areas in mechanical engineering are heat transfer in porous media and geothermal systems, as well as use of chemical reactions in supercritical water to produce high value chemicals from sugars.

The College of Engineering, in collaboration with the State and University of Hawaii, actively cooperates with research agencies such as the Pacific International Center for High Technology Research, Natural Energy Laboratory of Hawaii and the university's Water Resources Research Center, Hawaii Natural Energy Institute and Sea Grant College Program. Cooperative research projects include the use of underwater vehicles to explore the ocean floor, discovery of materials that corrode slowly when exposed to seawater and development of computer vision techniques to see underwater. The central Pacific location of the college and its research agencies afford faculty and students with unlimited opportunities

for pursuing high technology research in the Asia-Pacific region. Today, the College of Engineering benefits from intense international research interest and participation—a trend which ensures a progressive, well-funded and visible high technology research environment far into Hawaii's future.

The UHM COE's Native Hawaiian Science and Engineering Mentorship Program (NHSEMP) program has been very successful in increasing the number of Hawaiian students in STEM disciplines, and improving retention of undergraduate engineering students. Over the last 5 years, NHSEMP has completed K-12 outreach activities to 1500 Native Hawaiians annually, and implemented seven-week Summer Bridge residential programs emphasizing math skills acceleration and undergraduate research opportunities. NHSEMP has been a leader in two NSF Louis Stokes Alliances for Minority Participation, one with Alaska universities and a second with two- and four-year colleges in Hawaii and the American-affiliated Pacific Islands.

Since its establishment in 2001, NHSEMP has increased Native Hawaiian and Pacific Island students enrolled in Engineering from 56 in 2001 to 109 students in 2006. With its increasing success, NHSEMP has obtained support from the NSF-LSAMP Islands of Opportunity program, U.S. Department of Education, Hawaii State Legislature, NASA JPL, and Siemens Building Technologies. The program has been able to reverse problems of low attraction and retention for Native Hawaiian student enrollment at the COE. NHSEMP has also initiated efforts to derive external funding for Graduate Fellowships for Native Hawaiian STEM scholars, and to authentically partner with the UHM School of Hawaiian Knowledge.

The UHM COE is developing a Renewable Energy and Island Sustainability (REIS) certificate that combines: (1) an interdisciplinary research team with expertise ranging from nanotechnologies and composites to optimization, game theory, and smart energy integration and smart grids to alternative energy systems and devices to biofuels, climate change, economics, policies, and sustainability, to innovative applications of renewable energies, (2) an interdisciplinary research and education program that will require students to work in teams on both cutting edge research and with companies in Hawaii and elsewhere working on energy and sustainability problems, and (3) Hawaii's abundant renewable energy resources (including wind, water, wave, solar, and geothermal) and closed island power grids that are more amenable to analysis and simulation functioning as a natural laboratory for renewable energy production, storage, integration, consumption, and applications, which can then be applied to larger systems, such as the national power grid.

The REIS program is currently designed such that its undergraduate and graduate students from various disciplines will obtain a certificate in renewable energy and sustainability upon completion of the program. An undergraduate curriculum in renewable energy, energy efficiency, and sustainability will be developed for each of three summer programs for PEEC cohorts. Currently the UHM COE offers required courses in "Introduction to Engineering Design" and "Junior/Senior Engineering Design," which integrate projects with emphasis on renewable energy and sustainability.

PEEC students transferring from the community colleges will be recruited into the REIS undergraduate program and have REIS graduate students available as mentors. Undergraduate students will participate in multidisciplinary research teams with other undergraduate and graduate students and with supervision from a faculty mentor. They will use the knowledge gained from their course work and industry internships to perform tasks on their research projects. This exposure to working on teams will help prepare our undergraduate students for the workforce and/or becoming a graduate student.

Participating Community Colleges

Between 2005-06 and 2007-08, the UHM COE has accepted a total of 75 transfer students from the six other UH community colleges: 51 from Leeward, 8 from Maui, 7 from Kauai, 4 from Honolulu, 4 from Windward, and 1 from Hawaii.

Honolulu Community College (HCC) offers a full range of pre-engineering courses to transfer to the UHM COE: English 100, Chemistry 161, 161L, and 162, 162L, Math 205-206 [UHM MATH 241-242],

and Physics 170 and 170L. It also has fully articulated courses in Civil Engineering, Electrical Engineering and Mechanical Engineering. PEEC funding should help develop sufficient enrollment to offer these courses on a regular basis. HCC has full-time, tenured faculty in Chemistry, Information and Computer Science, Mathematics, and Physics and faculty who have taught engineering courses. HCC recently used Carl B. Perkins funding to update its Physics laboratory equipment.

Leeward Community College (LCC) enrolled its first class of pre-engineering students in the fall of 1981. Since that time, between five and ten percent of the graduates of the UHM COE, have completed coursework at LCC. LCC currently employs full time, tenured faculty in Chemistry, Engineering, Information and Computer Science, Math, and Physics, and offers nearly every freshman and sophomore course on UHM COE's transfer check sheets for each of its three undergraduate majors. Both the Liberal Arts and STEM courses offered at LCC are fully articulated with UHM COE. Students who complete a core consisting of English 100, Chemistry 161, 161L, and 162, 162L, Math 205-206, and Physics 170 and 170L, with a grade point ratio of 3.0 or higher, can transfer directly to the UHM COE. Those students who choose to complete all their freshman and sophomore engineering coursework at LCC, and who earn an average grade point ratio of 3.0 or higher, transfer seamlessly to the UHM COE with junior standing in all three majors. One LCC engineering professor serves as the UHM COE Student Advisor and works with LCC students, the UHM COE's admissions, and advising staff to facilitate the transfer process. In addition, representatives from the UHM COE periodically give transfer workshops for students at the LCC campus.

Windward Community College (WCC) offers the appropriate pre-requisite courses in chemistry, physics, and mathematics to prepare students for admission to the UHM COE. The college's laboratory and field facilities offer students the opportunity for an unparalleled hands-on introductory experience in biotechnology, aquaculture, reef studies, oceanography, earth sciences, and ethnobotany. WCC student counselors and faculty have a history of working together to form learning communities and other cohort learning programs to help students succeed in a variety of STEM classes. The student cohorts who complete the proposed WCC PEEC program will have been exposed to a range of science and engineering experiences that will allow them to make an informed choice of an engineering career. They will also have mastered the appropriate science and mathematics concepts to be able to succeed in baccalaureate studies. WCC proposes to focus on preparing a cohort of Native Hawaiian students in pre-engineering, and Bio-resources and Technology, with a focus on marine and environmental engineering, including habitat restoration, natural hazard mitigation, and climate alteration. WCC has held extensive discussions concerning developing a green-related curriculum focusing on alternative energy and sustainability, both energy-related sustainability and food and fiber-related sustainability studies.

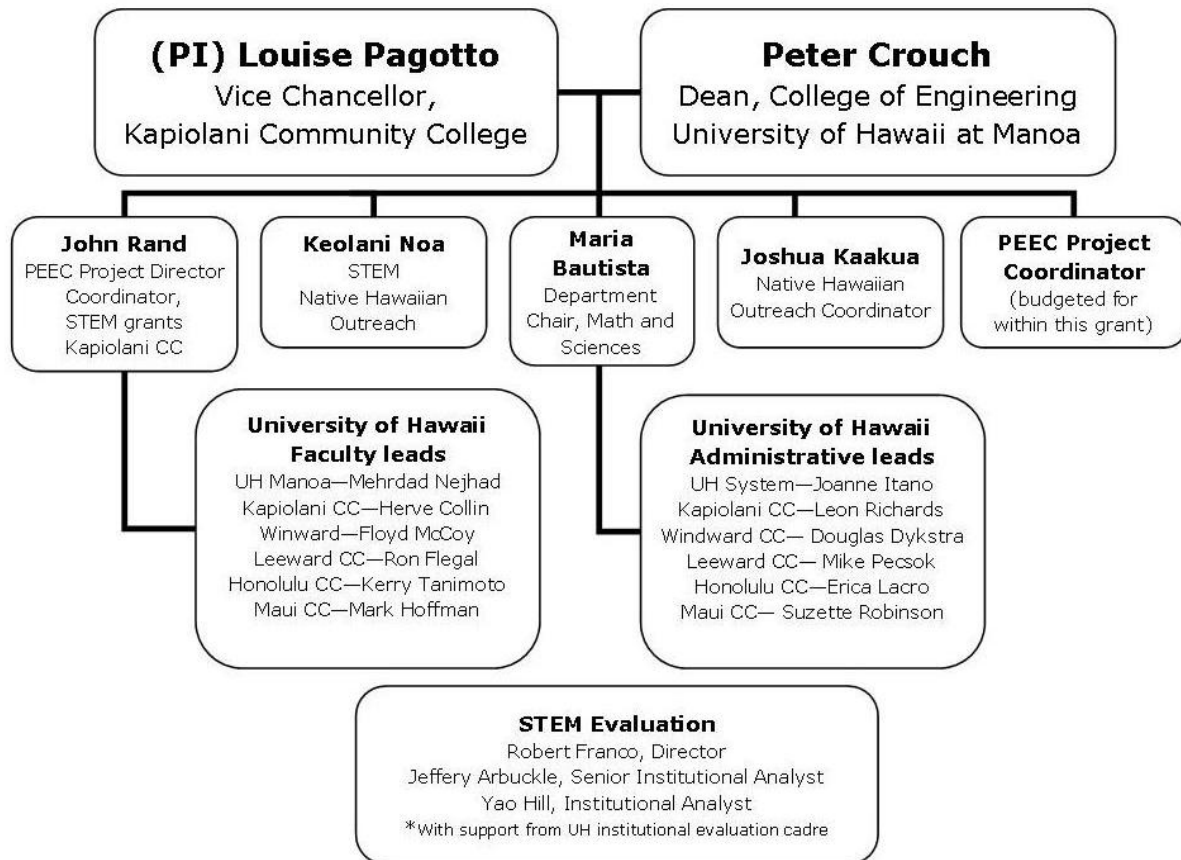
Maui Community College (MCC) offers freshman and sophomore pre-engineering courses tailored to the needs of students transferring into engineering at the University of Hawaii at Manoa or remaining at MCC to pursue the applied engineering baccalaureate. However, MCC currently has difficulty enrolling enough students in calculus and physics courses. MCC believes PEEC grant funding will help expand the engineering pipeline by funding low-enrolled calculus and physics sections while expanding outreach activities to recruit more students into an engineering pathway.

MCC supports Mayor Tavares' goal of 95 percent of County energy needs being met by renewable sources by 2020. To achieve this goal, MCC is working with state and federal agencies, utility companies, private businesses, other educational institutions, and non-governmental organizations. MCC's associate degree programs in sustainability include construction technology, introducing hybrid vehicles into the automotive curricula, integrating sustainable practices into the culinary arts, and integrating renewable energy systems into electronics and computer engineering. Moreover, MCC has introduced new sustainability-related baccalaureate degrees in Applied Engineering Technology and Sustainable Sciences.

MCC is a member of the Association for the Advancement of Sustainability in Higher Education, which provides a self-assessment tool of which sustainability across the curriculum comprises 30 percent of the total score.

Kauai Community College has also been successful in transferring students to the UHM COE but they will not be a fully participating campus in the Hawaii PEEC as their faculty and staff resources are limited and they are focusing their efforts on early STEM intervention in middle and high schools. They will engage their Native Hawaiian students in selected PEEC activities.

Hawaii’s PEEC Program: Management Plan



Dr. Louise Pagotto, Vice Chancellor for Academic Affairs at Kapiolani, has been deeply involved in UH system discussions on clarifying and strengthening transfer pathways to University of Hawaii baccalaureate institutions, and specifically the discussions with the UHM COE. She currently is the Principal Investigator for the college’s NSF STEP project. In the Hawaii PEEC she will continue to work closely with Dr. Peter Crouch, Dean of the UHM COE.

Dr. Crouch is a strong advocate for clear and strong transfer pathways and for Native Hawaiian student success across undergraduate and graduate education. Pagotto and Crouch will oversee the Hawaii PEEC while Dr. John Rand, Kapiolani STEM Professor and Grants Coordinator, will direct project activities. Rand will rely heavily on the Native Hawaiian expertise of Keolani Noa (KCC STEM Outreach) and Joshua Kaakua (Director, NHSEMP). A full-time project coordinator will be hired with NSF PEEC funds to plan and manage the multi-campus logistics, and to enable thorough formative evaluation. Faculty leads on each of the campuses will work with their academic and student affairs leaders and with Rand, Noa, Kaakua, and the project coordinator, to implement project activities.

Dr. Joanne Itano, UH Director of Academic Affairs, will closely monitor PEEC progress and provide UH system support for project success and long-term sustainability. Dr. Robert Franco, Kapiolani EPSCoR Coordinator and Director of the Office for Institutional Effectiveness, will build collaborations

with leaders in EPSCoR's diversity, education, workforce, and research components, and direct the formative and summative evaluation of the Hawaii PEEC. Franco oversees two professional research staff, Dr. Jeffery Arbuckle and Yao Hill, who will collaborate with institutional researchers at all the participating campuses.

Hawaii PEEC: Goal, Objectives, Activities and Outcomes

The Hawaii PEEC has one goal, two objectives, and ten activities resulting in four measurable outcomes.

Goal: Create, develop, evaluate and sustain a multi-campus Pre-Engineering Education Collaborative that will engage staff, faculty, researchers, and indigenous experts in a nurturing and rigorous support system for Native Hawaiian students pursuing and completing an associate degree in physical science and/or a baccalaureate degree in engineering.

Objective 1: Develop five Native Hawaiian students cohorts who will complete a 39-credit pre-engineering core curriculum, three Summer Experiences in Engineering with math acceleration, lab requirements and research opportunities, and cultural enrichment and REIS activities, and be supported by ongoing peer mentoring and advising support during each academic year to graduation.

Activities

- 1) Identify Native Hawaiian community college students successfully completing courses leading to the UHM COE, provide them with strong advising to complete the 39-credit pre-engineering core and with funding as peer mentors for entering high school cohorts. Provide Summer Experiences in Engineering focused on calculus and physics.
- 2) Recruit talented Native Hawaiian seniors from major feeder high schools into UH and Department of Education *Running Start* program, a statewide program that allows public high school students to attend college classes and earn both high school and college credits, engaging them in pre-engineering courses for college credit.
- 3) Across the five community colleges take advantage of ongoing "Achieving the Dream" initiatives funded by the Office of Hawaiian Affairs and Kamehameha Schools to identify promising Native Hawaiian STEM talent.
- 4) Advise these students on the courses required in the pre-engineering core curriculum, block schedule students into these courses to the maximum extent possible, and assemble these students into annual Summer Experiences in Engineering cohorts that will progress together over a three year period.
- 5) Provide funding, peer mentoring, and research enrichment opportunities for these students with funds from PEEC, the NSF LSAMP Islands of Opportunity Program, and the new Hawaii EPSCoR program.
- 6) Convene student support staff from each campus and develop a shared advising system, and an orientation, training, and enrichment program for successful Native Hawaiian pre-engineering students to assume funded peer mentoring and cohort leadership positions.

Objective 2: Develop high quality course, lab, and distance learning curricula, and research-based best practices, including community service and undergraduate research, so that students at each campus can access required pre-engineering courses, make efficient progress toward certificate and degree completion, and have a shared cohort experience during the academic year and summer sessions.

Activities

- 1) Convene lead and support faculty from each campus to review existing pre-engineering and math courses, develop strategies to improve success in all gatekeeper courses, identify gaps in the semester sequence of course availability, and develop three courses, Electrical Engineering 160, Electrical Engineering 211, and Physics 272, for online delivery to complement existing courses available on each campus.
- 2) Provide faculty development opportunities through Quality Education for Minorities (QEM) and other NSF-supported programs, such as SENCER, that advance best practices in the science of learning.
- 3) Develop pre-engineering “Energy and Sustainability” certificates at each of the four participating community colleges.
- 4) Develop a curricular bridge from the community colleges to the UH College of Engineering and their Renewable Energy and Island Sustainability program, and to prepare a green workforce for an alternative energies economy.

Outcomes

- 1) 125 Native Hawaiian students complete all of an **established** 39-credit pre-engineering core curriculum.
- 2) 125 Native Hawaiian students (25 per year) participate in four and six week “Summer Experiences in Engineering” programs at the community colleges and the UH Manoa campus, including the completion of three levels of “Energy and Sustainability” curriculum, research, and internships.
- 3) 50 Native Hawaiian students complete ASNS degree in Physical Sciences at Kapiolani.
- 4) 50 Native Hawaiian students complete the Bachelor of Science degree at UHM College of engineering.

Hawaii PEEC: Program Plans

Each of the participating campuses has Native Hawaiian undergraduates currently taking courses leading to transfer to the UHM COE, and these students will be provided with strong advising and funding as peer mentors to support the cohort experience outlined in Table 1.

After an intensive summer bridge program for recent high school graduates, Hawaii PEEC students will take a common and shared pre-engineering curriculum comprised of 12 three-credit courses and three one-credit labs. Table 1 below delineates these courses and labs, the semester and summer in which PEEC student cohorts will take them, their delivery mode (traditional and/or online, multi-week intensive), and courses and labs to be developed and delivered online to all campuses. Online PEEC courses will attract sufficient statewide enrollment to be sustainable over the long term. Further, online delivery can reach and support other minority-serving STEM programs nationally.

Table 1 Hawaii PEEC Cohorts: Curriculum and Summer Experiences in Engineering

Course/Lab	Semester/Summer Taken	Delivery Mode	Develop and Deliver Online
Senior Summer Bridge	Summer 1	4 wk intensive	
Math 135 Precalculus	1	Traditional	
Chem 161 General Chemistry	1	Traditional	
Chem 161L General Chemistry Lab	1	Traditional	
Math 140 Trigonometry	2	Traditional	
Chem 162 General Chemistry 2	2	Traditional	
Math 241 Calculus 1	Summer 2	6 wk Intensive	
Phys 170 General Physics 1	3	Traditional and Online	
Math 242 Calculus 2	3	Traditional and Online	

EE 160 Computer Programming	3	Traditional	To be developed online with PEEC funding
Phys 272 General Physics 2	4	Traditional and Online	To be developed online with PEEC funding
EE 211 Basic Circuit Analysis	4	Traditional	To be developed online with PEEC funding
Math 243 Calculus 3	4		
CE 270 Statics	4	Traditional and Online	
Phys 170L General Physics 1 Lab	Summer 3	4 wk intensive	
Phys 272L General Physics 2 Lab	Summer 3	4 wk intensive	
Transfer to UHM COE	5		
UHM COE Courses in Civil, Electrical, or Mechanical Engineering, and REIS	5-8		

Over a three-year cohort experience, Summer Experiences in Engineering (SEE) will emphasize strengthening math skills as they integrate with physics and engineering theories and concepts, engaging in Hawaiian cultural enrichment opportunities, completing Renewable Energy and Island Sustainability (REIS) curriculum, research, and internships, completing required Physics labs, and ongoing support from PEEC and REIS faculty, advisors, and peer mentor teams.

Also, over the three-year cohort experience, “Energy and Engineering” and REIS enrichment seminars will be offered each semester at all participating campuses. End-of-semester evaluation and celebration sessions will further build cohort cohesiveness.

The shared curriculum delineated in Table 1 will be available to Native Hawaiians and all students at all UH campuses. The SEE cohort program will only be available to Native Hawaiian students. In project years three through five, an increasing proportion of PEEC funding will support Native Hawaiian students to complete baccalaureate degrees in civil, electrical, and mechanical engineering, and the REIS Certificate. These supports will build on the substantial successes on the NHSEMP program and the integration of research-based best practices in engineering pedagogy, including peer mentoring, community service, internships, and undergraduate research.

Partnerships

Kapiolani Community College is providing leadership in the new Hawaii EPSCoR program. Robert Franco, Director OFIE, is heading the Diversity, Education, and Workforce (DEW) component of the EPSCoR project, along with David Sing, Executive Director of Na Pua Noe’au, a statewide organization supporting Native Hawaiians across the K-20 educational pipeline. This component will enable strong outreach to and partnership with public and charter schools as well as major Hawaiian community organizations and will align with very strong Native Hawaiian outreach and retention efforts already provided by Ms. Keolani Noa, STEM Outreach Coordinator at Kapiolani. The college is developing new partnerships with the Army Corps of Engineers, Johnson Controls and Chevron. The college is also an active partner with other TCUP colleges and has disseminated successful campus strategies related to program development, service-learning, undergraduate research, and evaluation through the TCUP and QEM workshops.

The UHM COE REIS team includes members from the Hawaii Natural Energy Institute which has substantial research expertise in many different renewable energy areas, as well as researchers and

educators in Economics, Urban & Regional Planning, Molecular Biosciences and Bioengineering, and Information & Computer Science, who are interested in renewable energy and sustainability research and education. All these partners have a distinguished research and education background in renewable energy and sustainability, and have received extensive funding from NSF and the U.S. Department of Education.

The REIS team is closely aligned with the State of Hawaii and industry in working towards implementation of the Hawaii Clean Energy Initiative. Our team will work closely with its electric power provider, Hawaiian Electric Company to develop the curriculum and to ensure that students are exposed to real energy and sustainability problems. Special attention will be given to the unique challenges that the Hawaiian Islands face with integrating an increasing amount of renewable energy to its isolated grid. Finally, the PEEC-REIS team has close associations with international institutions in Asia, Europe, and Canada.

Several LCC engineering students have had internships and/or part time employment with several local firms, including The AES Design Group Inc., Cedric D.O. Chong & Associates, Kiewit Corporation, and Tesoro Hawaii Corporation. MCC has important partnerships with Northrop Grumman Corporation, Oceanit, Maui High Performance Computing Center, Pacific Disaster Center, and Trex Hawaii.

To integrate sustainability into its construction trades programs, Honolulu Community College is a member of the U.S. Green Building Council, Green Advantage and National Association of Home Builders. HCC intends to engage successful UHM COE transfer students as mentors to students in its Construction Trades program.

Windward Community College partners with the UHM School of Ocean and Earth Science and Technology and Hawaii Institute of Marine Biology, Reefwatch and several other environmental non-profit organizations. They have also used substantial U.S Department of Agriculture funding to develop sustainability practices in biotechnology.

All the community colleges receive support from the Office of Hawaiian Affairs and Kamehameha Schools/Bishop Estate for their “Achieving the Dream” Initiatives to support Native Hawaiian success in English, Math, and other STEM gatekeeper courses. As a result, all the campuses have specific improvement interventions underway for all Hawaiian students, and many of the campuses have specific staff and learning center supports in place.

Evaluation

Four professional researchers in the Kapiolani Community College Office for Institutional Effectiveness will lead and conduct formative and summative evaluation using both qualitative and quantitative methods. These researchers will oversee a PEEC Evaluation Cadre comprised of institutional researchers at UHM and the four participating community colleges.

Formative evaluation will focus on the effectiveness of the PEEC management and development functions across the five years of the project. This evaluation will involve semi-annual structured focus group sessions with different project stakeholders, that is, administrators, faculty, and student support staff at each campus. Formative evaluation will also quantitatively track student progress across the common and shared curriculum and three Summer Experiences in Engineering. Key project effectiveness measures for Native Hawaiian students will include:

- 1) Course success rates, the percentage of Native Hawaiian students successfully completing PEEC course with “A,” “B,” or “C” grades.
- 2) Semester-to-semester re-enrollment rates from semester 1 to 8.
- 3) Summer-to-summer re-enrollment rates from summer 1 to 3.
- 4) First-year academic progress, percent completing 30+ credits (including general education courses) in year 1 (fall, spring, summer).

- 5) Second-year academic progress, percent completing 60+ credits in year 2 (fall, spring, summer).
- 6) Third-year academic progress, percent completing 90+ credits in year 3 (fall, spring, summer).
- 7) Fourth-year academic progress, percent completing 120 credits in year 4 (fall, spring, summer).
- 8) Number of enrichment seminars, community service, undergraduate research, internship opportunities completed by PEEC students.
- 9) Number of ASNS-Physical Science degree completers
- 10) Number of UHM COE Degree completers

PEEC students will also be engaged in annual structured focus group sessions. End-of-semester and end-of-summer student capstone essays with guided reflection questions will be assessed by faculty and student support teams at each campus using shared rubrics. Ethnographic methods such as observations, periodic free-writes, and interviews in classrooms, labs, and STEM Learning Centers will provide a deeper understanding of what is and what is not working for Native Hawaiian PEEC students.

Annual evaluation results will be reported to the Management Team and new improvement strategies will be planned, implemented, and assessed in annual completed feedback cycles.