

Chemical and Petroleum Engineering Department Plan 2009-2014

Mission and Aspirations

The Chemical and Petroleum Engineering Department provides outstanding educational preparation for students through ABET approved programs in undergraduate and graduate chemical engineering and petroleum engineering, as measured by our industrial, academic, and governmental constituents. The faculty perform nationally and internationally recognized research in areas relevant to Wyoming and the world. This research knowledge is disseminated in top-ranked scholarly journals. The faculty also provide service to the state and nation by working with professional organizations, serving on editorial boards, and working with industry and government consortia.

The department's aspiration is to maintain and build upon current excellence to address the frontier research challenges of the 21st century, particularly in the areas of energy and life, by developing and strengthening selected areas of expertise and depth in internationally recognized focus areas important to Wyoming, the US, and abroad. For chemical engineering, examples include biological engineering, materials research, coal conversion, and CO₂ capture and separation technology. For petroleum engineering, examples include interfacial surface science, improved oil recovery, unconventional natural gas, reservoir modeling and simulation, and CO₂ sequestration. The department will maintain and further develop its leadership role in support of the College of Engineering and Applied Science and the School of Energy Resources to be at the forefront in energy research for the state and nation.

Specifically, the department will train both undergraduate and graduate students to be leaders in emerging or transformational technologies. We must attract and retain leading researchers to address these challenges through ground-breaking research in areas such as advanced materials, nanotechnology, and next-generation energy technologies. As a small department with two programs, we will seek faculty with expertise that can be broadly applied to the focus areas. For example, thermodynamics, materials synthesis, or interfacial science expertise could apply to our planned areas of excellence in energy, life, and material science. The department will integrate education and research with industry to bring more high-tech value to Wyoming. Our educational programs will be positioned to be flexible to adapt to a rapidly changing world.

Previous Planning Accomplishments (see Appendix)

Relevant Institutional Issues

The Department of Chemical and Petroleum Engineering is in a unique position to strengthen several of the university's comprehensive areas of distinction, including energy, materials science, and life sciences. The department is an integral part of the College and the School of Energy Resources, and is home to two SER faculty involved in energy research (clean coal conversion and improved oil recovery), while a third position has been proposed in the area of energy catalysis. **The department is currently central to and expected to become a focal point for energy research at the university.** The department has faculty members who can provide future leadership at all levels of the university. Foremost, the department is critical to addressing the frontier challenges in the College of Engineering and Applied Science, including meeting the changing economic base by adding economic value, particularly in the areas of energy and life.

Action Items

Plans/Goals	Action Items
ACCESS	
A-1 Attract the best quality undergraduate students	<ul style="list-style-type: none"> - Increase faculty participation in high school recruiting to involve 8 faculty members. - Work with the College's Center for Student Services to achieve this goal. - Maintain current upper division undergraduate ChE class sizes in the 25-30 range, while increasing PETE class sizes to that number (approximately doubling).
A-2 Increase higher educational opportunities	<ul style="list-style-type: none"> - Provide wider opportunities for doing undergraduate research - Establish MS Quick Start program (in progress)
A-3 Increase proportion of female students to meet College goal of 25% of undergraduates and 35% of graduate students.	<ul style="list-style-type: none"> - Chemical Engineering has met and exceeded these goals; work to achieve goals in Petroleum Engineering through recruiting efforts in A-1.
EXCELLENCE	
EXCELLENCE: Department in general	
<p>E-1 Become a center of excellence for the university and the state in fossil fuel energy and biological engineering by building upon the foundation achieved in implementation of the previous department plan. Foremost, faculty numbers, especially Chemical Engineering (ChE), are below "critical mass," based on comparison with similar-sized, research active, PhD-granting research institutions. Increase faculty to a minimum of 24, 12 for each program.</p> <ul style="list-style-type: none"> - Increase ChE positions by 5, to strengthen coal conversion, materials science (synthesis, characterization, or computation), and biological engineering (materials synthesis, gene manipulation and expression, or biomedical). 4 of the 12 proposed ChE faculty are targeted in the biological engineering area, to play crucial roles in the life area by collaborating with other departments, such as Microbiology and Pharmacy. - Increase Petroleum Engineering positions by 4. The new positions would strengthen unconventional oil and natural gas recovery, interfacial surface science, and reservoir modeling and simulation. 	<ul style="list-style-type: none"> - Recruit and retain the best quality faculty: committed teachers, active researchers, collegial and service oriented leaders. - Work within established University CPM procedures and with the SER to convince the University and State of the central role of our department to the University and the State. - Work with industrial and private donors to generate named professorships and endowed chairs. - In addition to growth, prepare to replace 2-4 senior faculty due to planned or anticipated retirements. - New and existing faculty will work to create and participate in research centers in defined areas of excellence, such as Subsurface Flow, Unconventional Natural Gas Production, Coal Gasification (partnering with the High Plains Gasification Research Center and GE), and CO₂ Capture and Sequestration.

<p>E-2 Provide adequate staff to meet departmental needs by providing:</p> <ul style="list-style-type: none"> -Two state-funded shop positions (<1/2 exists), as existed prior to the ChE/PetE department merger. -Two new state-funded administrative positions. -Two state-funded academic professional positions (one for each program), not at the expense of the 24 faculty positions. 	<ul style="list-style-type: none"> - Work within established University CPM procedures to demonstrate the central role of our department for the University and the State. - Pursue other options for staff growth, including project funds and private
<p>E-3 Obtain necessary office and laboratory space to meet our growing department's needs</p> <ul style="list-style-type: none"> -The PETE undergraduate program was restarted in ~1/2 the space it originally had. -The department has grown by 50-100% in the number of faculty and graduate students over the past five years. Virtually all of this growth has occurred using existing space within the department. We are simply at a limit and future necessary growth cannot be accommodated within the department's currently allocated space. 	<ul style="list-style-type: none"> - Work within the College to obtain additional required space: office space is at the highest premium, but laboratory space is close behind. We need 3 offices and 2 ~1000 ft² labs now and 12 new offices and 10 new 1000 square foot laboratories with fume hoods to accommodate growth, depending on the mix of experimental and computational researchers that are hired. - Ensure that additional space is included in the new SER building plan. - Ensure that additional space is included in future College building plans.
<p>E-4 Create separate departments</p>	<ul style="list-style-type: none"> - Many of the departmental goals described in this plan will be facilitated by restoring Petroleum Engineering as a separate department. Separate departments are vital for the sustainability of the Chemical Engineering program and for the growth of the Petroleum Engineering program.
<p>EXCELLENCE: Undergraduate education</p>	
<p>E-5 Develop sustainable instructional laboratories. The current state of the instructional laboratories within the department is fair to poor. Despite some exceptional gifts in the Petroleum Engineering program, the department does not have the resources to maintain or improve these facilities in the future.</p>	<ul style="list-style-type: none"> - Explore and implement potential methods to provide necessary funding, including student use fees, differential tuition, and/or additional institutional/state funding. - Seek external funding from corporations and private donors.
<p>E-6 Enhance the quality of undergraduate education</p>	<ul style="list-style-type: none"> - Strengthen Chemical Engineering options + Developing Biological Engineering option - Strengthen PETE and ChE elective course offerings as faculty growth permits.
<p>E-7 Maintain ABET accreditation for Chemical Engineering program</p>	<ul style="list-style-type: none"> - Complete ABET Self Study - Perform continuous improvement evaluation by established Continuous Improvement Committee
<p>E-8 Obtain ABET accreditation for Petroleum Engineering program</p>	<ul style="list-style-type: none"> - Complete ABET Self Study - Perform continuous improvement evaluation by established Continuous Improvement Committee

EXCELLENCE: Graduate education and research	
E-9 Recruit and support the best quality graduate students, targeting an average of 3 PhD candidates per faculty member, while recognizing this will vary for individual faculty based on their teaching and service commitments and interests.	- Develop external funding to support these students.
E-10 Obtain Graduate Assistantship support for all first year graduate students. - Necessary to be competitive with other Carnegie STEM dominant institutions, as many other institutions provide this support. - Necessary for stable foundation for research excellence.	- Work within the College, University, and SER to increase the number of fellowships available to the 12-15 assistantships that would likely be required. - Establish corporate, private, and named fellowships to fill need. - Increase sponsored research
E-11 Effectively implement and manage the influx of facilities in the department - BP Rock and Fluids Lab completion - EnCana Reservoir Simulation Lab completion	- Departmental committees are currently working on both of these laboratories. - Develop funding for ongoing maintenance of these labs (possibilities identified above). - Identify areas of future need.
E-12 Enhance the quality of graduate education	- Strengthen graduate requirements + Establish required core courses + Improve the PhD examination sequence
E-13 Increase externally funded research	- Target \$5M/yr by targeting 4 research proposals and 1 new major grant (>\$100k) per faculty per year. - Target at least 50 peer reviewed publications per year when goal of 24 faculty is achieved.
E-14 Develop graduate program assessment similar to ABET for undergraduate programs	- Support College and Graduate School efforts in this area
LEADERSHIP	
L-1 Provide leadership in the energy and life areas for the state and nation	- Supported by previous goals/action items to recruit and retain talented faculty and to develop centers of excellence
L-2 Separate departments will provide many more leadership opportunities on College and University committees that require one or more faculty per department.	- Additional department head - Separate representation on college and university committees will provide more service opportunities.
L-3 Promote faculty visibility	- Increase service on national and international boards and committees
L-4 Promote collaboration with other institutions	- Within our defined areas of excellence, provide leadership for researchers in other institutions
L-5 Continue and strengthen the undergraduate professional society chapters (American Institute of Chemical Engineers, Society of Petroleum Engineers, and the American Association of Drilling Engineers) to provide leadership opportunities for undergraduate students.	- Strengthen faculty involvement. - Encourage student independence and growth by continuing to provide them with meaningful leadership opportunities.

Implementation

Action Item	2009		2010				2011				2012				2013				2014	
	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q
A-1 Access for quality undergrads																				
A-2 Increased higher ed opportunities																				
A-3 Increase enrollment by women																				
E-1 Center of excellence																				
E-2 Adequate staff																				
E-3 Necessary space																				
E-4 Separate departments																				
E-5 Sustainable instructional labs																				
E-6 Enhance undergrad education																				
E-7 Maintain ChE ABET accreditation																				
E-8 Obtain PETE ABET accreditation																				
E-9 Recruit top grad students																				
E-10 Obtain 1 st year grad support																				
E-11 Manage facilities influx																				
E-12 Enhance grad student education																				
E-13 Increase external research funding																				
E-14 Assess graduate program																				
L-1 Energy and life leadership																				
L-2 Leadership via separate depts.																				
L-3 Faculty visibility																				
L-4 Collaboration with others																				
L-5 Strengthen professional societies																				

Appendix: Previous Planning Accomplishments

Goals for 2004-2009	Status
Focus on energy and life	<ul style="list-style-type: none"> - Fully involved in energy research, with special emphasis in coal, petroleum, and CO₂ capture - Hired 1 new faculty member in the bio area
Undergraduate education <ul style="list-style-type: none"> - Enhance the quality of the undergraduate experience - Undergraduate recruiting and retention - Implement ABET accreditation process 	<ul style="list-style-type: none"> - Developed more flexible ChE curriculum and implemented new PETE curriculum with program restart - Achieved ChE target of ~25 graduates per year; both programs currently growing exponentially - ABET-mandated continuous improvement has become part of department culture
Graduate education and research <ul style="list-style-type: none"> - Stimulate externally-funded research - Enhance graduate education and research productivity - Exploit interaction/networking, both on and off campus 	<ul style="list-style-type: none"> - Exceeded goal of \$1M/yr external funding by factor of 2-3 - Exceeded goal of 20 peer reviewed publications per year; increased number of PhD students by factor of ~3 - Many ongoing collaborations with other campus departments and other universities and companies
Faculty visibility <ul style="list-style-type: none"> - Work to increase - Encourage outreach activity 	<ul style="list-style-type: none"> - Faculty and students have earned numerous institutional and national honors (e.g., AIChE fellow, 3 Hakes awards, 3 Graduate School outstanding dissertation awards) - External classes and symposia are active examples

