

**University of Wyoming**  
**Department of Chemical and Petroleum Engineering**  
**2004 Academic Plan**

**Focus on Energy and Life**

The Department of Chemical and Petroleum Engineering is focused on two areas of excellence, both of which are central to the UW Academic Plan:

- (a) Interface with energy and natural-resource sciences (petroleum, gas, coal, trona), a current strength, which is relevant to the local constituencies.
  
- (b) Interface with life sciences (biomaterials, an interface of life sciences and materials sciences), a new frontier with new funding, new jobs, and hence new students.

The Department is committed to this vision. Over the last two years the Department has made three excellent tenure-track hires: Dr. Youqing Shen, Dr. Matthew Rosinski (both in the bio area), and Dr. Morris Argyle (energy area). The Department has a faculty opening in the bio area to bring this area up to critical mass. In addition, the Department proposed a new opening for the energy focus, for example, to strengthen Dr. Morrow's area of interfacial phenomena. The Department needs a minimum faculty size of 12 to sustain both areas of focus.

**Action Items for 2004-2009**

The overarching goal of the Department of Chemical and Petroleum Engineering is to continue to build a research-active department with an excellent undergraduate program and students. The approach is (a) create a climate where the best faculty can be recruited and retained, (b) develop a cutting-edge curriculum, and (c) deliver the best instruction. The following points summarize the objectives, action items, status, and measurement for undergraduate education, graduate education and research, and faculty visibility.

**Undergraduate Education**

- Enhance the quality of the undergraduate experience.

Status: (a) Senior Design with plant trips have become a regular practice; these will be augmented by additional undergraduate field trips, for example, within ChE3000 (b) curriculum enhancements described below are being implemented, (c) an undergraduate research/experimental design experience will be introduced.

Action: Enhance Unit Ops Labs I and II, where one or more experiments will utilize on-line data acquisition and will incorporate fundamentals of process control. Continue emphasis on individual attention, and plant trips.

- Continue the undergraduate recruiting and retention effort; aim at about 25 graduates per year.

Status: Freshmen enrollment is up, new curriculum is in place.

Action: Use all means of recruiting, including HS visits, participation in the College recruiting program, HS teacher relations, CC relations, alumni, and scholarships.

- Implement the ABET accreditation processes.

Status: (a) The Advisory Board is functioning well (b) a faculty ABET/Continuous Improvement Committee has been formed and is active, (c) assessment processes are in place and functioning.

Action: Continue Advisory Board meetings and faculty ABET/Continuous Improvement Committee activities.

### Graduate Education and Research

- Stimulate externally-funded research; aim at \$1M in external funding per year.

Status: Our output of research results and publications has been consistently high, good proposals are forthcoming, new faculty hires generate proposals and funding, external funds are growing rapidly, and recruiting of graduate students produces good results.

Action: Promote evaluation criteria, teamwork, individual mentoring (esp. for junior faculty), and individual recruiting of graduate students through new contacts by recently recruited faculty.

- Enhance graduate education and research productivity; maintain the number of PhD students at around 14-16, aim at about 4 PhD graduates per year and at least 20 refereed publications per year.

Status: A new graduate curriculum and guidelines are in place, we publish much more than 20 refereed papers per year.

Action: Continue focusing TA stipends on new PhD students and offering competitive stipends.

- Exploit opportunities to interact and network with other departments and organizations, on and off campus.

Status: This has been a strength; many of our research projects and the EPSCoR faculty proposals in partnership with IER, Math, Chemistry, Geology/Geophysics, ME, EE, Physics, and Molecular Biology have been multidisciplinary, for

example, recent DoE/EPSCoR proposal on Carbon Dioxide Capture and Utilization, with IER, Math, and EE.

Action: Continue to encourage multidisciplinary projects, particularly with new faculty hires, for example, exploit other Enhanced Oil Recovery initiatives with IER, Geology/Geophysics and Math, and explore a Coal Bed Methane center or network.

### Faculty Visibility

- Work on increasing the visibility of the faculty.

Status: CPE faculty have earned teaching and research awards, Morrow has been elected to NAE.

Action: Continue to nominate faculty for memberships, honors, and awards, encourage attendance at national meetings.

- Encourage outreach-like activities by the faculty.

Status: Harris, Morrow, and Towler have been active in giving courses to industrial and SPE groups.

Action: Continue this activity.

## **ATTACHMENT: Progress on Action Items from the 1999 Academic Plan**

The College of Engineering 1999 Academic Plan listed the four primary college goals as:

Goal 1 - Continuously improve all aspects of the undergraduate experience.

Goal 2 - Enhance graduate education and research productivity.

Goal 3 - Increase the visibility of the College locally, regionally and nationally.

Goal 4 - Create an environment that motivates every faculty member to be fully engaged in the research, teaching, or service enterprise of the College.

Within this framework, the Department of Chemical and Petroleum Engineering established a number of action items. It should be emphasized that the 1999 Academic Plan formed the basis of a dynamic process, which has involved continued revisions and adjustments to our goals, objectives, and actions. Progress on major Departmental action items of the 1999 Academic Plan is summarized as follows:

### **Goal 1 - Continuously improve all aspects of the undergraduate experience**

Departmental action items:

- Form a Department Advisory Board
- Explore curriculum changes and make modifications where deemed appropriate

Progress:

A Departmental Advisory Board has been formed and meetings were held in December 2001 and 2002. The Board has been invaluable in providing planning and direction for program goals and assessment. The Department has just completed a major revision of the undergraduate curriculum. This is discussed further in the next sections.

### **Goal 2 - Enhance graduate education and research productivity**

Departmental action items:

- Supplement our State Teaching Assistantships to make UW more competitive with other institutions.
- Reduce the formal coursework requirement for both the Plan A MS and PhD.
- Revise the PhD qualifying examination to deemphasize discipline specific material.
- Maintain a core of faculty who specialize in minerals extraction and processing.
- Obtain a half-time position for technical support of departmental research.

Progress:

Over the last several years supplements and adjustments to TA stipends have been increased significantly; we must continue to work to be competitive. Formal coursework for graduate degrees has been reduced, to enable students to tailor coursework and focus more on research; in addition, discipline specific material for the PhD qualifying process has been greatly reduced. The number of PhD students has gradually increased, for example, 1999-7, 2000-9, 2001-11, 2002-14, and 2003-17. We continue to maintain core faculty competency in minerals. We developed internally consistent Graduate Guidelines for the ChE and PETE programs. A half-time, state-funded technical position was added to support departmental research.

### **Goal 3 - Increase the visibility of the College locally, regionally and nationally**

Departmental action items:

- Provide travel funds assistance for faculty presenting at national meetings.
- Place greater emphasis on publication in the premier, refereed journals.
- Keep the Departmental website current.

Progress:

Due to shrinking support budgets, travel assistance remains a problem. Faculty of the Department have an excellent recent record of publication in premier, refereed journals; this will continue to receive emphasis. Through combined College and Department efforts, our website is current.

Goal 4 - Create an environment that motivates every faculty member to be fully engaged

Departmental action items:

- Adjust faculty workload in an ongoing manner as individual goals change.
- Nominate and support faculty for appropriate awards.
- Encourage faculty consultations with industry and government agencies.

Progress:

The College and University administrations are aware of salary disparities between UW and comparator institutions. During the last State budget cycle, the University made significant steps toward reducing disparities. Undoubtedly this will remain a focus for the University administration. The Department strives to be responsive to the faculty needs listed above; documentation of awards, editorships, and industry and government consultations and interactions is available.

**Curriculum**

The first two goals of the College of Engineering 1999 Academic Plan were (1) continuously improve all aspects of the undergraduate experience, and (2) enhance graduate education and research productivity.

A major factor in meeting these two goals is the development and implementation of forward-looking, formal undergraduate and graduate curricula. Since adoption of the 1999 Academic Plan, the Department has completed major revisions of both the undergraduate and graduate curricula.

Undergraduate Curriculum

Several factors motivated and informed the desire to update the undergraduate curriculum:

- The need to meet the changing face of chemical engineering by increasing the emphasis on life sciences and biological processes, while maintaining a strong physical sciences component.
- The desire to add a “Bio Option” to our programs to address the first factor and to provide additional recruiting opportunities.
- The need to successfully complete the accreditation process discussed in the next section, to correct weaknesses and deficiencies in the current curriculum, and to improve the curriculum in ways suggested by the continuous improvement process.
- The desire to reduce curriculum hours to 128 and thus pro-actively address University needs.
- The requirement to implement the new 2003 University Studies program.

After careful consideration, in Spring Semester 2003 the faculty of the Department adopted a new curriculum for the B.S. in Chemical Engineering which addresses each of the above factors.

Several points are worthy of specific note:

- All students will be required to take BIOL 1010 - General Biology I, which is a prerequisite for subsequent life sciences courses and will give our students an excellent introduction to this field.

- A “Bio Option” has been added to our existing Petroleum, Environmental, and International options; this should be very popular with those students interested in bioengineering applications, manufacture of pharmaceuticals, and pre-dentistry or pre-med programs.
- The new curriculum meets the University Studies Program requirements which will become effective Fall Semester 2003.
- The curriculum totals 128 hours, while maintaining strong components in mathematics, physical sciences, and engineering sciences.
- Several of our current offerings in the core chemical engineering curriculum have been strengthened to address specific recommendations made during the ABET/Continuous Improvement process.

### Graduate Curriculum

A major effort was also undertaken to improve the graduate curricula of the Department. A new curriculum was adopted Fall Semester 2002, which requires students to take at least four core classes from six areas of chemical and petroleum engineering, as well as one course in mathematics, statistics, or computing. Significant changes were also made in other graduate studies requirements, including preliminary and qualifying exams and seminar requirements.

### Departmental Cohesiveness

A major effort has been undertaken to integrate Chemical and Petroleum Engineering into a coherent program. This has been accomplished, for example, we share the same TA pool and consistent graduate coursework guidelines.

### Assessment

Assessment and improvement of Department programs is a key component of our mission. A major factor driving assessment is the necessity for our undergraduate programs to remain accredited. Undergraduate programs in the College of Engineering are accredited by a national Accreditation Board for Engineering and Technology (ABET) of the Engineering Accreditation Commission (EAC). New procedures were adopted by ABET in 2000, and the College has been going through an extensive assessment process for the last three years as part of the regular ABET 6-year accreditation cycle, which culminates Fall Semester 2003. This effort involves (a) development and implementation of assessment methodology, (b) preparation of a program self-study report describing this assessment, and (c) a site visit by representatives of ABET, which will occur Fall Semester 2003.

As part of this process, the Department has established (a) Program Educational Objectives, which define the qualities which graduates of our program should possess three to six years after graduation from UW, (b) Program Outcomes, which are skills, understanding, knowledge, or other characteristics of undergraduate students at the time of graduation, and (2) a means of assessing program outcomes. As a key component of the self-study, the department has adopted and implemented five assessment tools:

- Written surveys of graduating seniors and 3 and 6-year alumni.
- Evaluation of the results of the Fundamentals of Engineering (FE) Exams, which is taken by most of our students, and provides a range of data on student performance in mathematics, science, engineering science, and advanced chemical engineering course work.
- Work product assessment of students in key chemical engineering courses.

- Input from the Departmental Advisory Board.
- Evaluation of the strengths and weaknesses of the program by a Student Focus Group and via exit oral interviews of graduating seniors.

The results of the assessment were a major component of our self-study accreditation report and were used as a basis to design the curriculum improvements spelled out in the preceding section.