THE UNIVERSITY OF UTAH

March 23, 2015

Ruth V. Watkins
Senior Vice President for Academic Affairs
205 Park Bldg.
Campus

RE: Graduate Council Review
Department of Chemical Engineering

Dear Vice President Watkins:

Enclosed is the Graduate Council's review of the Department of Chemical Engineering. Included in this review packet are the report prepared by the Graduate Council, the Department Profile, and the Memorandum of Understanding resulting from the review wrap-up meeting.

After your approval, please forward this packet to President David Pershing for his review. It will then be sent to the Academic Senate to be placed on the information calendar for the next Senate meeting.

Sincerely,

David B. Kieda
Dean, The Graduate School

Encl.

XC: Milind Deo, Chair, Department of Chemical Engineering
Richard B. Brown, Dean, College of Engineering

The Graduate School
201 Presidents Circle, Room 302
Salt Lake City, Utah 84112-9016
(801)581-7642
FAX (801)581-6749
http://www.gradschool.utah.edu

The Graduate School - The University of Utah

GRADUATE COUNCIL REPORT TO THE SENIOR VICE PRESIDENT
FOR ACADEMIC AFFAIRS AND THE ACADEMIC SENTATE

November 24, 2014

The Graduate Council has completed its review of the Department of Chemical Engineering. The External Review Committee included:

Jennifer Sinclair Curtis, PhD
Professor, Department of Chemical Engineering
University of Florida

Philip R. Westmoreland, PhD
Professor, Department of Chemical and Biomolecular Engineering
North Carolina State University

The Internal Review Committee of the University of Utah included:

Aaron Bertram, PhD
Professor
Department of Mathematics

Robert B. Keiter, JD
Wallace Stegner Professor of Law
S.J. Quinney College of Law

Henry S. White, PhD
Professor
Department of Chemistry

This report of the Graduate Council is based on the self-study submitted by the Department of Chemical Engineering, the reports of the internal and external review committees, the OBIA profile, and the Department Chair's Response to the review reports. The Dean of the College of Engineering did not provide the Council with a separate response.

DEPARTMENT PROFILE

Program Overview

The mission of the Department of Chemical Engineering (hereinafter referred to as "the Department") is "to cultivate an environment through teaching, research, and service that fosters the technical, critical thinking, and communication skills necessary for students and faculty to contribute to the engineering profession and to the well-being of society." The Department offers three degrees in Chemical Engineering: a BS degree, an MS degree, and a PhD degree. An additional emphasis in Energy Engineering is available to undergraduates. At the graduate level, the Department has recently added a new MS degree in Petroleum Engineering in collaboration with the Department of Geology and Geophysics. Both the internal and external review teams commended the Department for the new MS degree and predict that it should increase the Department's visibility and competitiveness.

Both the internal and external review teams reported high levels of overall satisfaction with the leadership of Chair Milind Deo among those students and faculty interviewed.

The Department's state line based budget has been essentially flat since the last review. This erosion of the base budget has been offset by the establishment of differential tuition, significant increases in SCH-based productivity funds, development drives, and a five-fold increase in returned overhead on research grants to the Department. Both internal and external reviewers expressed concern that, although laudable, these developments, combined with the management of a new MS degree, might be overloading the Departmental resources. In the Chair's response to the review reports it is reported that several proactive steps have been made, including the hiring of additional staff.

Internal and external reviewers expressed concern that the Department's research portfolio has been imbalanced toward a small number of areas (combustion and fossil fuels). The Chair's response outlines several investments the Department has made toward diversifying faculty research areas.

An additional long-standing area of concern provided by the internal and external reviewers was the continued lack of female representation among full-time faculty, despite the Department's ongoing recruitment efforts.

Faculty

The Department has 17 tenure-track (14 full-time equivalent FTE) and 8 career-line faculty (3 lecturers and 5 research faculty). The two-tiered faculty structure ensures adequate resources to accomplish the Department's teaching and research missions and represents a common arrangement in chemical engineering departments.

Much of the core curriculum is taught by career-line lecturing faculty, and although those students interviewed reported that they were generally pleased with the instruction, advising, and the mentoring they receive, they also expressed to the internal reviewers a desire to have more tenure-track faculty involved in undergraduate teaching. However, the characterization provided by the internal reviewers of limited faculty engagement in the undergraduate curriculum was challenged in the Chair's response, where it was noted that currently 12 of the tenure-track faculty have undergraduate teaching assignments.

Faculty research productivity was reported to be adequate, but was also characterized by both review teams as uneven across the Department in terms of publications and outside funding support. In addition, the external reviewers encouraged the faculty to publish more frequently in archival journals with higher impact factors in order to raise the visibility of their research among the chemical engineering community. In part, these concerns reflect the Department's successful long-standing connections with industry and faculty accomplishments in the particular research areas of combustion and energy. Earlier departmental reviews expressed concern with the imbalance, and in response the Department has made notable strides in diversifying faculty research areas, accomplished in part with strategic hires in key outside areas (biotechnology, nuclear, and geomechanics). However, a strong emphasis in combustion and traditional energy- related areas remains, as evidenced by funding, publications, the content of PhD theses, and the limited non-combustion/energy elective offerings for graduate students.

Students

Office of Budget and Institutional Analysis (OBIA) data reveal the Department served 425 students in 2012 (the last year of available data). This represents an overall 79% increase since 2006. Most of the growth over this time period is attributable to a doubling in the number of undergraduate majors. Both internal and external review teams commended the Department for having done an outstanding job since the last review in recruiting undergraduate students through a variety of investments, including a K-12 Outreach program that visits public schools and numerous on-campus recruiting events to reach potential students.

The Department provides undergraduate and graduate students with a variety of scholarship and research/teaching assistant positions. Undergraduate and graduate students interviewed by the review teams both reported high levels of satisfaction with the quality and quantity of instruction, advising, and mentoring, as well as with the facilities and research opportunities available to them. Student concerns included (1) the need to incorporate computing concepts earlier in the undergraduate curriculum; (2) the need to expand graduate electives; (3) the perceived inequity across RA stipends across different research groups; (4) the application of differential tuition to student paychecks; and (5) the burden of international student fees.

Curriculum

According to the internal reviewers, the Department's curriculum aligns well with generally accepted standards for undergraduate and graduate degrees. The Department provides students at each level with clearly articulated programs of study. Undergraduate students are required to meet minimum GPA requirements and pass the national Fundamentals of Engineering exam prior to graduation. The MS degree requirements include both thesis and non-thesis options. One suggestion by the internal reviewers was to consider expanding the MS degree program toward the completion of more thesis degrees, which could help grow the PhD program. The PhD degree involves meeting specific course requirements, passage of a qualifying exam, completion of the PhD thesis and successful defense, and completion of two unpaid teaching assistant assignments. In addition, PhD candidates are expected to produce two to three published papers prior to graduation.

Diversity

Gender diversity within the Department faculty remains a concern carried over from the last review. The national average of female tenure-track faculty in chemical engineering departments is just over 20%. In contrast, the Department average is 11.7% female representation with just two female tenure-track faculty (Lighty and Jeremovic), and only one if Dr. Lighty, who is on assignment as Division Director at the National Science Foundation, is not included. This is recognized as a problem and the Department has been working towards addressing the imbalance. The Chair's response to indicated that an offer at the Professor level is being made to a female faculty member and that there are some female candidates in the pool for a junior position.

With respect to students, according to the Department's self-study, 24% of the undergraduate students are women and 31.4% are from minority racial/ethnic communities. Very similar levels were reported for the graduate student composition.

Program Effectiveness and Outcomes Assessment

The Department's BS degree in Chemical Engineering is accredited by the Accreditation Board of Engineering and Technology (ABET), whose guidelines have been adopted by the Department without modification. In addition, the Department's self-study provides extensive detail regarding the main outcome assessment tools used by the Department. These include (1) feedback from recruiters, (2) surveys of instructors in Chemical Engineering, (3) student exit interviews, (4) employer surveys, (5) the Fundamentals of Engineering (FE) examination, and (6) reports from Communication Leadership Ethics and Research (CLEAR) Program, which provides the Department with annual reports and suggestions for strengthening students' oral and written communication skills.

Overall, the assessment tools provide the Department with excellent means to monitor the quality of the educational programs. The results of these assessments were generally positive, indicating the programs were in good health. However, one common theme across various metrics was the continued need to improve students' communication skills. The internal reviewers noted that the recent influx of international students might be contributing to the perceived weaknesses in this area.

Facilities and Resources

The Department faculty and graduate students are distributed among several buildings depending on the different research centers and institutes with which they associate. The main office and staff are in the Merrill Engineering Building (MEB). More than half of the tenure-track and all of the career-line faculty are in MEB. The undergraduate laboratories and the Departmental computing facilities are in close proximity. Additional sites for faculty include the Institute for Clean and Secure Energy, located in the Intermountain Network Scientific Center; the Sorenson Molecular Sciences and Engineering Building; the Energy and Geosciences Institute in Research Park; and the Meldrum Civil Engineering Building. The Department self- study reports that "at the current time space is not an impediment to progress." Both internal and external review teams reported that the Department appeared to be well-resourced.

COMMENDATIONS

1. Since the last review, the Department has made some progress toward diversifying the faculty research areas including new hires in biotechnology, nanotechnology, and nuclear technology. However, more progress on this item is needed.

2. The addition of a new MS degree in Petroleum Engineering was a strategic and timely move in terms of meeting demands for graduate students in this energy sector. It provides the Department with a second major center of strength.

3. The Department has made outstanding efforts in developing outreach programs.

4. The move toward requiring PhD candidates to produce two to three published papers should strengthen the Department's research culture and reputation.

5. The expansion of graduate fellowships to attract top PhD candidates is commended.

RECOMMENDATIONS

1. The Department should engage in strategic planning emphasizing the need to increase national visibility and ranking. The development and marketing of a third key area of expertise besides combustion and petroleum engineering should be a central component of this planning. The plan should include contributions from all of the Department's stakeholders.

2. Gender diversity in the faculty remains a serious concern. High priority should be given to increasing the number of female and underrepresented faculty.

Submitted by the Ad Hoc Committee of the Graduate Council:

Sean Redmond (Chair)
Professor, Department of Communication Sciences and Disorders

Ginny Pepper
Professor and Associate Dean, College of Nursing

Mary Jane Taylor
Professor and Associate Dean, College of Social Work

Sharon Aiken-Wisniewski (Undergraduate Council Representative)
Asst. Vice President for Academic Affairs/Undergraduate Studies
Associate Dean for University College Advising

Chemical Engineering

	2006	2007	2008	2009	2010	2011	2012
FACULTY: With Doctoral Degrees Including MFA and other terminal degrees							
Full Time Tenured Faculty	10	10	10	10	10	10	11
Full Time Tenure Track	4	3	2	4	4	4	2
Full Time Auxiliary Faculty	2	3	2	3	4	5	6
Part Time Auxiliary Faculty	0	0	0	1	1	1	0
With Masters Degrees							
Full Time Tenured Faculty	0	0	0	0	0	0	0
Full Time Tenure Track	0	0	0	0	0	0	0
Full Time Auxiliary Faculty	0	0	0	0	0	0	0
Part Time Auxiliary Faculty	0	0	0	0	0	0	0
With Bachelor Degrees							
Full Time Tenured Faculty	0	0	0	0	0	0	0
Full Time Tenure Track	0	0	0	0	0	0	0
Full Time Auxiliary Faculty	0	0	0	0	0	0	0
Part Time Auxiliary Faculty	0	0	0	0	0	0	0
Total Headcount Faculty							
Full Time Tenured Faculty	10	10	10	10	10	10	11
Full Time Tenure Track	4	3	2	4	4	4	2
Full Time Auxiliary Faculty	2	3	2	3	4	5	6
Part Time Auxiliary Faculty	0	0	0	1	1	1	0
FTE from A-1/S-11/Cost Study Definition							
Full-Time Salaried	16	16	14	16	17	18	17
Part-Time or Auxiliary Faculty	1	0	0	1	0	1	1

Chemical Engineering

	2006	2007	2008	2009	2010	2011	2012
Number of Graduates							
Bachelor's Degrees	23	22	38	26	30	30	54
Master's Degrees	7	7	9	8	9	16	4
Doctoral Degrees	3	8	8	7	7	5	12
Number of Students Based on Fall Third Week Semester Data							
Enrolled in Masters Program	19	19	16	28	28	24	17
Enrolled in Doctoral Program	40	35	37	43	45	55	61
Department FTE Undergrad	66	73	84	68	80	105	126
Department FTE Graduate	45	52	48	59	65	70	68
Department SCH Undergrad	1,990	2,187	2,514	2,026	2,393	3,159	3,788
Department SCH Graduate	895	1,033	954	1,176	1,304	1,390	1,370
Undergraduate FTE per Total Faculty FTE	4	4	6	4	5	6	7
Graduate FTE per Total Faculty FTE	3	3	3	4	4	4	4
Cost Study Definitions							
Direct Instructional Expenditures	2,159,265	2,298,177	2,579,354	2,170,550	2,405,914	2,499,550	2,516,917
Cost Per Student Fte	17,672	20,683	20,428	16,306	18,833	17,029	14,333
Funding							
Appropriated Funds	2,171,360	2,282,940	2,593,699	2,444,317	2,379,335	2,471,886	2,633,851
Teaching Grants	3,905,140	4,713,336	677,892	468,420	325,434	147,595	232,679
Total Grants	4,051,601	4,872,669	823,689	488,212	365,392	168,145	328,199

Faculty Degrees represent highest degree awarded per faculty member

FTE Cost Study Definitions are the number of faculty FTE's supported by Apprpropriated Instructional Funding. Faculty with Administrative appointments are excluded.

Student FTE per Total Faculty FTE excludes Teaching Assistants

Teaching Grants are Fund 5000 Grants classified as Teaching per General Accounting

Total Grants are all of the Fund 5000 Grants

Memorandum of Understanding
Department of Chemical Engineering
Graduate Council Review 2013-14

This memorandum of understanding is a summary of decisions reached at a wrap-up meeting on March 3, 2015, and concludes the Graduate Council Review of the Department of Chemical Engineering. Ruth V. Watkins, Senior Vice President for Academic Affairs; Richard B. Brown, Dean of the College of Engineering; Milind Deo, Chair of the Department of Chemical Engineering; David B. Kieda, Dean of The Graduate School; and Donna M. White, Associate Dean of The Graduate School, were present.

The discussion centered on but was not limited to the recommendations contained in the review summary report presented to the Graduate Council on November 24, 2014. At the wrap-up meeting, the working group agreed to endorse the following actions:

Recommendation 1: The Department should engage in strategic planning emphasizing the need to increase national visibility and ranking. The development and marketing of a third key area of expertise besides combustion and petroleum engineering should be a central component of this planning. The plan should include contributions from all of the Department's stakeholders.

The Department has engaged in strategic planning for several years and the Chair included their most recent plan (2011) as part of his response to the review reports. The Chair will initiate an update to that plan that will include action plans for addressing both of the recommendations in this Memorandum of Understanding. The updated strategic plan will be included in the Department's 2016 follow-up report to the Graduate School. The Department has made a new hire and another offer has been made. The new hire and potential additional hire will provide diversity to the areas of expertise currently offered by the Department. The area of nanomaterials/bioengineering is one that is highly visible in other top ranked chemical engineering programs nationally, and it is believed that adding this area of emphasis will increase national visibility and ranking. The Sr. VP voiced support for this plan, as did the other parties present. It was suggested by the College Dean that a conversation with Health Sciences leadership might be strategic and timely in terms of partnering with them to develop this area. Numerous additional marketing and PR strategies and events to increase visibility and ranking are being implemented and are outlined in the Chair's response. Other recommendations associated with the strategic planning process included:

- Improving safety in the undergraduate labs (this has been addressed).
- Mandating accepted publications for PhD students (in progress).
- Balancing faculty publication and PhD student supervision, and/or increasing teaching loads of some faculty who are less productive. These measures are being considered by the Chair and are supported by the Dean.
- Hiring a new graduate advisor (this has been done).

Recommendation 2: Gender diversity in the faculty remains a serious concern. High priority should be given to increasing the number of female and underrepresented faculty.

The Chair recognizes the importance of increasing gender and racial/ethnic diversity in the Department. The updated strategic plan will include strategies to address this recommendation. As stated in Recommendation 1, the addition of the "bio" focus will help increase multiple dimensions of diversity and the recruitment of top graduate students and faculty. The status of recent searches is as follows:

- Three females out of seven candidates were interviewed but an offer made to one of those candidates was turned down (despite assistance from the Sr. VP to make the offer competitive).
- Two female research faculty members have recently joined the Department.
- One female career-line faculty member is being recruited for 2015/16.

Regular update reports will be submitted to The Graduate School and further progress on the strategic plan will be included.

This memorandum of understanding is to be followed by regular letters of progress from the Chair of the Department of Chemical Engineering to the Dean of The Graduate School. Letters will be submitted until all of the actions described in the preceding paragraphs have been completed.

Ruth V. Watkins
Richard B. Brown
Milind Deo
David B. Kieda
Donna M. White

David B. Kieda
Dean, The Graduate School