Tier 3 (b and c) Program Narrative reports due March 6 (5-10 page maximum [no spreadsheet required] by department, submitted through each college and for International, Graduate and Extended Education).

Tier 3 – Curriculum, Pedagogy, Enrollment.

(a) formal, scheduled or organized instruction, and (b) informal learning outside the classroom or laboratory.

- Tier 3 Considerations
  - Academic Mix (including state-support/self-support funding)
  - Program mix/college shares (program headcount; FTES including GE and support)
  - Undergraduate/post-baccalaureate/graduate mix (by college)
  - CA resident/domestic non-resident/international student mix (by college, by level)
    - Teaching and Learning (by program and student level)
  - Learn by Doing; Teacher-Scholar
  - Pedagogy/learning modes (e.g., engaged learning, undergraduate research, community service, internships/field placements, technology, session structure)
  - Space, infrastructure and information systems implications
    - Co-curricular Learning (in general and by program, level)
  - Discipline-based activities; student life more generally
  - Residential community
    - Student Success (in general and by program, level)
  - Retention, graduation rates; preparation at entry, achievement gaps; student diversity (gender, ethnic origin, financial means)

3b. Teaching and Learning.

3.b.1 What effective approaches to teaching and learning are emerging in your field and related interdisciplinary areas?

and

3.b.2 What learning environments should Cal Poly develop or modify to accommodate new modes of teaching and learning in the future?

Agriculture is the largest wealth generator in California and the USA. Technology is the driver of agricultural productivity. The BRAE program excels at engineering and high-tech in Ag. The ASM curriculum provides solid preparation for increased service component of US economy, in Ag or otherwise. There is a high probability that future career opportunities will emphasize knowledge and skills in these educational areas.

Regardless of the information source, there global agreement that the critical survival issues will be food, water and energy. All predictions for the future point to fresh water being the most critical global
commodity, displacing oil as driver of international and domestic politics. This observation is of strong relevance to BRAE department, in which water engineering is a popular specialization and the Irrigation Training and Research Center (ITRC) is based. The interdependency of health/disease with food/water/sanitation/fuel is expected to further increase demand for graduates in BRAE and ASM.

US Agriculture, and especially California agriculture, leads the world in productivity, it’s likely that increased international accessibility of the university will disproportionately affect BRAE, with increased demand by non-US students. A potential increase in enrollment of international students will pose new challenges to maintain relevance of educational content and student services to a more diverse suite of student needs. Communication and cultural assimilation may involve disproportionate challenges for the BRAE programs, which were designed to primarily meet the needs of US and California. Recognizing the benefits of increased international awareness, these are as much opportunities as challenges, that can and will be met. But it is important that they be recognized by the university in conversations that focus on higher out-of-state and international tuition rates.

Similar challenges may follow from a changing student age distribution – both younger and older students. This may lead to difficult tradeoffs between services required by an aging population vs. services for youth. This is probably of small relevance in the next decade, but there is the potential for student demography to develop a bimodal age distribution as continuing education and career transitions impact the BRAE student population. Currently, our students are almost entirely in the 18-24 age range. Differences in learning styles could also drive modifications of classroom and laboratory methods.

Cal Poly has long been known for its high educational value relative to cost. In fact, it is a defining principle for the CSU system. If cost could be maintained as competitive, this is a major advantage for Cal Poly, especially in educational areas such as BRAE that directly address needs of existing and future employers.

But the declining role of State support is a dominant force that has already and will continue to shape Cal Poly. Increased tuition and student debt shifts costs to students and their parents. Financial aid opportunities target the lowest income households. Middle income households are disproportionately affected at Cal Poly, formerly a haven for education to the 20-80th percentile income households. The trend will clearly be continued loss of educational accessibility to middle class Americans, traditionally the core constituency of Cal Poly, especially in Ag-related areas. Broader class separation and the negative societal consequences will accompany this trend. Societal ramifications are unknown, but not expected to be positive.

The BRAE and ASM curricula emphases knowledge and skills that prepare students to create and implement innovative approaches to climate change, energy, resource management and environmental sustainability. Skill sets required to implement solutions to expected challenges of climate change, energy and resource management are essentially the core courses of the BRAE and ASM majors. Increased future relevance and educational demand is reasonably expected.

Keeping up with rapidly changing technology is a necessity in all fields of education, but especially in rapidly evolving areas of engineering and technology management. The facilities ramifications are significant. And the investment of professional time is an absolute necessity for the faculty who teach BRAE and ASM majors. Exponential growth in technology will inevitably bring increasing laboratory
facilities and related workload demands for faculty struggling to do their jobs as effective teacher-scholars. Details will be provided in the context of Section 3.c “Learn by Doing”.

Adaptability and readiness for change is considered by the BRAE faculty to be of high relevance, as future educational needs track rapidly advancing technologies in the field. Agility and resilience is facilitated not only by faculty interest and industry guidance, by attention of administration to the barriers to such agility, e.g., cross-department and cross-college institutional impediments and intransigent facilities services.

Advances in educational research rarely take into account the special nature and facilities requirements of experiential education, and the criticality of 1:1 supervision in the development of high-risk hands-on skills (e.g., welding, motive power system design, chemical handling). To most faculty in CAFES and the BRAE Department who teach labor-intensive application-based courses, teacher-scholar expectations translate into additional expectations in professional arenas beyond their primary teaching responsibilities. As discussed above, currency in field will surely increase in importance in the future as technology and the regulatory environment continue to grow. With increased future emphasis on the TS model, a shift in the type and experience base of faculty is inevitable. A faculty known for industry/operational experience may evolve into a more traditional academic-based body that lacks the pragmatic understanding that is critical in BRAE. This shift is not viewed as a completely positive development by either faculty or industry advisers.

3.c. **Learn by Doing.**

3.c.1 How should Learn by Doing incorporate new learning needs, opportunities and technologies (in your field and related interdisciplinary areas)

The core value of the BRAE Department is stated in both its mission and its vision statements:

"Learn by Doing" is non-negotiable

At Cal Poly in the BRAE and ASM majors, our learn-by-doing mandate is expected to affect the evolution of the professor/instructor from the traditional role of knowledge purveyor to more of a mentor, guide or coach. With this transition comes a fundamental change in learning needs, opportunities, and the attendant technologies. We are aware of external pressure to serve larger student audiences, on and off campus, via expanded “distance” and “online” learning modes of delivery. Indeed, electronic course delivery could extend the reach of our instruction to a larger audience, especially in rural communities. But the major challenge will be how to accomplish actual learn-by-doing when the “by-doing” part is removed. We believe in our time-proven learn-by-doing format for skill-based fields such as BRAE and ASM.

We view positively the increased opportunity of students to participate in a whole-life experience, engaging them beyond the classroom experience. The heavy involvement of students at all levels in the BRAE department helps to foster this environment – a model of education that we believe would definitely benefit students in the future.

The BRAE and ASM majors provide a strong opportunity to better serve a more diverse population, preparing these transitional students for the work force. The nature of our curriculum also presents increased opportunity for transfer and non-traditional student pipelines, connecting with that
population’s identity and harnesses their potential. This observation is of particular relevance for academic departments/majors that directly serve the needs of employers and focus strongly on expected areas of employment opportunity. BRAE is noteworthy in this sense. The expected shift in educational priorities to career opportunity and success will almost surely rebalance the objectives of the university back towards polytechnic education as exemplified by the BRAE and ASM majors. Increased ancillary services and financial aid would have uncertain relevance to the BRAE Department. Enhanced support for cross-over constituencies could increase the student applicant pool and academic success rate in this population. But current the student economic demographic in BRAE and ASM is strongly middle class and California-rural. If attention to this economic group is diminished to meet other university objectives, potential reduction in student numbers and success rate in BRAE and ASM majors is possible.

We expect that the effects of changing priorities in public higher education will be evolutionary rather than revolutionary. The hands-on skills required in our majors are tough to impart over a network connection. Admittedly, the taxpayers that support the university system and the average educational consumer do not necessarily distinguish this fundamental difference in educational quality.

Following national trends, we expect a growing need for a more technically literate workforce in almost all areas of employment, but especially areas that are enabled by technical advances. BRAE and ASM programs must continue to evolve to track this evolution. And increased demand for continuing education in selective areas is reasonably expected, as well as increased demand for MS programs, especially in the water and energy areas.

The BRAE Department has been on the leading edge in developing new formats for delivering class content. Since Cal Poly is well known for the "hands-on/learn by doing" model of education, the BRAE Department has embraced this teaching model in the form of lab-intensive courses. Innovations have been in the form of providing online content to classes in a hybrid format where a portion of the lecture material is provided with carefully produced online content. This process is not new but the approach is dramatically different than previous attempts. The key has been to deliver only a small percentage of the lecture material of the online content to help ease the professor and student into the new model. We have also found that developing new online content is expensive and time-consuming.

For example, the Irrigation Training and Research Center (ITRC), a unit of the BRAE Department, has pursued numerous contracts to fund these efforts. ITRC is an excellent model of the implementation of teacher-scholar model/collaborative research and water industry partnerships to respond to future needs with innovative responses. ITRC works in conjunction with the BRAE Department as well as CAFES.

The first commitment of the ITRC is to enhance the strong irrigation teaching program at Cal Poly through activities in training and research. That is, the primary purpose of the Center is to serve as a training center to not only support the Cal Poly irrigation/drainage graduate and undergraduate programs, but to provide opportunities for education, training, research, and special studies in water management to water users within the agricultural and urban irrigation industry. The second commitment is to help with the modernization of irrigation. This involves working both with the on-farm aspects of irrigation as well as the irrigation project-level aspects to make improvements and help agriculture solve technical issues.
The Center supports multi-disciplinary needs for research and training as related to water conservation and irrigation through technology transfer, studies, and applied research. The Center fosters interaction between the University and industry, consistent with the overall goals of Cal Poly. Cal Poly and the ITRC are proud of their ability to combine sophisticated irrigation theory with a "hands-on" approach to provide a usable product. By contributing products such as short courses on irrigation management and analysis of irrigation district efficiencies, for example, the Center balances the theory and application of engineering practice, thereby supporting the University and the College of Agriculture’s stated mission. Center members are faculty and students who have a declared interest in irrigation technology, training, and research programs as related to activities at Cal Poly.

The Center serves as a vehicle for securing industry, public agency, and international sponsorships and support to sustain irrigation training- and research-oriented projects at Cal Poly. The undergraduate and graduate teaching programs are strengthened through continuing acquisition of donations and equipment, funding of student projects, and faculty professional development. Meeting the demand for unit services is only restricted by man-hours available for oversight, and demand for the Center’s services continues to grow.

ITRC projects vary based on client demand that is often fueled by environmental, political, or legislative changes, as well as technological advances. For example, the recent California State Senate Bill x7-7 set regulations that require farm delivery measurement within specified accuracy. Irrigation districts that have not had stringent flow measurement programs in the past must now evaluate and update their equipment and management techniques. The ITRC has been called upon frequently to educate California districts on the ramifications of the bill, and to define the exact requirements.

Below is a sample of a new proposal to the California Department of Food and Ag for $225,000. This is a simple example of the work required to put together a new online teaching module.

The following describes the method of developing an online module (note: each module will contain several tutorials that are between 2 – 15 minutes each) can be outlined as follows:

1. Update the Fertigation book, which will define the general content for the modules (which will follow chapters in the book). It will also be evident that some topics in a book require graphics, video of actual field installations and practices, and animations to convey the message better.
2. Photos, existing PowerPoints, and other resources are consolidated.
3. A script (in Word) is developed for each tutorial, with as much detail and explanation as possible.
4. The script is modified to start creating a tutorial.
   a. The script is divided into paragraphs that will take 30 seconds or less to narrate and pasted into the Notes sections of PowerPoint slides.
   b. Bringing in the other materials provided with, the script is supplemented with more detailed explanations (since people who are watching the tutorial can’t ask questions), and the wording is modified to make it more conversational than a textbook would be, or easier to read aloud.
5. In PowerPoint, we create animations and text to illustrate the script.
   a. Sometimes this means dividing the script onto more slides, or adding more to the script to describe the animation being shown.
   b. The Adobe Creative Suite (especially Photoshop and Fireworks) are used for creating and editing images, but most animations are created in PowerPoint.
6. The narration is then recorded with a CAD u2 microphone/headset and sync the animation to the narration, all in PowerPoint using either Adobe Presenter or Articulate Presenter (two different add-ins for PowerPoint).
7. Using either Presenter add-in, an HTML-embedded Flash video of the PowerPoint is published.

8. The link or video is sent to the original creator to review. The creator will then send back requested revisions, either in Word or as an email, or they are discussed. The back-and-forth revisions can take a long time, depending on how much the creator wants to add or change from the original script.

9. Depending on the class, quiz questions are often inserted into the tutorials to force the students to stop and interact with the tutorial. These are usually added to the PowerPoint file near the end of the process.

10. Each tutorial must be examined closely to make sure the narration and the animation match up, and that all of the animations work as they are supposed to when published.

11. When the tutorial is completely approved, it is published as a SCORM package (through Adobe or Articulate Presenter) for uploading into an online class.

12. Additionally, downloadable PDF files of the script are created that can be downloaded and printed.

Overall, the combined forces of budgetary constraints, changing learning behaviors, changing demographics, and evolving public perceptions of higher education will no doubt shape the future of Cal Poly. The inevitable question will be, how will our special brand of “Learn-by-doing” evolve to meet these challenges?

3.c.2 What are the facilities implications for both (a) formal instruction and (b) informal learning?

A major objective of the Cal Poly BRAE Department is the updating of facilities that are 70+ years old. More important than new structures are the updating of laboratory equipment, which enable our learn-by-doing approach to engineering and systems management education.

Rather than speak in general terms, the faculty of the BRAE Department have contributed detailed lists of laboratory equipment necessary now and in the near future to maintain and/or expand our capabilities. These lists are attached as separate appendices.