College of Engineering & Computing

Blueprint for Academic Excellence

March 2016

2017 Blueprint Report for College of Engineering and Computing

Section I. Executive Summary

The CEC offers eight undergraduate degrees through its five departments, as well as eight graduate degrees and two professional Masters degrees. Overall undergraduate enrollment has grown too rapidly, from a low of 1,122 in Fall 2006 to 1,587 in Fall 2010 to 2,747 in Fall 2015; this is a 73% increase in UG enrollment just since 2010. The TT faculty count was 102 in Fall 2010, reached a maximum of 114 in Fall 2012, and is presently 111. Graduate enrollments have remained fairly level, between 520 and 540 in this same time frame. Our UG student/faculty ratio is thus about 25. CEC has the second highest number of students in the SC Honors College. The SAT of our freshmen has plateaued. Of particular note is that two of our Fall 2015 graduates and 10 of our Spring 2015 graduates were recognized for *Graduation with Leadership Distinction*.

Our retention rates remain the lowest on campus, which is cause for concern. We propose to address this concern at several levels. First, The USC Admissions Office needs to work with CEC to implement more strategic admissions requirements for CEC, most notably to focus in students who are indeed calculus-ready. Simultaneously, CEC must work to develop curricula that serve not just the research track, but also industry, professional-school, or management consulting tracks. We are investing funds and increasing staff to enhance academic advisement and other student services to increase our retention and graduation rates. We are also looking to invest in experiential activities and industry-inspired capstone design projects. We are developing a strategic, long-term faculty hiring plan with a goal of reaching 145 faculty in the next five years. The strategy will include hiring in cross-disciplinary areas and areas that will support multiple departments. Some of the hires will be non-tenure track, but experienced and capable "Professors of Practice," likely Clinical Faculty officially. These faculty will bring an industry perspective and outside experience that will transform education, enhance design and interdisciplinary projects, and will help the college balance its teaching and research missions.

The research enterprise in CEC has been under-invested for sometime. There has not been much hiring, and the startup packages are small. For the faculty who are here, there has not been any return of indirect costs to them to support the basic needs of their research. Moreover, there is little College-level funds to help maintain equipment. Also the salaries are lagging in general, which can be cause for concern, because the College has lost several high-performing researchers to other institutions over the past few years. While addition to the base funding of the College is needed, the College itself needs to adopt a more strategic approach in how it spends its funds. Currently there is zero correlation with research productivity, and all funds flow in proportion to the credit hours taught. CEC will address this shortcoming, and adopt a strategic view in allocating funds. The hiring process will also be strategic, and driven by areas of research, not by curricular needs. As such, we can create critical mass, and benefit from economies of scale in our startup investments. With the current student-faculty ratio, it has not been easy to invest in research, or find time to do research. As the faculty size grows to

145, the research funding per faculty will also grow, and with it, the rankings will rise, and the quality of incoming students will improve, i.e. a genuinely virtuous cycle will set in.

As for service, we will continue to engage with companies and help the state be successful in attracting companies. We will also collaborate with the Technical Colleges and sister USC campuses to offer 2+2 programs, where students can get a USC engineering degree without setting foot on USC-Columbia campus. This is a strategic approach: if we do not take the lead, then it is inevitable that some of these 2-year colleges will eventually become 4-year colleges, and start offering pre-engineering, and eventually full engineering. This is the picture that played out in Virginia. And the end result is not desirable, as the slim investment of the state gets further diluted among multiple campuses.

The College offers a great opportunity for investment. But the time for it is now. Most of our peers (Table B.2.) have maintained, or improved their US News rankings from 2016 to 2017. But USC appears to have fallen out of the top 100 in the latest rankings (results are still embargoed until next week). Notably, Clemson has risen from 71 to 65. Interestingly, Clemson in 2011 started investing heavily in engineering, including increasing their salaries drastically. This was the year of the NRC rankings, where USC far outshined Clemson. At this point, it is somewhat pointless to hold up the NRC rankings as a sign that USC engineering and computing is better than Clemson; NRC rankings are historic. But with investment, and with leadership and vision, we can regain that mantle. The comprehensive nature of USC will allow us to create a college where we produce liberally educated engineers and computer scientists, in the mold of ivy leagues, but on the scale of a flagship public university. In an environment where technology and science are permeating every field of inquiry, we will build bridges to sister colleges and in the process create a stronger university, with many interdisciplinary fields to position our students for success.

Section II. Meeting the University's Academic Dashboard Targets

1. Total Undergraduate Enrollment

1.1 Strategies

Our undergraduate enrollments have increased by approximately 61% from Fall 2010 to Fall 2015 and by 10% in the just past year. We aggressively recruit undergraduate students. Two full-time staff are dedicated to outreach and recruitment; administrators and faculty are also engaged. Outreach programs include Project Lead The Way (PLTW), computer science and engineering summer camps, field study opportunities in College, and partnerships with other organizations. We participate in recruitment events at USC and in the primary regions served. For prospective students, we provide daily tours of the College and college "Big Fridays" involving the Dean, a student panel, and faculty-lead department tours. We created a new outreach event (The Edison Lecture Series) which brings high school and middle school students to campus to show them current research in an interesting and interactive way. We actively participate in the national 'Engineers Week' program and host a public Open House on a Saturday with a large number of demonstrations around the College's facilities.

Additionally, Dr. Harik worked actively with the director of the Richland Two Institute of Innovation (R2I2) on developing a state of the art curriculum offering high school students a world-level design and manufacturing education. To this end, a semester long CAD/CAM curriculum including description, objectives, performance indicators and outline was created. Dr. Harik used McNAIR's vital relationship with Dassault Systemes (DS) to provide students training on the world class software used to manufacture over 60% of the world aircrafts: CATIA V5. DS offered a highly competitive pricing that makes the acquisition of CATIA almost free. The R2I2 instructor is trained by the McNAIR Advance program on the fundamentals of CATIA V5.

1.2 Progress

Total UG Enrollment	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015
No. of Undergrads	1,584	1,698	1,849	1,971	2,188	2,477	2,747
No. of UG applicants	1,935	2,111	2,525	2,940	3,191	3,397	3719

1.3. Plans

- Continue with the recruitment strategies described above, as they are perceived as effective.
- The move of IIT department to CEC will immediately add over 200 students to the college, pushing the undergraduate enrollment to close to 3,000. Moreover, it is expected that the numbers will increase even more, due to the additional visibility that IIT garners by being housed in CEC.
- Actively exploring the following:

    - Aerospace major, for the 21st century (responsive to the needs of the industry, and leveraging the strengths of CEC in engineering and computing.
    - Minors in manufacturing, as well as in innovation and entrepreneurship (with DMSB). There will also be certificates, as well as 12-month masters programs related to these.
    - 2+2 articulation with SC Technical Colleges and USC sister campuses. Especially with Florence-Darlington Tech, Trident+Citadel (for Boeing), and USC Beaufort (for Gulfstream).
    - Developing challenging tracks (initially for Honors College), stressing the importance of analysis and mathematics in modern engineering and computing. Joint initiative with Math; especially with Interdisciplinary Math Institute (Professors Schep, Petrushev, and Dahmen).
- Create experiential activities, including a year-long capstone design sponsored by industry (with a fee schedule), including startups in our incubators (with an ownership stake schedule for USC).
    - Upfit the woodchip area in the Biomass building to become a maker space, with bays housing student project teams.
- Create sense of community in CEC: students only take their courses in the CEC complex; and the faculty members are in their offices. There is very little possibility of chance meeting over coffee or a meal where great interdisciplinary ideas (curricular or research) are often developed. The lack of a central eating/café facility is a shortcoming. There is no substitute for time invested into initiatives/projects. What makes MIT, MIT, is that the place is open 24 hours a day. And the café's and libraries support that high level of energy. CEC needs to have a café, so that our students start "living" in CEC, and in the proposed experiential activities space.

2. Average SAT Score

2.1 Strategies

Recruiting strategies above apply to this dashboard metric: by sharing with the applicants the level of research activity in CEC, as well as generating more interest in CEC, we will continue to increase both the size and the quality of the pool of applicants. In addition, each year, hundreds of CEC students receive college scholarships. Increasing the number and amount of scholarship funds is a priority for our development office. However, our freshmen average SAT score has dropped by 15 points compared to Fall 2013; this after several years of small but steady increases. The drop over two years may represent a trend that is associated with the university's decision to admit more freshmen each year. Anecdotally, we appear to be seeing an increasing number of incoming freshmen that are not Calculus-ready but have declared a CEC major.

2.2 Progress

Freshman Profile	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015
Number admitted	1,493	1,687	1,958	2,275	2,460	2711
Freshmen Class Size	431	485	494	618	627	712
Average SAT	1217	1226	1226	1254	1,242	1,239

2.3 Plans

- Increase the number and amount of scholarship funds.
- *Explore differential freshman admission criteria for engineering and computer science programs*.
- Continue exploring modern/modernized curricula, minors, certificates, experiential activities as stated in 1.3 above.

3. Freshman-Sophomore Retention Rate

3.1 Strategies

We have implemented several retention efforts. These include the hiring of three First Year Advisors in cooperation with the University Advising Center. An academic program manager position, whose responsibilities include retention, was hired in 2013. We have created space for the Student Success Center to offer satellite tutoring center in Swearingen and an Engineering and Computing Living/Learning Community (ECC) effort. We partner with the Student Success Center and the Department of Mathematics on summer program for incoming freshmen called Carolina Precalculus Review, intended to boost performance in first math classes and thereby increase retention.

3.2 Progress

		2010 Cohort	2011 Cohort	2012 Cohort	2013 Cohort	2014 Cohort
Started	*Ended*	Returned '11	Returned '12	Returned '13	Returned '14	Returned '15
CEC	Same School	69.4%	65.6%	73.7%	76.1%	76.0%
	Other School	14.6%	14.3%	12.9%	12.3%	9.8%
	Total	84.0%	79.9%	86.7%	88.4%	85.8%

3.3. Plans

- Implement a First Year Advising program.
- *Explore differential freshman admission criteria for engineering and computer science programs*.
- Add to the ECC program a linked-courses option, in which residents will have priority registration in MATH classes as a cohort.
- Hire more faculty and full-time instructors to: reduce class sizes, and offer more recitation and office-hour help.

- Moving IIT to CEC should help, especially with the current attrition that may happen in computer science and engineering. Those students will now have a well-developed option within CEC.

4. Six-Year Graduation Rate

4.1 Strategies

Our six-year graduation rates have increased slightly, but generally remain the lowest on campus. Data indicates that poor performance in a student's first math class correlates with student attrition. This negatively affects overall GPA, and creates course sequencing problems. Improved freshmen retention as a result of a First Year Advising Program should improve graduation rates.

4.2 Progress

Six-Year Graduation Rate	Cohort Starting Year				
	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
From the College	41.1%	45.3%	49.5%	42.3	42.5
From USC	61.5%	64.2%	66.2%	67.7	68.7

4.3. Plans

- Address freshman advising as in 3.3
- CEC is hiring an assistant dean for academics, to;
    - Oversee student services
    - Improve how departments deal with advising their students
    - Free up the associate dean for academics to work with departments to streamline and improve curricula, and envision new and strategic initiatives
- Task a committee with exploring modernization of curricula so that math and physics are not the bottleneck courses that they are today, but that through the context of engineering they are actually motivated and retained better. There is great merit in "learning by doing"; we did that at Virginia, to great effect. Specifically, we need to develop multiple tracks to serve multiple types of students that we get.
    - More than 80% of the students in public engineering universities do not go to research graduate programs, and yet, the curricula are designed to be focused on graduate research.
    - CEC will explore the development of 4 tracks to address: research, professional schools (med/law/business), industry, and management consulting.
    - An investment is needed to free up the time needed to develop the above. Development will be tasked with creating an endowment for this activity, which needs to become part of the fiber of CEC and sustained into the future indefinitely.

5. Student to Faculty Ratio

(FT students +1/3 PT students)/(FT Faulty+1/3 PT (Faculty + Staff who Teach))

5.1 Strategies

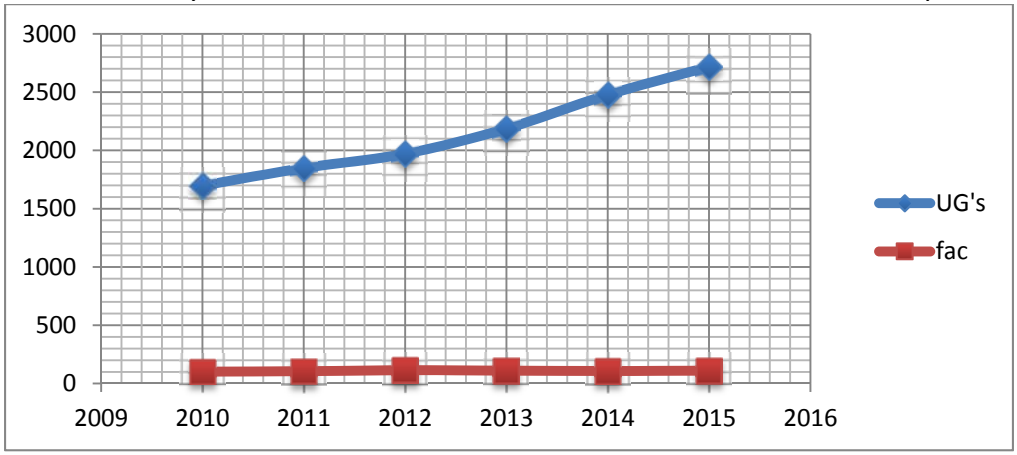
CEC has very few part-time students, and no part-time instructors. Therefore the student faculty ratios are calculated by dividing the number of students by the faculty. *Note that student enrollments do not include the rather large service load of CSCE courses taught to non-majors*.

5.2 Progress

Year	2010	2011	2012	2013	2014	2015
TT Fac Count	102	106	114	111	107	111
Lecturers	0	0	0	0	0	0
Instructors	2	3	3	3	3	3
UG enrollment, FT	1698	1849	1971	2,187	2,477	2,718
FT Grad enroll	325	327	322	350	348	484
PT Grad Enroll	103	122	125	166	151	148
UG Stu/TT Fac	16.6	17.4	17.3	18.3	23.1	24.5
Total FT stu/TT Fac	19.8	20.5	20.1	21.4	25.7**	28.8

5.3. Plans

- Hire faculty and instructors. Because the student count will trend up due to demand.



6. Research Expenditures

6.1 Strategies

Faculty is engaged in the submission and award of funded research from federal, state and private sources. A high priority for the college is to increase research expenditures. The Associate Dean for Research and Graduate Education provides college-level mentoring to help ensure that new hires develop the skills to become successful and that all faculty can compete for large grants.

6.2 Progress

FY	ECHE	ECIV	CSCE	ELCT	EMCH	Total
2010	$5,867,173	$2,220,853	$1,586,337	$5,585,041	$6,922,575	$22,181,979
2011	$6,971,268	$2,001,181	$1,948,763	$5,932,043	$11,266,895	$28,120,150
2012	$6,085,328	$2,354,816	$2,023,981	$5,271,143	$9,320,792	$25,056,060
2013	$5,057,885	$2,520,411	$2,097,241	$4,727,947	$7,081,486	$21,484,970
2014	$5,119,805	$1,938,690	$1,555,523	$4,268,845	$7,675,040	$20,557,903
2015	$4,299,997	$1,598,417	$1,166,574	$3,025,469	$7,721,321	$17,827,690
2015 awards	*$7,109,558*	*$2,123,889*	*$1,574,282*	*$4,564,633*	*$14,186,649*	*$29,879,446*

6.3. Plans

- Promotion and tenure process in CEC is department based. It appears that over time there has developed variation in standards among departments. We will develop uniform metrics for measuring contribution of faculty members to the overall mission of the college and the university. Funded research will be an area where all departments need to contribute to the mission.
- The infrastructure for support of research needs to improve:
    - The office of the VPR needs to help identify and disseminate funding opportunities.
    - Given the relative lack of central support for pre and post awards, CEC will invest in hiring or re-assigning 3 staff people dedicated to pre and post awards, and the number will most likely grow as the volume of proposal activity increases.
- There needs to be more investment in research, beyond investment in pre and post awards staffing:
    - Due to the shortage of funds in CEC, *all* returned indirects currently go into subsidizing the undergraduate teaching mission, and none into support of research.
    - The college spends a substantial portion of its budget on graduate teaching assistants, who are currently distributed to the departments solely based on the amount of credit hours. This is not a strategic way of investing in the mission of the college. It is a much better option to hire upper-level undergraduates to assist with the teaching of lower-level classes (better language skills, have gone through the course themselves, and the teaching reinforces the learning for those students). Subsequently, the distribution of the graduate student portion of assistants will not be solely in proportion to the credit hours taught, but also in proportion to the research activity of the department. *Essentially the funds will now be also used to seed research, and to maintain research infrastructure*. In other words, our investment approach will be strategic, and not based on solely a single dimension of our mission.
    - Approval of the fees, or addition to the base budget, will help strike a healthy balance between investments in undergraduate education and research.
- The level of awards (2015) is higher than expenditures. This can be a positive sign. But overall, the level of awards is still low for our size. We need to be substantially higher (after proper investment).

- Need to hire faculty in clusters focused on specific areas of strength, to create critical mass in areas where CEC can be a leader.
    - Hiring in clusters also allows for management of the startup expenses, and creates an automatic vehicle for competing for multidisciplinary projects, which is the main way to grow the volume of research today.
- Need to have better connection and representation in Washington. In particular with the Department of Defense. The current lobbying presence in Washington is focused solely on the Congress. With the elimination of earmarks and line-items, we need to develop connections to the agencies directly.
    - Hire onto the staff a retiring program manager from ONR, DARPA, AFOSR, ARO, or others.
    - Hire prominent senior faculty who are already nationally recognized and have very well-funded programs.

7. Faculty Productivity

7.1 Strategies

Faculty of CEC continues to compete for funding, publish, supervise graduate students, while teaching a very large number of undergraduate students. The goal of the College is to balance the faculty loads across the College so that each faculty member can contribute fully to the mission of the College, in a way that is best suited to his/her talents and abilities. To achieve that goal, USC/CEC need to put in place better support staff/structure, and incentives. Also there needs to be suitable classroom and instructional laboratory space and staff/equipment. With addition of resources, additional faculty need to be hired as well.

7.2 Progress

Research productivity, as measured by expenditures/faculty members, is now the lowest among our peers and peer aspirants. We are still quite a bit higher than Clemson. But this is just one dimension of a complex development. There needs to be improvement of infrastructure and support, as well as rebalancing of loads and numbers, before a full and correct assessment of the state of productivity of the faculty can be conducted.

School	# fac	res $/ fac (K)
6 UIUC	392	$587
23 UMD	252	$601
39 UVA	145	$519
43 Florida	260	$247
59 UMass Amherst	155	$370
63 UT Knoxville	172	$343
68 Auburn	146	$370
71 Clemson	211	$146
88 Missouri	111	$222
99 USC	111	$202

Below we provide a table for departmental averages for a number of faculty productivity metrics. The number of archival journal publications, and the number of PhD students need to increase if we are to improve our rankings.

Dept.	Avg. Student credit hours	Avg. # Archival journals	Avg. # Post docs	Avg. # PhD advisees
Civil & Env.	219	3.8	0.4	2.9
ME	358	6.4	2.1	2.8
EE	249.7	3.7	0.8	3.1
ChE	257	4.1	1.1	3.2
CSE	326	3.2	0.5	3.4

7.3. Plans

- What is an FTE? Will institute FTE calculation/enforcement. Some people (faculty/staff) are working hard, and some are not. The ones working hard are typically the research active ones, so they cannot be as free to do research as if CEC loads were distributed more equitably
- As a unit, the departments must do 40-40-20. But individual faculty should be allowed to deviate substantially from that model.
- All of the central funds which currently support graduate students, flow in proportion to the credit hours taught. This is not a strategic investment of central funds. We will devise a new distribution method which still serves the courses, but also the research.
- Need to also provide centralized funds to support equipment maintenance
- Shared use facilities
- Cluster hires based on research area, joint with other departments.
- Currently all indirects go to teaching. So we are underinvested in research. Will address this situation as well.

8. Doctoral Degrees

8.1 Strategies

Doctoral degree production in Engineering and Computing is closely tied to research funding and faculty productivity. All comments from 7 apply here as well.

8.2 Progress

CEC Degree Productivity					
AY	**2010-2011**	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**
Doctorate	29	40	49	67	56
Masters	88	78	62	74	69
Certificates	1	1	0	0	1
Baccalaureate	292	289	315	295	400

8.3. Plans

Same as 7.3. These two topics are the same.

Section III. Unit's Goals and their Contribution to the University's Key Performance Parameters

Five Year Goals

1. *Teaching Excellence*: Our College will be the premiere destination of choice in the Southeast for engineering and computing students and the companies that hire them.
    a. Modernized curricula, preparing for research, industry, professional schools, and management consulting
    b. Liberal educated engineers
    c. Engineering clinic, aligning research and design needs of our partner companies with the capstone design requirements of our students
    d. State of the art instructional laboratories
    e. Maker space
    f. Challenging Honors track
    g. Strong bridges and degree programs with all colleges within USC

2. *Research/Scholarship*: Our research productivity will be internationally regarded based upon the reputation of our scholarship and its impact upon society.
    a. Attracting top-tier faculty at all levels
    b. Establishing research partnerships with major multinational companies
    c. Leading multiple multi-university research grants
    d. Improved portfolio of research from DoD
    e. Strong IP activity and spin offs

3. *Service*: We will lead the university and the state that supports us in the advancement and dissemination of knowledge.
    a. Workforce development: education, training, and paths to advancement.
    b. 2+2 online BS degree programs with SC Tech Colleges and USC sister campuses
    c. Cybersecurity
    d. Shared-use facilities made available to partner companies as well
    e. STEM Outreach to local and state schools

4. *Sustainability of our mission*: The College will be on sound financial and administrative footing to sustain the above three goals.
    a. *Address financial challenges*
    b. *Create published administrative practices and policies*
    c. Develop rigorous annual review processes that promote excellence.

Next Year Goals

Resource requests follow in Appendix A.

1. *Teaching Excellence*: Enhance undergraduate education by decreasing the student-to-faculty ratio, enhancing instructional laboratories, and improving advising services.
    a. Hire 8+ faculty members this year

b. Invest in engineering and computing laboratory upgrades
c. Hire Assistant Dean for Student Services, implement First Year Advising

2. *Research/Scholarship*:
    a. Hire new faculty in targeted areas that build upon existing research strengths, or create timely areas of research, that develop high-value multidisciplinary research opportunities.
    b. Identify the areas to build upon
    c. Create incentivize through return of indirect funds, allocation of CEC-supported graduate students, and creation of central pool of funds for maintenance of large and shared equipment
    d. Identify equipment that could be placed in shared-use facilities
    e. Develop new

3. *Service*: Provide leadership for university and state organizations aimed at enhancing engineering and computing education, practice, and research.
    a. Explore 2+2 programs with Florence Darlington, and Trident/Citadel (Boeing). Also begin conversation with USC Beaufort (Gulfstream).
    b. Identify faculty from CEC and College of Education to work together and with the schools for STEM outreach.
    c. Continue to participate in economic engagement activities.
    d. Continue to engage with international partners for exchange programs.

4. *Sustainability of our mission*: Manage financial challenges while maintaining commitment to long-term goals by evaluating our programs and activities based on cost, revenue, and mission impact.
    a. Hire Associate Dean for Administration and Finance
    b. Resources stated in Appendix A.

Appendix A. Resources Needed

Discuss additional resources your unit needs to meet the academic dashboard targets and to contribute effectively to the key performance parameters. Examples of resources needed include personnel, fiscal, space/facilities, information technology. Indicate if the resource is existing or additional. Identify potential sources for the resources needed and provide a brief strategy of how the resource will be used to achieve the stated goal.

Recurring:

Type of resource	*Existing*	*Additional*	*Strategy*
Goals 1,2,3,&4:			
Fiscal	-1.1M/yr (deficit)	$5.85M/yr	Addition/simplification of fees; reallocation of resources, mainly to hire faculty
Goal 1:			
Fiscal	None	$480K/yr	Hire 6 additional full-time lecturers (1 for each program)
Fiscal	None	$160K/yr	Hire a lecturer and office staff for IIT
Fiscal	None	$120K/yr	Hire assistant dean for academics
Fiscal	None	$80K/yr	Hire a technician for experiential activities
Goal 2:			
Fiscal	0-$90K	$180K/yr	Hire a preawards and a post awards director in CEC (one position may be repurposed from today)

One-time:

Type of resource	*Existing*	*Additional*	*Strategy*
Goals 1,2,3:			
Fiscal	None	$3M	Upfit of Horizon II
Goal 1:			
Fiscal	None	$500K	Cleanup ($100K) and update of the furniture ($200K) and equipment ($200K) of the instructional labs ahead of the accreditation visit.
Fiscal	None	$60K	Lecture-capture equipment in three updated classrooms in 300Main, in support of online education and 2+2 agreements.
Fiscal	None	$600K-1M	To convert the woodchip area of the biomass building to a maker space and also an experiential activities space for the university
Goal 4:			
Fiscal	None	$250K	A café in Swearingen, to help build a community
Fiscal	None	variable	For new initiatives, for three years CEC retains 62.5% of the post-debt-service gross revenues. To create seed funding for other initiatives which may not lead to success.

Goal ?			
Fiscal	None	?	On Swearingen and 300 Main, the name of the College appears as Engineering and Information Technology. These need to be corrected immediately, especially if we care about branding.

Appendix B. Benchmarking Information

B.1. Top ten ranked public undergraduate engineering programs (some may or may not have computing).

The source for the state appropriations, as well as tuition and fees, is *National Center for Education Statistics Integrated Post-secondary Education Data System* (IPEDS). The fees are from their websites.

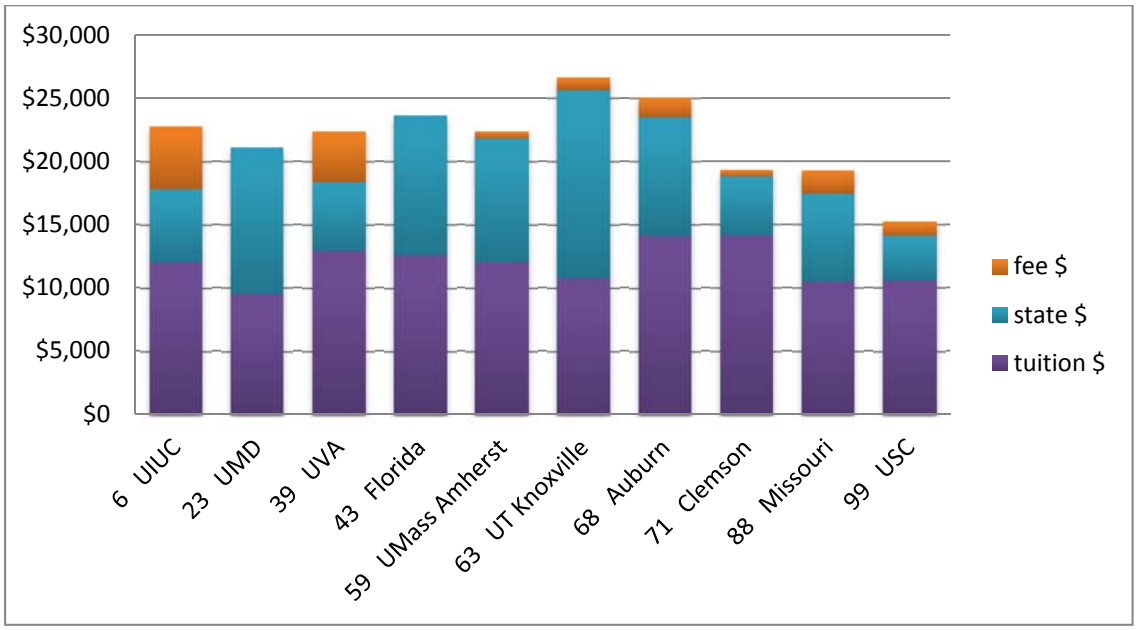
US News UGrad	Public University/College	FY2012 Per FTE State Appro	Base Tuition/ Fees	Diff. Tuition/ Fees	Student Total	Student Total Incl. State
3	U of California - Berkeley	$7,486	$15,162	$0	$15,162	$22,648
5	Georgia Institute of Technology	$9,564	$11,394	$0	$11,394	$20,958
5	University of Illinois	$5,780	$12,036	$5,004	$17,040	$22,820
7	University of Michigan	$5,728	$14,858	$3,020	$17,878	$23,606
10	Purdue University	$7,499	$10,002	$2,050	$12,052	$19,551
10	University of Texas	$6,255	$9,346	$868	$10,214	$16,469
13	University of Wisconsin	$9,481	$11,546	$1,400	$12,946	$22,427
15	Texas A&M University	$9,655	$9,180	$2,000	$11,180	$20,835
15	Virginia Tech	$6,963	$12,017	$948	$12,965	$19,928
19	Pennsylvania State University	$8,468	$18,846	$1,662	$20,508	$28,976

B.2. Peers, peer aspirants, and Clemson.

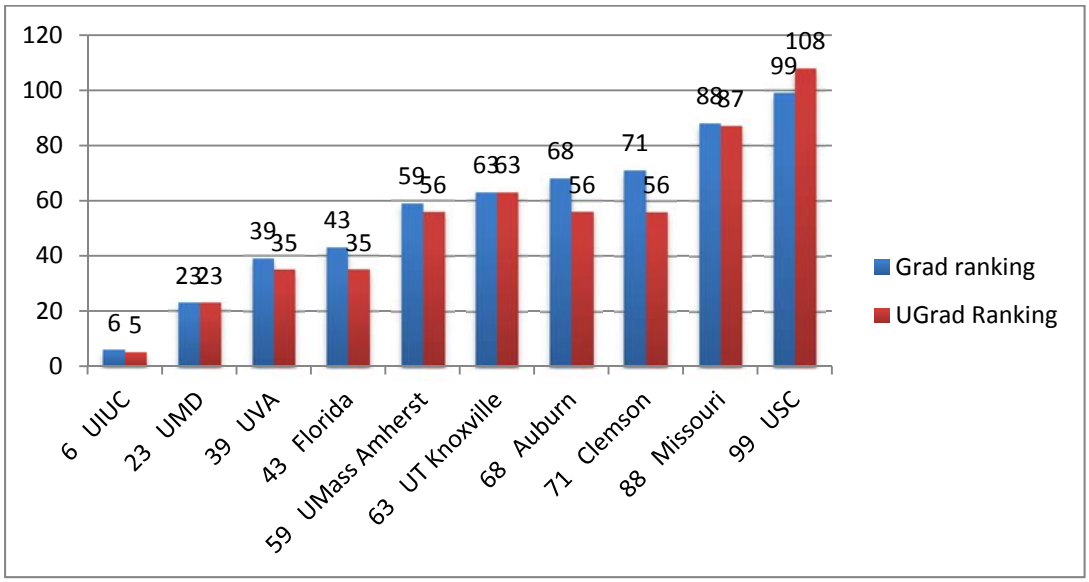
	School	USNews Grad '16/'17	USNews Ugrad	Per FTE State $	Base Tuition/Fees	Diff. Tuition/ Fees	Student Total	Student Total Incl. State
Peer Aspirants	UIUC	6/7	5	$5,780	$12,036	$5,004	$17,040	$22,820
	UMD	23/24	23	$11,538	$9,579	$0	$9,579	$21,117
	UVA	39/39	35	$5,456	$12,948	$4,000	$16,948	$22,404
	Florida	43/43	35	$11,026	$12,620	$0	$12,620	$23,646
Peers	UMass Amherst	59/57	56	$9,749	$12,076	$575	$12,651	$22,400
	UT Knoxville	63/62	63	$14,866	$10,788	$992	$11,780	$26,646
	Auburn	68/62	56	$9,360	$14,135	$1,590	$15,725	$25,085
	Missouri	88/91	87	$6,970	$10,477	$1,822	$12,299	$19,269
	Clemson	71/65	56	$4,673	$14,109	$500	$14,609	$19,282
	USC	99/100+	108	$3,552	$10,577	$1,119	$11,696	$15,248

It is notable that the total investment per students FTE at USC is by far the lowest compared with not only the top-10 public engineering/computing programs, but also with our peers and peer aspirants, including Clemson. The investment at USC is lower by ~$4,000 to $14,600. It may appear that the investment at UT Austin is only $1,200 more than that at USC. However, the endowment and investment return at Texas is much higher than USC's. IPEDS data shows

UT Austin to have $16,975 per student in gifts and investment returns, compared with $2,708 for USC. In fact, inclusion of the investment return and gifts shows the investment per student at USC to be over $6,500 less than Clemson, which is the next school in the list. The non-investment comparisons are tabulated below.



And notably, USC is the only school from among its peers and peer aspirants (plus Clemson) to have its undergraduate program ranked lower than its graduate program. Additional investment in CEC is now necessary.



Appendix C. Unit's Top Strengths and Important Accomplishments

I am too new to know all the strengths. The bulk of my time has been spent on exploring ways to devise potential solutions for the budgetary challenges of the College. I need to have a handle on the resources before I begin meeting with the departments and have conversations about their aspirations and needs.

- Strong track record of hiring junior faculty. Many have received the NSF CAREER award. 38 faculty members have received these; and today 21% of the College is a CAREER awardee.
- Good level of IP generation: 19 patents were issued in FY15!
- Very involved with the development of new initiatives, economic engagement, and international initiatives.
- Faculty is vested in the success of students.
- SmartState program has had some success in attracting world-class faculty to USC.
- Faculty is committed to undergraduate education, and the departments take the accreditation process seriously.
- Honors College helps attract good students to CEC. CEC needs to do more with Honors College to ensure that Honors College challenges the students, and in turn, more students will want to come to Honors College and CEC.

Appendix D. Unit's Weaknesses and Plans for Addressing the Weaknesses

- No hiring in nearly two years.
- The early success of junior hires (21% of CEC received NSF CAREER!!) has not translated into sustained research excellence in every case.
    - Improve mentorship system. Institute incentives or rewards for mentors. Consider peer or external mentors (even from outside CEC or USC).
    - Need immediate attention to High Performance Computing, and Data Repository.
- The research expenditure for the College as a whole is quite low for its size.
    - Build critical mass to compete for center-level grants.
    - By the time faculty size gets close to 145 in 5 years, our expenditures need to be double of todays.
- CEC needs more large classrooms and high-tech classrooms.
    - Per startup, some of the current CSE space in Swearingen will be repurposed by USC.
- Facilities and instructional laboratories are under-maintained, and outdated. Quality of space is low, especially in 300 Main.
    - Develop space policy to clear up under utilization or squatting situations.
    - Invest in the labs proactively ahead of the ABET visit.
- Student/faculty ratio is too high (present is 25, going to 28. USC goal 18)
    - Hire faculty through imposition of higher program fees.
- There are very few written policies and bylaws.
    - Faculty senate has been inactive; it is being re-activated.
- Student retention needs to be improved.
    - IIT department will help
    - Investing in student success (assistant dean for academics is being searched for)
    - More first-year advisors
    - Online integrated advising system at the university level.
- Faculty (and staff) loads do not seem to be managed well. Not everyone is contributing to the overall mission of CEC at the same level.
    - Work with department chairs to institute rigorous and quantitative annual reviews.
    - Give faculty the support and infrastructure needed to succeed.
- Salaries are lagging, even compared with Clemson (see Appendix F).
    - This has already led to loss of top flight faculty. Needs to be addressed.
- Lack of administrative and financial planning capability
    - Need to hire associate dean for administration and finance.
- Lack of college-level attention to diversity and inclusion
    - Search for associate dean for diversity, engagement, and inclusion is under way.
- Lack of direction for the advancement efforts.
    - CEC needs cash (more than scholarships) to start programs, which can then excite donors into naming those programs. Also chair endowments.
    - Advancement vs. economic engagement: the lines in USC remain unsettled.
- Lack of community: among students, and especially faculty from different departments.
    - common space/café is needed

Appendix E. Unit Statistical Profile

1. **Number of entering freshman for Fall 2012, Fall 2013, Fall 2014, and Fall 2015 classes and their average SAT and ACT scores**

New Freshmen/Test Avg.	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015
# New Fresh / ACT	485/27	494/28	618/28	682/28	758/28
# New Fresh / SAT	485/1226	494/1226	618/1254	682/1239	758/1242

2. **Freshman retention rate for classes entering Fall 2012, Fall 2013, and Fall 2014.**

		2010 Cohort	2011 Cohort	2012 Cohort	2013 Cohort	2014 Cohort
Started	*Ended*	Returned '11	Returned '12	Returned '13	Returned '14	Returned '15
CEC	Same School	69.4%	65.6%	73.7%	76.1%	76.0%
	Other School	14.6%	14.3%	12.9%	12.3%	9.8%
	Total	84.0%	79.9%	86.7%	88.4%	85.8%

3. **Sophomore retention rate for classes entering in Fall 2011, Fall 201, and Fall 2013.**

		2010 Cohort	2011 Cohort	2012 Cohort	2013 Cohort
Started	*Ended*	Returned '12	Returned '13	Returned '14	Returned '15
CEC	Same School	68.8%	74.5%	75.8%	80.7%
	Other School	17.8%	16.1%	14.6%	9.3%
	Total	86.6%	90.6%	90.4%	90.1%

4. **Headcount - Number of majors enrolled in Fall 2012, Fall 2013, Fall 2014, and Fall 2015 by level: undergraduate, masters, or doctoral (no certificate or first professional majors in CEC)**

Student Headcount	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015
Undergraduate	1,849	1,971	2,187	2,477	2,742
Masters	192	164	178	186	242
Certificate	0	0	0	0	3
First Professional	0	0	0	0	0
Doctoral	343	370	338	308	323
Total	2,384	2,505	2,703	2,974	3,310

5. **Number of entering first professional and graduate students: Fall 2012, Fall 2013, Fall 2014, Fall 2015, and their average GRE, MCAT, LSTAT, etc.**

New Freshmen/Test Avg.	Fall 2011	Fall 2012	Fall 2013*	Fall 2014	Fall 2015
#New Graduate Students	90	88		93	105
Average GRE**					

*No reliable data – banner transition

**No reporting mechanism

6. Number of graduates in Fall 2014, Spring 2015, and Summer 2015 by level.

	Fall 2014	Spring 2015	Summer 2015
Undergraduate	96	275	24
Masters	22	29	18
Certificate	1	0	0
First Professional	0	0	0
Doctoral	30	17	9
Total	**149**	**321**	**51**

7. Four-, Five-, and Six-Year Graduation rates for the tree most recent applicable classes (undergraduate only).

Started	***Ended***	**2007 Cohort**				**2008 Cohort**				**2009 Cohort**		
CEC	Same School	28.6%	44.4%	49.5%		27.1%	40.9%	42.3%		26.9%	39.6%	42.5%
CEC	Other School	6.1%	14.2%	16.7%		11.4%	22.9%	25.4%		13.7%	22.8%	26.2%
CEC	Total	34.7%	58.6%	66.2%		38.6%	63.7%	67.7%		40.7%	62.4%	68.7%

8. Total credit hours generated by your unit regardless of major for Fall 2014, Spring 2015, and Summer 2015.

	Fall 2014	Spring 2015	Summer 2015	Fall 2015	Total
Total Credit Hours	?	22,785	2,145	26,457	51,387
Total FTE Students	?	1,601	164	1,869	3,634

****ORIA Staff Still updating reporting – information not available at time of submission**

9. Percent of credit hours by undergraduate major taught by faculty with a highest terminal degree.

	BMEN	CSCE	ECHE	ECIV	ELCT	EMCH	ENCP	Total
Percent								

****** Reliable data not available**

10. Percent of credit hours by undergraduate major taught by full-time faculty.

Percent

	Prof	Assoc Prof	Asst Prof	Instructor	Clinical	Adjunct	Grad Asst	Other	Total
BMEN	10.0%	35.6%	33.0%	15.0%	6.4%				100%
CSCE	22.2%	19.0%	4.2%	7.0%		12.8%	33.0%	1.7%	100%
ECHE	50.7%	20.2%	23.8%			4.7%		0.6%	100%
ECIV	11.1%	37.8%	13.8%			22.6%	11.3%	3.4%	100%
ELCT	31.2%	39.3%	19.8%				8.3%	1.4%	100%
EMCH	26.4%	27.7%	27.1%	8.4%		10.4%			100%
ENCP	88.9%	9.3%			0.0%	1.8%			100%

Number

	Prof	Assoc Prof	Asst Prof	Instructor	Clinical	Adjunct	Grad Asst	Other	**Total**
BMEN	135	481	446	203	87				**1,352**
CSCE	1,819	1,554	342	573		1,048	2,699	141	**8,176**
ECHE	1,063	424	500			99		12	**2,098**
ECIV	319	1,086	397			651	324	99	**2,876**
ELCT	729	919	462				195	33	**2,338**
EMCH	1,543	1,623	1,587	492		609			**5,854**
ENCP	753	79				15			**847**
Total	**6,361**	**6,166**	**3,734**	**1,268**	**87**	**2,422**	**3,218**	**285**	**23,541**

11. Number of faculty by title (tenure-track by rank, non-tenure track (research or clinical) by rank) as of Fall 2013, Fall 2014, and Fall 2015 (by department where applicable).

	FALL	Full	Assoc	Assist	FT Instr	PT Instr
Chemical Engineering	2013	12	4	7	0	2
	2014	9	5	6	0	2
	2015	9	5	6	1	1
Civil and Environmental Engineering	2013	4	8	6	4	4
	2014	4	8	8	0	4
	2015	4	10	4	0	10
Computer Science and Engineering	2013	6	13	3	1	3
	2014	10	9	2	0	3
	2015	12	6	5	2	3
Electrical Engineering	2013	7	6	4	0	0
	2014	6	5	5	0	0
	2015	6	6	5	0	2
Mechanical Engineering	2013	13	7	10	3	4
	2014	14	6	10	0	4
	2015	16	7	10	0	6

Source for 2013 and 2014: ASEE On-line tables

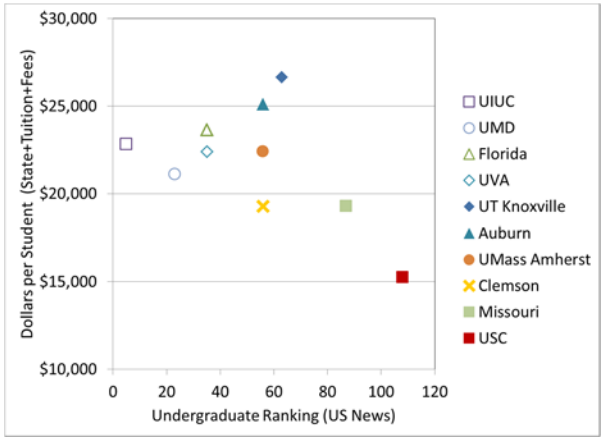
12. Current number and change in the number of tenure-track and tenured faculty from underrepresented minority groups from FY 2014.

	2014				2015				Delta			
	Prof	Asso Prof	Asst Prof	Total	Prof	Asso Prof	Asst Prof	Total	Prof	Asso Prof	Asst Prof	Total
Two or More	0	0	0	0	1	0	0	1	+1	0	0	+1
Am In/ Alaska N	0	0	0	0	0	0	0	0	0	0	0	0
Asian	9	14	11	34	12	14	12	38	+3	0	+1	+4
Black/AAA	0	0	1	1	0	0	1	1	0	0	0	0
Hispanic	3	1	0	4	2	1	0	3	-1	0	0	-1
N/R Alien	2	3	1	6	0	0	0	0	-2	-3	-1	-6
White	26	16	11	53	32	19	17	68	+6	+3	+6	+15
Not Available	1	0	6	7	0	0	0	0	-1	0	-6	-7
Unknown	0	2	0	2	0	0	0	0	0	-2	0	-2
TOTAL	41	36	30	107	47	34	30	111	+6	-2	0	+4

Appendix F. Challenges

- Little possibility of chance meeting among faculty of different departments, or students.
- The College needs a CFO to manage and plan the finances as well as administration of the College. The HR side of the house
    - Need to hire associate dean for administration and finance.
- In its combined A and E funds, CEC is running a deficit of over $1M/year, and has a debt of nearly $3M today. Even with no hiring beyond the 3/year promised to the dean, the debt will continue to grow to over $8M, and the faculty size will shrink over the next five years.
    - Need addition to the base, by $5.85M/year (a fee-increase plan was proposed which achieves the desired goal)
    - Can then hire 8 faculty per year, and bolster the health of the college.
- For a variety of reasons, the funding for the College as a whole is quite low for its size. USC/CEC does not provide the infrastructure that is enjoyed by the more research active universities. And our salaries are starting to lag. We do have some excellent faculty members, and need to find ways to retain them while we address the overall infrastructure issues over the next few years. Below is the comparison data in terms of funding per faculty. The table shows the graduate rankings, the number of faculty, and the amount of research funding per faculty. The plot shows the ranking vs. the total of tuition, fees, and programs fees per student.

School	# fac	res $/ fac (K)
6 UIUC	392	$587
23 UMD	252	$601
39 UVA	145	$519
43 Florida	260	$247
59 UMass Amherst	155	$370
63 UT Knoxville	172	$343
68 Auburn	146	$370
71 Clemson	211	$146
88 Missouri	111	$222
99 USC	111	$202

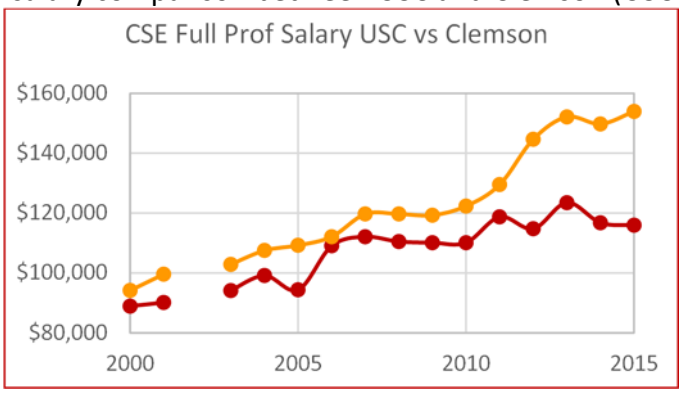


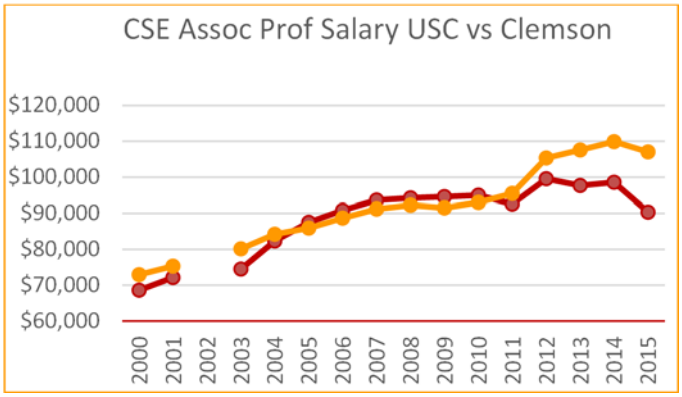
    - We have submitted a plan to increase the number of faculty to 143. This recognizes that there are fixed costs of offering curricula, and that research productivity does not scale linearly with the size of the faculty. It is expected that growth to 143 faculty places us in the range of Auburn and UMass Amherst, where the faculty funding is $370K/year. The additional directs, and indirects returned to CEC, will then amount to $24.1M/yr. This is all the result of an addition of $5.85M/yr to the base (currently being proposed as fees), for a cash-on-cash ROI of infinity (since the original investment is fees), or a cash-on-fees ROI of 412%. In the meantime, there are the real advantages of improved instruction and retention, improved scholarship, improved PhD count, improved morale, equipment, facilities, etc. In

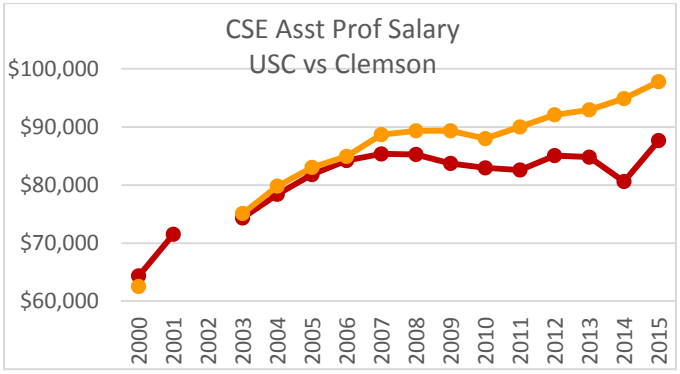
fact, it is expected that the PhD head count will increase from today's value of 3.0 per faculty to 4.1 per faculty (even as the faculty head count increases from 111 to 143).
    - From Appendix G, it is seen that the level of proposal generation is not uniform across CEC. It is also seen that higher number of proposals correlate strongly with higher total funding. The faculty evaluation metrics in CEC need to elevate the importance of funded research activity, either directly, or indirectly, through teaching more courses and freeing others to engage in funded research.
- CEC needs more large classrooms, and hi-tech classrooms.
    - Per startup, some of the current CSE space in Swearingen will be repurposed by USC.
    - Also Facilities is refurbishing several classrooms in 300 Main. In the current request we ask for $60K to incorporate lecture capture equipment into two of the rooms, in support of the future online offerings supporting international and 2+2 initiatives.
- Facilities and instructional laboratories are under-maintained, and outdated. Quality of space is low, especially in 300 Main.
    - Develop space policy to clear up under utilization or squatting situations.
    - Invest in the labs proactively ahead of the ABET visit: CEC is currently performing an audit of the instructional labs with Facilities management, in order to determine the cost of cleanup and update ahead of the ABET accreditation visit. *A previous visit precipitated an addition of $2M/year* (by Provost Becker) to the base budget of the College. The look and feel of labs figure prominently in the impression that the reviewers form, and in their reports. Having led two ABETs at Virginia, this is from personal experience. The first ABET we had failed mainly because of "antiquated and shop-made" labs, which is when I was asked to become Chair, and get us through the problem. The next time around, with the development of the Rolls Royce labs, the reviewers deemed our labs "the best they had ever seen". At this late a stage I do not see the option of creating a Rolls-Royce quality lab at USC for the upcoming visit. But I do see that an investment of $5-600K could create a set of professional looking laboratories that save us a great deal of headache and larger investments down the road.
- Faculty loads do not seem to be managed rigorously across the board.
    - Not everyone is contributing to the overall mission of CEC at the same level. Some are doing many things and working hard (compared with other schools, nobody is over-worked). Overall, the available time of the faculty does not seem to be used efficiently. In fairness to the faculty, one can enumerate many contributing factors: high student-faculty ratio, significant lack of infrastructure, shortage of pre and post-award research support staff, low quality of IT service delivery, effectively no high performance computing at the university level (RCI owns a total of 65 nodes; I purchased more than that for the last two assistant professors that I hired at UVA), lack of data management facilities, lagging salaries, wide spectrum of salaries, no return of indirects, inhospitable surroundings which are not conducive for round-the-clock working (no café or restaurant, and somewhat transitional neighborhood), etc.

- Student/faculty ratio is high (present is 25, going to 28. USC goal 18)
    - Must hire more faculty.
- Freshman student retention needs to be improved.
    - The freshman-sophomore retention remains a challenge because of lack of differential admissions. Eventually, with the adoption of tools, we will develop ways of educating more engineers and computer scientists, in a way that they can learn the necessary physics and mathematics in the context of engineering, and in parallel with the engineering topics. Until that time (any curricular changes are multi-year endeavors), students who are not strong in mathematics will struggle, even though we will continue to provide more help for them. While it may be viewed as doing students a favor by letting them declare engineering or computing as a major, even if they may not have all the math requirements, in reality, we may be doing the students a disservice by setting them up for failure. And if those students are the first in their family to go to college, then the effect on those students, as well as on their younger siblings, friends, and cousins, will be quite negative and drastic.
- *Salaries are lagging*. Specially when compared with Clemson. Computer science is severely lagging Clemson's scale, mainly because for years it had been assigned the incorrect cip code as "general engineering" (14.0101 instead of 14.0901). The results for EE are also provided below. There is no cip-code related issue for EE. Note the big change in slope of raises at Clemson in 2011, when the NRC rankings came out, and USC was better than Clemson in every area of CEC.

CSE salary comparison between USC and Clemson (USC is the lower curve)







EE salary comparison between USC and Clemson

	Professor			Associate Prof.			Assistant Prof.		
	USC	Clemson	Difference	USC	Clemson	Difference	USC	Clemson	Difference
2004	$139,536	$119,928	$19,608	$75,315	$81,612	-$6,297	$66,260	$74,207	-$7,947
2005	$139,270	$124,583	$14,687	$77,944	$85,590	-$7,646	$69,275	$77,633	-$8,358
2006	$157,087	$133,002	$24,085	$81,939	$89,238	-$7,299	$71,126	$77,946	-$6,506
2007	$161,006	$138,719	$22,286	$84,934	$88,493	-$3,559	$73,920	$83,226	-$9,306
2008	$162,600	$137,389	$25,210	$84,484	$87,325	-$2,841	$76,670	$84,832	-$8,162
2009	$162,600	$137,389	$25,210	$84,600	$87,764	-$3,165	$77,725	$84,828	-$7,103
2010	$167,394	$137,747	$29,648	$85,455	$90,067	-$4,611	$77,684	$84,738	-$7,054
2011	$154,434	$138,421	$16,012	$85,725	$92,289	-$6,565		$88,647	-$88,647
2012	$151,544	$153,493	-$1,949	$88,296	$101,417	-$13,122	$85,710	$102,269	-$16,559
2013	$134,504	$153,057	-$18,553	$88,817	$106,019	-$17,201	$85,710		
2014	$142,341	$154,037	-$11,696	$94,681	$107,855	-$13,175	$86,223		
2015	$144,991	$153,386	-$8,395	$97,492	$115,988	-$18,496	$86,598		

Appendix G. Proposal and Funded-Research Statistical Profile

Blueprint #1 - Total and Amount Sponsored Proposal Submissions - FY2015

Dept.	Total $	Total #	Agency - (Z Accounts)	COMM	FED	OTHER	PRIVATE	STATE
ChE	10,835,159	79		6	63	2	6	2
Civil & Env	5,027,096	50		4	37	3	5	1
Comp Sci & E	5,107,789	40	1		38			1
EE	4,306,540	45		2	41	1	1	
College	421,668	1					1	
ME	18,576,887	105		10	89	1	2	3
Tot #		**320**						
Tot $	**44,275,139**		**100,000**	**3,315,038**	**38,938,681**	**253,442**	**1,245,600**	**422,378**

Blueprint Data #2 - Total sponsored awards by funding source / faculty / rank - FY2015

Chemical Engineering

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Alexeev, Oleg	RESEARCH PROFESSOR		20,000		20,000				
Amiridis, Michael			725,318	275,318	450,000				
Gower, Michael	ASST PROFESSOR		205,500		205,500				
Hattrick-Simpers, Jason	ASST PROFESSOR		249,576	4,200	195,377		49,999		
Heyden, Andreas	ASSOC. PROFESSOR	TENURED	218,000		218,000				
Jabbari, Esmaiel	PROFESSOR	TENURED	528,278		528,278				
Jabbarzadeh, Ehsan	ASST PROFESSOR		83,250		83,250				
Lauterbach, Jochen	PROFESSOR	TENURED	50,000		50,000				
Matthews, Michael	PROFESSOR	TENURED	1,250,000						1,250,000
Monnier, John			90,002	90,002					
Moss, Melissa	ASSOC. PROFESSOR	TENURED	523,895		523,895				
Padak, Bihter	ASST PROFESSOR		20,000	20,000					
Ploehn, Harry	PROFESSOR	TENURED	110,116						110,116

Popov, Branko	PROFESSOR	TENURED	780,000		780,000				
Regalbuto, John	PROFESSOR	TENURED	232,975	110,001	122,974				
Ritter, James	PROFESSOR	TENURED	680,879	175,000	480,879		25,000		
Shimpalee, Sirivatch	RESEARCH PROFESSOR		114,869		114,869				
Uline, Mark	ASST PROFESSOR		51,470		51,470				
Weidner, John	PROFESSOR	TENURED	40,000	40,000					
White, Ralph	PROFESSOR	TENURED	269,995		269,995				
Williams, Christopher	PROFESSOR	TENURED	29,597		29,597				
Yu, Miao	ASST PROFESSOR		295,338		295,338				
Zhou, Xiao-Dong	ASSOC. PROFESSOR	TENURED	540,500		540,500				

Civil and Environmental Engineering

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Caicedo, Juan	PROFESSOR	TENURED	84,541		44,000			40,541	
Chaudhry, M.	PROFESSOR	TENURED	255,755						255,755
Gassman, Sarah	ASSOC. PROFESSOR	TENURED	4,589	4,589					
Huynh, Nathan	ASSOC. PROFESSOR	TENURED	286,000		286,000				
Matta, Fabio	ASSOC. PROFESSOR	TENURED	389,049	93,400	295,649				
Mullen, Robert	PROFESSOR	TENURED	200,988		200,988				
Pierce, Charles	ASSOC. PROFESSOR	TENURED	12,432					12,432	
Rizos, Dimitris	ASSOC. PROFESSOR	TENURED	469,748	22,468	447,280				
Sasanakul, Inthuorn	ASST PROFESSOR		11,400	11,400					
Song, Jeong-Hoon			-50,000		-50,000				
Viparelli, Enrica	ASST PROFESSOR		50,585		50,585				
Yoon, Yeomin	ASSOC. PROFESSOR	TENURED	319,023				319,023		
Ziehl, Paul	PROFESSOR	TENURED	89,779		89,779				

Computer Science and Engineering

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Bakos, Jason	ASSOC. PROFESSOR	TENURED	325,050	61,000	264,050				
Beer, Jenay	ASST PROFESSOR		15,000		15,000				
Hu, Jianjun	ASSOC.	TENURED	27,320						27,320

	PROFESSOR								
Huhns, Michael			148,044		148,044				
Nelakuditi, Srihari	PROFESSOR	TENURED	59,414		59,414				
O'Kane, Jason	ASSOC. PROFESSOR	TENURED	21,210		21,210				
Rekleitis, Ioannis	ASST PROFESSOR		520,981		520,981				
Tang, Jijun	PROFESSOR	TENURED	16,000		16,000				
Valafar, Homayoun	PROFESSOR	TENURED	414,263		414,263				
Wang, Song	PROFESSOR	TENURED	27,000		27,000				

Electrical Engineering

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Ali, Mohammod	PROFESSOR	TENURED	95,570		95,570				
Benigni, Andrea	ASST PROFESSOR		61,000	61,000					
Brown, Gabriel			-80,188		-80,188				
Chandrashekhar, MVS	ASSOC. PROFESSOR	TENURED	8,000		8,000				
Dougal, Roger	PROFESSOR	TENURED	4,069,029	43,564	2,025,465				2,000,000
Ginn, Herbert	ASSOC. PROFESSOR	TENURED	131,651	29,708	101,943				
Matolak, David	PROFESSOR	TENURED	8,000		8,000				
Santi, Enrico	ASSOC. PROFESSOR	TENURED	86,087	86,087					
Wang, Guoan	ASST PROFESSOR		169,484		169,484				
Wang, Xiaofeng	ASST PROFESSOR		16,000		16,000				

College of Engineering and Computing

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Boccanfuso, Anthony	PROGRAM DIRECTOR		320,435		320,435				

Mechanical Engineering

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Banerjee, Sourav	ASST PROFESSOR		8,013		8,013				
Bayoumi, Abdel	PROFESSOR	TENURED	1,159,860	30,000	1,129,860				
Besmann, Theodore	PROFESSOR	TENURED	93,427		93,427				
Cacuci, Dan	PROFESSOR	TENURED	456,462		456,462				
Chen, Fanglin	PROFESSOR	TENURED	190,405	150,434	39,971				
Farouk, Tanvir	ASST PROFESSOR		350,117		350,117				
Giurgiutiu, Victor	PROFESSOR	TENURED	265,000		265,000				
Huang, Kevin	PROFESSOR	TENURED	3,390,051		3,390,051				

Huang, Xinyu	ASSOC. PROFESSOR		399,999		399,999				
Kaoumi, Djamel	ASST PROFESSOR		216,183		216,183				
Khan, Jamil	PROFESSOR	TENURED	944,845	14,255	552,941				377,649
Kidane, Addis	ASST PROFESSOR		189,376		189,376				
Knight, Travis	PROFESSOR	TENURED	3,709,930	113,000	2,946,967			25,000	624,963
Li, Chen	ASSOC. PROFESSOR	TENURED	359,999		279,999				80,000
Majumdar, Prasun	ASST PROFESSOR		750,000		500,000				250,000
Reifsnider, Kenneth	EMERITUS	TENURED	60,297		53,297				7,000
Reynolds, Anthony	PROFESSOR	TENURED	152,750	148,750	4,000				
Shazly, Tarek	ASST PROFESSOR		34,250		34,250				
Sutton, Michael	PROFESSOR	TENURED	30,000		30,000				
Tarbutton, Joshua	ASST PROFESSOR		310,001	10,000	300,001				
van Tooren, Michael	PROFESSOR	TENURED	365,684	237,142			128,542		
Xue, Xingjian	ASSOC. PROFESSOR	TENURED	750,000		750,000				

SmartState Chairs

PI	Title	Tenure?	Tot	COMM	FED	LOCAL	OTHER	PRIVATE	STATE
Lauterbach, Jochen	PROFESSOR	TENURED	50,000		50,000				
Regalbuto, John	PROFESSOR	TENURED	232,975	110,001	122,974				
Besmann, Theodore	PROFESSOR	TENURED	93,427		93,427				
Cacuci, Dan	PROFESSOR	TENURED	456,462		456,462				
van Tooren, Michael	PROFESSOR	TENURED	365,684	237,142			128,542		

Blueprint Date #3 - Summary of Research Expenditures per faculty/tenure status/rank - FY2015

Last, First	**Dept**	**Expenditure**	**Tenured?**	**Title**
Boccanfuso, Anthony	CEC	24,148.97		PROGRAM DIRECTOR
Boccanfuso, Anthony	CEC	3,436.34		PROGRAM DIRECTOR
Boccanfuso, Anthony	CEC	(1,673.10)		PROGRAM DIRECTOR
Weidner, John	ChE	(3,862.93)	TENURED	PROFESSOR
Heyden, Andreas	ChE	2,087.24	TENURED	ASSOC. PROFESSOR
Ritter, James	ChE	(32,038.42)	TENURED	PROFESSOR
Weidner, John	ChE	(9,683.31)	TENURED	PROFESSOR
Shimpalee,	ChE	(1,968.73)		RESEARCH ASSOC PROF

Sirivatch				
Popov, Branko	ChE	482,037.01	TENURED	PROFESSOR
Weidner, John	ChE	(8,377.68)	TENURED	PROFESSOR
Zhou, Xiao-Dong	ChE	10,420.04		ASSOC. PROFESSOR
Heyden, Andreas	ChE	150,634.75	TENURED	ASSOC. PROFESSOR
Ritter, James	ChE	158,856.75	TENURED	PROFESSOR
Zhou, Xiao-Dong	ChE	1,885.32		ASSOC. PROFESSOR
Heyden, Andreas	ChE	184,749.96	TENURED	ASSOC. PROFESSOR
Padak, Bihter	ChE	93,110.19		ASST PROFESSOR
Heyden, Andreas	ChE	58,198.79	TENURED	ASSOC. PROFESSOR
Regalbuto, John	ChE	109,323.90	TENURED	PROFESSOR
White, Ralph	ChE	30,269.75	TENURED	PROFESSOR
Regalbuto, John	ChE	126,330.94	TENURED	PROFESSOR
Blanchette, James	ChE	23,802.92		
Yu, Miao	ChE	77,042.27		ASST PROFESSOR
Heyden, Andreas	ChE	30,284.61	TENURED	ASSOC. PROFESSOR
Moss, Melissa	ChE	(50,658.74)	TENURED	ASSOC. PROFESSOR
Regalbuto, John	ChE	7,800.00	TENURED	PROFESSOR
Ploehn, Harry	ChE	154.54	TENURED	PROFESSOR
Williams, Christopher	ChE	370,990.04	TENURED	PROFESSOR
Jabbari, Esmaiel	ChE	366,473.31	TENURED	ASSOC. PROFESSOR
Jabbari, Esmaiel	ChE	(640.63)	TENURED	ASSOC. PROFESSOR
Jabbarzadeh, Ehsan	ChE	(15,430.02)		ASST PROFESSOR
Uline, Mark	ChE	(1,306.38)		ASST PROFESSOR
Zhou, Xiao-Dong	ChE	62,845.68		ASSOC. PROFESSOR
Lauterbach, Jochen	ChE	114,672.18	TENURED	PROFESSOR
Regalbuto, John	ChE	10,428.91	TENURED	PROFESSOR
Hattrick-Simpers, Jason	ChE	12,421.98		ASST PROFESSOR
Jabbarzadeh, Ehsan	ChE	5,988.01		ASST PROFESSOR
Jabbari, Esmaiel	ChE	12,199.09	TENURED	ASSOC. PROFESSOR
Jabbarzadeh, Ehsan	ChE	84,519.29		ASST PROFESSOR
Moss, Melissa	ChE	212,974.33	TENURED	ASSOC. PROFESSOR
Yu, Miao	ChE	74,460.76		ASST PROFESSOR
Shimpalee, Sirivatch	ChE	90,647.19		RESEARCH ASSOC PROF
Lauterbach, Jochen	ChE	49,506.14	TENURED	PROFESSOR
Zhou, Xiao-Dong	ChE	243,160.99		ASSOC. PROFESSOR
Moss, Melissa	ChE	24,660.00	TENURED	ASSOC. PROFESSOR
Uline, Mark	ChE	45,145.53		ASST PROFESSOR
White, Ralph	ChE	73,347.37	TENURED	PROFESSOR
Hattrick-Simpers, Jason	ChE	76,510.12		ASST PROFESSOR
Yu, Miao	ChE	79,708.22		ASST PROFESSOR
Shimpalee, Sirivatch	ChE	25,005.40		RESEARCH ASSOC PROF
Williams, Christopher	ChE	32,878.59	TENURED	PROFESSOR
Ritter, James	ChE	15,627.47	TENURED	PROFESSOR
Gower, Michael	ChE	102,750.00		ASST PROFESSOR

Yu, Miao	ChE	16,201.32		ASST PROFESSOR
Jabbarzadeh, Ehsan	ChE	8,387.52		ASST PROFESSOR
Ritter, James	ChE	107,975.43	TENURED	PROFESSOR
Jabbari, Esmaiel	ChE	3,279.64	TENURED	ASSOC. PROFESSOR
Regalbuto, John	ChE	14,724.98	TENURED	PROFESSOR
Moss, Melissa	ChE	10,459.51	TENURED	ASSOC. PROFESSOR
Amiridis, Michael	ChE	87,330.41	TENURED	PROFESSOR
Weidner, John	ChE	16,688.94	TENURED	PROFESSOR
Weidner, John	ChE	277.48	TENURED	PROFESSOR
Ritter, James	ChE	25,536.63	TENURED	PROFESSOR
Lauterbach, Jochen	ChE	108,408.08	TENURED	PROFESSOR
Hattrick-Simpers, Jason	ChE	1,606.84		ASST PROFESSOR
Padak, Bihter	ChE	45,893.04		ASST PROFESSOR
Lauterbach, Jochen	ChE	(106,659.04)	TENURED	PROFESSOR
Monnier, John	ChE	6,572.42		
Monnier, John	ChE	6,349.36		
Lauterbach, Jochen	ChE	93.02	TENURED	PROFESSOR
Regalbuto, John	ChE	2,403.69	TENURED	PROFESSOR
Matthews, Michael	ChE	0.00	TENURED	PROFESSOR
Ritter, James	ChE	76,196.02	TENURED	PROFESSOR
Regalbuto, John	ChE	70,188.23	TENURED	PROFESSOR
Monnier, John	ChE	49,082.04		
Ritter, James	ChE	78,051.37	TENURED	PROFESSOR
Padak, Bihter	ChE	20,000.18		ASST PROFESSOR
Ritter, James	ChE	39,699.47	TENURED	PROFESSOR
Matthews, Michael	ChE	1,307.49	TENURED	PROFESSOR
Chaudhry, M.	Civil & Env	196,947.64	TENURED	PROFESSOR
Viparelli, Enrica	Civil & Env	18,353.62		ASST PROFESSOR
Caicedo, Juan	Civil & Env	29,983.52	TENURED	ASSOC. PROFESSOR
Caicedo, Juan	Civil & Env	98,028.68	TENURED	ASSOC. PROFESSOR
Chaudhry, M.	Civil & Env	26,248.35	TENURED	PROFESSOR
Berge, Nicole	Civil & Env	59,328.51		ASST PROFESSOR
Imran, Jasim	Civil & Env	60,656.06	TENURED	PROFESSOR
Huynh, Nathan	Civil & Env	11,438.89	TENURED	ASSOC. PROFESSOR
Matta, Fabio	Civil & Env	(9,314.63)		ASST PROFESSOR
Ziehl, Paul	Civil & Env	5,152.83	TENURED	PROFESSOR
Matta, Fabio	Civil & Env	9,873.26		ASST PROFESSOR
Huynh, Nathan	Civil & Env	40,587.19	TENURED	ASSOC. PROFESSOR
Huynh, Nathan	Civil & Env	46,826.36	TENURED	ASSOC. PROFESSOR
Viparelli, Enrica	Civil & Env	49,517.09		ASST PROFESSOR
Huynh, Nathan	Civil & Env	33,588.15	TENURED	ASSOC. PROFESSOR
Song, Jeong-Hoon	Civil & Env	9,420.82		
Matta, Fabio	Civil & Env	39,860.64		ASST PROFESSOR
Gassman, Sarah	Civil & Env	62,957.37	TENURED	ASSOC. PROFESSOR
Goodall, Jonathan	Civil & Env	27,600.76		
Berge, Nicole	Civil & Env	80,525.51		ASST PROFESSOR
Huynh, Nathan	Civil & Env	16,336.25	TENURED	ASSOC. PROFESSOR
Chaudhry, M.	Civil & Env	24,284.61	TENURED	PROFESSOR
Song, Jeong-Hoon	Civil & Env	5,500.00		

Caicedo, Juan	Civil & Env	41,354.35	TENURED	ASSOC. PROFESSOR
Ziehl, Paul	Civil & Env	5,746.27	TENURED	PROFESSOR
Ziehl, Paul	Civil & Env	72,734.23	TENURED	PROFESSOR
Rizos, Dimitris	Civil & Env	83,895.92	TENURED	ASSOC. PROFESSOR
Matta, Fabio	Civil & Env	173,451.77		ASST PROFESSOR
Huynh, Nathan	Civil & Env	4,363.29	TENURED	ASSOC. PROFESSOR
Huynh, Nathan	Civil & Env	13,984.49	TENURED	ASSOC. PROFESSOR
Huynh, Nathan	Civil & Env	2,718.86	TENURED	ASSOC. PROFESSOR
Imran, Jasim	Civil & Env	10,173.38	TENURED	PROFESSOR
Matta, Fabio	Civil & Env	(7,047.76)		ASST PROFESSOR
Imran, Jasim	Civil & Env	72,349.29	TENURED	PROFESSOR
Matta, Fabio	Civil & Env	33,758.22		ASST PROFESSOR
Matta, Fabio	Civil & Env	6,410.18		ASST PROFESSOR
Berge, Nicole	Civil & Env	51,228.30		ASST PROFESSOR
Pierce, Charles	Civil & Env	12,083.10	TENURED	ASSOC. PROFESSOR
Yoon, Yeomin	Civil & Env	19,666.03	TENURED	ASSOC. PROFESSOR
Yoon, Yeomin	Civil & Env	57,845.76	TENURED	ASSOC. PROFESSOR
Dougal, Roger	EE	14,043.24	TENURED	PROFESSOR
Koley, Goutam	EE	87,451.85		VISITING PROFESSOR
Koley, Goutam	EE	9,276.27		VISITING PROFESSOR
Dougal, Roger	EE	(0.09)	TENURED	PROFESSOR
Sudarshan, Tangali	EE	143,154.20		
Koley, Goutam	EE	(118.83)		VISITING PROFESSOR
Koley, Goutam	EE	19,795.43		VISITING PROFESSOR
Dougal, Roger	EE	(6,961.26)	TENURED	PROFESSOR
Koley, Goutam	EE	(3,780.06)		VISITING PROFESSOR
Ginn, Herbert	EE	48,419.94	TENURED	ASSOC. PROFESSOR
Mandal, Krishna	EE	(2,212.87)		ASSOC. PROFESSOR
Khan, Asif	EE	10,335.67	TENURED	PROFESSOR
Mandal, Krishna	EE	147,459.04		ASSOC. PROFESSOR
Koley, Goutam	EE	3,469.28		VISITING PROFESSOR
Chandrashekhar, MVS	EE	112,857.30		ASST PROFESSOR
Dougal, Roger	EE	2,491.44	TENURED	PROFESSOR
Matolak, David	EE	42,151.56	TENURED	PROFESSOR
Santi, Enrico	EE	610.06	TENURED	ASSOC. PROFESSOR
Matolak, David	EE	119,873.47	TENURED	PROFESSOR
Ali, Mohammod	EE	134,336.10	TENURED	PROFESSOR
Wang, Guoan	EE	73,755.86		ASST PROFESSOR
Ali, Mohammod	EE	10,105.24	TENURED	PROFESSOR
Chandrashekhar, MVS	EE	101,184.42		ASST PROFESSOR
Koley, Goutam	EE	0.10		VISITING PROFESSOR
Koley, Goutam	EE	4,365.28		VISITING PROFESSOR
Ali, Mohammod	EE	4,259.02	TENURED	PROFESSOR
Wang, Xiaofeng	EE	66,877.95		ASST PROFESSOR
Dougal, Roger	EE	26,506.41	TENURED	PROFESSOR
Sudarshan, Tangali	EE	41,490.42		
Dougal, Roger	EE	994,338.31	TENURED	PROFESSOR
Ali, Mohammod	EE	93,321.97	TENURED	PROFESSOR
Dougal, Roger	EE	167,503.95	TENURED	PROFESSOR
Dougal, Roger	EE	23,518.18	TENURED	PROFESSOR

Dougal, Roger	EE	13,157.80	TENURED	PROFESSOR
Huray, Paul	EE	14,021.18	TENURED	PROFESSOR
Ginn, Herbert	EE	14,292.98	TENURED	ASSOC. PROFESSOR
Santi, Enrico	EE	70,944.62	TENURED	ASSOC. PROFESSOR
Khan, Asif	EE	234,694.20	TENURED	PROFESSOR
Santi, Enrico	EE	22,987.36	TENURED	ASSOC. PROFESSOR
Benigni, Andrea	EE	51,626.15		ASST PROFESSOR
Dougal, Roger	EE	3,386.69	TENURED	PROFESSOR
Ginn, Herbert	EE	30,134.25	TENURED	ASSOC. PROFESSOR
Simin, Grigory	EE	63,175.85	TENURED	PROFESSOR
Zhang, Bin	EE	1,490.85		ASST PROFESSOR
Wang, Guoan	EE	15,677.79		ASST PROFESSOR
Reynolds, Anthony	ME	1,929.39	TENURED	PROFESSOR
Reynolds, Anthony	ME	3,200.00	TENURED	PROFESSOR
Giurgiutiu, Victor	ME	8,097.56	TENURED	PROFESSOR
Reifsnider, Kenneth	ME	802,173.33	TENURED	PROFESSOR
Chen, Fanglin	ME	262,582.85	TENURED	ASSOC. PROFESSOR
Xue, Xingjian	ME	8,704.21	TENURED	ASSOC. PROFESSOR
Reifsnider, Kenneth	ME	(2,637.94)	TENURED	PROFESSOR
Knight, Travis	ME	75,075.13	TENURED	ASSOC. PROFESSOR
Baxter, Sarah	ME	3,631.66		
Chen, Fanglin	ME	24,757.68	TENURED	ASSOC. PROFESSOR
Reynolds, Anthony	ME	(20,554.09)	TENURED	PROFESSOR
Huang, Xinyu	ME	(6,489.85)		ASST PROFESSOR
Wang, Guiren	ME	15,477.08	TENURED	ASSOC. PROFESSOR
Chen, Fanglin	ME	(17,529.97)	TENURED	ASSOC. PROFESSOR
Giurgiutiu, Victor	ME	90,652.25	TENURED	PROFESSOR
Xue, Xingjian	ME	178,923.40	TENURED	ASSOC. PROFESSOR
Giurgiutiu, Victor	ME	(15,611.28)	TENURED	PROFESSOR
Giurgiutiu, Victor	ME	180,178.24	TENURED	PROFESSOR
Khan, Jamil	ME	96,899.73	TENURED	PROFESSOR
Knight, Travis	ME	22,601.88	TENURED	ASSOC. PROFESSOR
Giurgiutiu, Victor	ME	10,019.43	TENURED	PROFESSOR
Reynolds, Anthony	ME	10,781.09	TENURED	PROFESSOR
Li, Chen	ME	68,712.19	TENURED	ASSOC. PROFESSOR
Chen, Fanglin	ME	60,051.02	TENURED	ASSOC. PROFESSOR
Cacuci, Dan	ME	1,992.94	TENURED	PROFESSOR
Farouk, Tanvir	ME	17,235.39		ASST PROFESSOR
Majumdar, Prasun	ME	122,033.66		ASST PROFESSOR

Huang, Kevin	ME	(5,212.36)		ASSOC. PROFESSOR
Tarbutton, Joshua	ME	42,458.05		ASST PROFESSOR
Deng, Xiaomin	ME	88,130.29	TENURED	PROFESSOR
Knight, Travis	ME	0.42	TENURED	ASSOC. PROFESSOR
Li, Chen	ME	19,881.01	TENURED	ASSOC. PROFESSOR
Kidane, Addis	ME	79,451.04		ASST PROFESSOR
Huang, Kevin	ME	102,408.57		ASSOC. PROFESSOR
Farouk, Tanvir	ME	165,699.48		ASST PROFESSOR
Bayoumi, Abdel	ME	13,147.99	TENURED	PROFESSOR
Bayoumi, Abdel	ME	195,760.73	TENURED	PROFESSOR
Shazly, Tarek	ME	(4,238.42)		ASST PROFESSOR
Cacuci, Dan	ME	219,689.15	TENURED	PROFESSOR
Xue, Xingjian	ME	122,272.02	TENURED	ASSOC. PROFESSOR
Huang, Kevin	ME	33,016.12		ASSOC. PROFESSOR
Kidane, Addis	ME	9,187.71		ASST PROFESSOR
Yu, Lingyu	ME	23,263.06		ASST PROFESSOR
Bayoumi, Abdel	ME	(10,138.05)	TENURED	PROFESSOR
Knight, Travis	ME	226,823.01	TENURED	ASSOC. PROFESSOR
Yu, Lingyu	ME	142,307.53		ASST PROFESSOR
Cacuci, Dan	ME	283,759.03	TENURED	PROFESSOR
Kaoumi, Djamel	ME	65,816.87		ASST PROFESSOR
Chen, Fanglin	ME	48,670.78	TENURED	ASSOC. PROFESSOR
Knight, Travis	ME	24,126.40	TENURED	ASSOC. PROFESSOR
Khan, Jamil	ME	239,556.27	TENURED	PROFESSOR
Li, Chen	ME	187,813.31	TENURED	ASSOC. PROFESSOR
Sutton, Michael	ME	31,061.70	TENURED	PROFESSOR
Farouk, Tanvir	ME	91,267.28		ASST PROFESSOR
Kaoumi, Djamel	ME	93,074.36		ASST PROFESSOR
Giurgiutiu, Victor	ME	51,360.40	TENURED	PROFESSOR
Sutton, Michael	ME	21,754.92	TENURED	PROFESSOR
Kidane, Addis	ME	40,755.05		ASST PROFESSOR
Shazly, Tarek	ME	23,176.83		ASST PROFESSOR
Kidane, Addis	ME	20,000.00		ASST PROFESSOR
Huang, Kevin	ME	1,219.54		ASSOC. PROFESSOR
Li, Chen	ME	158,597.22	TENURED	ASSOC. PROFESSOR
Xue, Xingjian	ME	15,442.89	TENURED	ASSOC. PROFESSOR
Huang, Kevin	ME	692,978.40		ASSOC. PROFESSOR
Huang, Kevin	ME	36,601.45		ASSOC. PROFESSOR
Bayoumi, Abdel	ME	272,603.75	TENURED	PROFESSOR
Bayoumi, Abdel	ME	146,319.46	TENURED	PROFESSOR
Knight, Travis	ME	56,837.35	TENURED	ASSOC. PROFESSOR
Knight, Travis	ME	91,369.83	TENURED	ASSOC. PROFESSOR
Reifsnider, Kenneth	ME	34,852.55	TENURED	PROFESSOR
Knight, Travis	ME	39,688.97	TENURED	ASSOC. PROFESSOR
Khan, Jamil	ME	7,733.35	TENURED	PROFESSOR
Farouk, Tanvir	ME	14,363.04		ASST PROFESSOR
Tarbutton, Joshua	ME	52,661.75		ASST PROFESSOR

Huang, Kevin	ME	49,951.63		ASSOC. PROFESSOR
Besmann, Theodore	ME	28,515.71	TENURED	PROFESSOR
Besmann, Theodore	ME	19,096.42	TENURED	PROFESSOR
Huang, Kevin	ME	8,321.73		ASSOC. PROFESSOR
Reynolds, Anthony	ME	853.17	TENURED	PROFESSOR
Huang, Xinyu	ME	65,003.48		ASST PROFESSOR
Banerjee, Sourav	ME	555.79		ASST PROFESSOR
Giurgiutiu, Victor	ME	154,230.43	TENURED	PROFESSOR
Majumdar, Prasun	ME	212,599.43		ASST PROFESSOR
Reynolds, Anthony	ME	66,269.36	TENURED	PROFESSOR
Kidane, Addis	ME	30,000.00		ASST PROFESSOR
Chen, Fanglin	ME	25,513.59	TENURED	ASSOC. PROFESSOR
Yu, Lingyu	ME	20,650.00		ASST PROFESSOR
Reifsnider, Kenneth	ME	6,683.62	TENURED	PROFESSOR
Khan, Jamil	ME	11,954.38	TENURED	PROFESSOR
Reynolds, Anthony	ME	140,108.64	TENURED	PROFESSOR
Sutton, Michael	ME	(9,754.25)	TENURED	PROFESSOR
Huang, Xinyu	ME	62,229.93		ASST PROFESSOR
Reynolds, Anthony	ME	33,075.26	TENURED	PROFESSOR
van Tooren, Michael	ME	45,856.70	TENURED	PROFESSOR
Huang, Xinyu	ME	712.60		ASST PROFESSOR
Tarbutton, Joshua	ME	5,000.00		ASST PROFESSOR
Knight, Travis	ME	24,318.73	TENURED	ASSOC. PROFESSOR
van Tooren, Michael	ME	18,829.06	TENURED	PROFESSOR
Knight, Travis	ME	56,488.07	TENURED	ASSOC. PROFESSOR
Tarbutton, Joshua	ME	1,821.51		ASST PROFESSOR
Huang, Xinyu	ME	(834.18)		ASST PROFESSOR
Kidane, Addis	ME	7,652.04		ASST PROFESSOR
Shazly, Tarek	ME	64,620.02		ASST PROFESSOR
Giurgiutiu, Victor	ME	38.50	TENURED	PROFESSOR
Wang, Guiren	ME	65,703.14	TENURED	ASSOC. PROFESSOR
van Tooren, Michael	ME	194,999.25	TENURED	PROFESSOR
Xu, Wenyuan	CSE	(5,186.47)	TENURED	ASSOC. PROFESSOR
Bakos, Jason	CSE	31,305.09	TENURED	ASSOC. PROFESSOR
Fenner, Stephen	CSE	(1,099.78)	TENURED	PROFESSOR

Hu, Jianjun	CSE	(5,286.90)	TENURED	ASSOC. PROFESSOR
Tang, Jijun	CSE	1,666.50	TENURED	ASSOC. PROFESSOR
Xu, Wenyuan	CSE	23,506.57	TENURED	ASSOC. PROFESSOR
O'Kane, Jason	CSE	67,641.30	TENURED	ASSOC. PROFESSOR
Nelakuditi, Srihari	CSE	(4,034.80)	TENURED	PROFESSOR
Wang, Song	CSE	152,694.09	TENURED	PROFESSOR
Wang, Song	CSE	2,250.00	TENURED	PROFESSOR
Nelakuditi, Srihari	CSE	19,660.27	TENURED	PROFESSOR
Xu, Wenyuan	CSE	149,850.36	TENURED	ASSOC. PROFESSOR
Wang, Song	CSE	64,814.43	TENURED	PROFESSOR
Tong, Yan	CSE	39,654.76		ASST PROFESSOR
Bakos, Jason	CSE	7,893.21	TENURED	ASSOC. PROFESSOR
Wang, Song	CSE	53,203.04	TENURED	PROFESSOR
Tang, Jijun	CSE	165,156.01	TENURED	ASSOC. PROFESSOR
Vidal, Jose	CSE	63,478.41	TENURED	PROFESSOR
Alekseyev, Max	CSE	(113.52)		
Valafar, Homayoun	CSE	8,824.13	TENURED	ASSOC. PROFESSOR
Beer, Jenay	CSE	17,212.10		ASST PROFESSOR
Bakos, Jason	CSE	33,761.84	TENURED	ASSOC. PROFESSOR
Huhns, Michael	CSE	2,556.98		
Valafar, Homayoun	CSE	98,594.55	TENURED	ASSOC. PROFESSOR
Nelakuditi, Srihari	CSE	13,870.92	TENURED	PROFESSOR
Huhns, Michael	CSE	46,667.54		
Huhns, Michael	CSE	41,372.67		
Hu, Jianjun	CSE	20,636.79	TENURED	ASSOC. PROFESSOR
Huhns, Michael	CSE	0.05		
Bakos, Jason	CSE	56,024.05	TENURED	ASSOC. PROFESSOR

Blueprint Data #4 – Summary of Patents, disclosures, and licensing agreements in FY2015

College: CEC	Invention Disclosures	Provisional patent applications	Non-Provisional patent applications	Issued patents
Total	20	19	14	19
Breakdown	*Civil Eng - 2* *Chem Eng - 4* *Mech Eng - 5* *EE - 9*	*Civil Eng- 1* *Chem Eng - 5* *Biomedical Eng* *Mech Eng - 5* *EE - 8*	*Chem Eng - 6* *Civil Eng - 1* *Mech Eng - 4* *EE – 3*	*Civil Eng - 2* *Chem Eng - 2* *Biomedical Eng - 1* *Mech Eng - 7* *EE – 6* *CEC - 1*

Document Justifying Fee Request

Proposal for Undergraduate Engineering and Computing Fee Change

Summary

The College of Engineering and Computing (CEC) is proposing to increase and restructure undergraduate fees in order to support enhancements to the student learning experience. The additional resources from the fee increase enable CEC to:

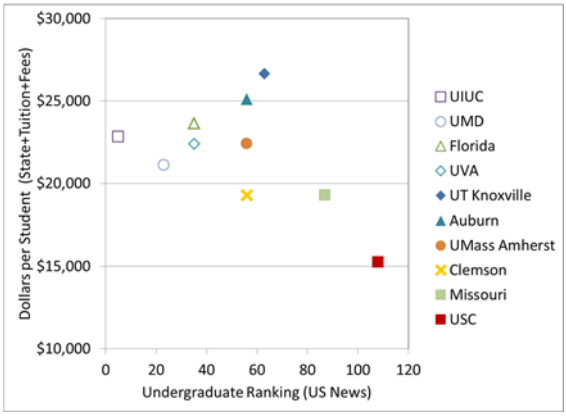
- Continuously improve the instructional laboratories necessary to produce competitive engineering and computing graduates necessary for the economic development of the state, as enrollments continue to ramp up rapidly (1100 in 2006, to 2700+ in 2015)
- Reduce class size, decrease the student-to-faculty ratio from 28 to 21 (USC goal is 18), and improve instruction by hiring and retaining additional instructors and faculty members
- Increase teaching assistance support for core engineering and computing courses
- Improve retention and professional development programs through additional advisors, career counselors, tutors and academic support staff
- Enrich targeted student experience programs, including student projects, student organizations and teams, co-op and internship placement, professional and leadership development, study abroad and undergraduate research

The current course-based fee structure is inefficient to implement, and is confusing for the parents and students due to unknown tuition costs until the time of registration. We propose to simplify the fee assessment by eliminating lab fees for major courses, and by assessing an increased program fee, as shown in the table below. Detailed justification for fee increase, including supporting data, is presented in the body of the document.

Current CEC Undergraduate Fees	Full-Time	Part-Time
Program Fee Non freshman Per Semester	$504	$42*
Program Fee: Freshman Per Semester	$228	$19*
Lab Fees ELCT 201, 301, 302, 403, 404; ECIV 303L, 330L, 350L, 362L; ECHE 550, 460, 461; EMCH 361, 362, 363; BMEN 260, 271, 321, 361, 427; CSCE 145, 146, 201	$148	$148

Proposed CEC Undergraduate Fees	Full-Time	Part-Time
Program Fee Per Semester	$1,500	$125*
** Per credit hour*		

Funding of CEC *per student* is noticeably below that of programs at peer and peer aspirant institutions (by $4,000 to $11,000). The proposed fee increase better aligns our funding to that of those programs (while still remaining substantially below them), and positions CEC for improved national rankings. Modern engineering and computing education is costly, because it is most effective with smaller class sizes, and with equipment and laboratories that are at the forefront of technology. Furthermore, the professional development and preparation that happens outside the classroom is ever more important in preparing engineers and computer scientists for the workforce. The increased fees provide a sustainable solution moving forward.



Engineering and computing fee change

The College of Engineering and Computing (the College) is proposing additional fees to support enhancements to the learning experience of undergraduate (UG) students enrolled in engineering programs. Engineering education is costly, particularly because it is most effective with smaller class sizes and with equipment and laboratories that are at the forefront of technology. Furthermore, the professional development and preparation that happens outside of the course schedule is more and more important in preparing engineers for the workforce or study for advanced degrees. The proposed fees will enhance undergraduate education. In particular, some major outcomes will be:

- Simplified and more fair fee structure
- Lowered (UG) student-to-faculty ratio (from 28 to 21), and decreased class sizes
- Improved student services such as advising, internship and career assistance,
- Upgraded and better maintained instructional laboratories
- Increased offerings of courses, minors, certificates, and degrees
- New student-centered engineering education at the level of excellence consistent with our high standards,
- More experiential opportunities such as: organized study abroad with partners, industry-sponsored student projects, and involvement in research

How will engineering fees be spent?

All funds raised from fees will be used to enhance undergraduate engineering education, including:

- Hiring and retaining additional faculty members and instructors to offer more sections and courses with reduced class sizes
- Additional teaching assistance support for core engineering and computing courses
- Upgrading and maintaining hands-on and computer teaching laboratories: technology has become expensive and necessary; and its life cycle shorter.
- Adding staff for advisors, career counselors, tutors and academic support staff

Comparison with peer and peer-aspirant institutions

The table below presents the funding per student FTE at USC's peers and aspirant peers[1]. The data for tuition, state funding per student, as well as investment return and other core revenues per student are extracted from the website: *National Center for Education Statistics Integrated Postsecondary Education Data System*[2]. The data for fees was extracted from the websites of the actual programs. The top four rows correspond to the aspirant peers. The penultimate column from the right (shaded) contains the total dollars per student FTE from three sources of: state, tuition, and fees. We also present the results in a subsequent bar graph.

[1] UNC and UGA were left off the list because the former does not have significant engineering presence, and the latter has just started engineering. They are not peers or peer aspirants as far as engineering or computing are concerned.

[2] http://nces.ed.gov/ipeds/datacenter/Default.aspx

	School	USNews Grad	USNews Ugrad	State	Tuition	Fee	Tuition+ fee	Total $/ FTE	# Fac
Peer Aspirants	UIUC	6	5	$5,780	$12,036	$5,004	$17,040	$22,820	392
	UMD	23	23	$11,538	$9,579	$0	$9,579	$21,117	252
	UVA	39	35	$5,456	$12,948	$4,000	$16,948	$22,404	145
	Florida	43	35	$11,026	$12,620	$0	$12,620	$23,646	260
Peers	UMass Amherst	59	56	$9,749	$12,076	$575	$12,651	$22,400	155
	UT Knoxville	63	63	$14,866	$10,788	$992	$11,780	$26,646	172
	Auburn	68	56	$9,360	$14,135	$1,590	$15,725	$25,085	146
	Missouri	88	87	$6,970	$10,477	$1,822	$12,299	$19,269	111
	Clemson	71	56	$4,673	$14,109	$500	$14,609	$19,282	211
	USC	99	108	$3,552	$10,577	$1,119	$11,696	$15,248	111

Table 1. Breakdown of total funding per undergraduate FTE at USC's peer and peer aspirant schools

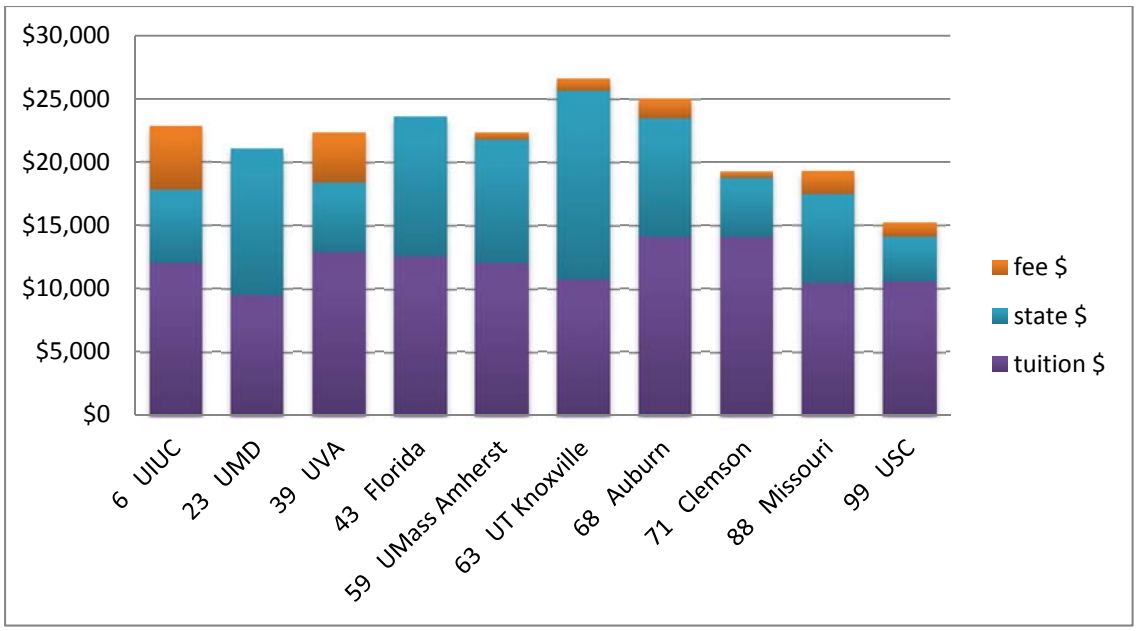


Figure 1. Total $'s per undergraduate FTE

In all scenarios (with or without the investment return), the total funding per student FTE at USC is by far the lowest of the group. Several observations are noteworthy:

1. The USC funding amounts are lower than Clemson's by $4,000 per student FTE if one does not account for investment returns and core revenues, and by $6,500 if one does account for such.
2. The tuition amounts for USC and Missouri are identical. So is the number of faculty at each, as well as the research funding per faculty (~$200K/faculty). The Missouri undergraduate program however is ranked 87th, while the USC undergraduate program is ranked 108th. Missouri receives a slightly larger amount of fees from each student, but a much larger contribution from the state. So for each student FTE they have about $4,000 more than USC.

Further exploring the US News rankings, the bar graph below presents the rankings for the graduate and undergraduate engineering programs of USC's peer and peer aspirant schools (some may have

computer science, and some not). The four higher ranked programs are our peer aspirant schools, and the rest are peers, and Clemson.

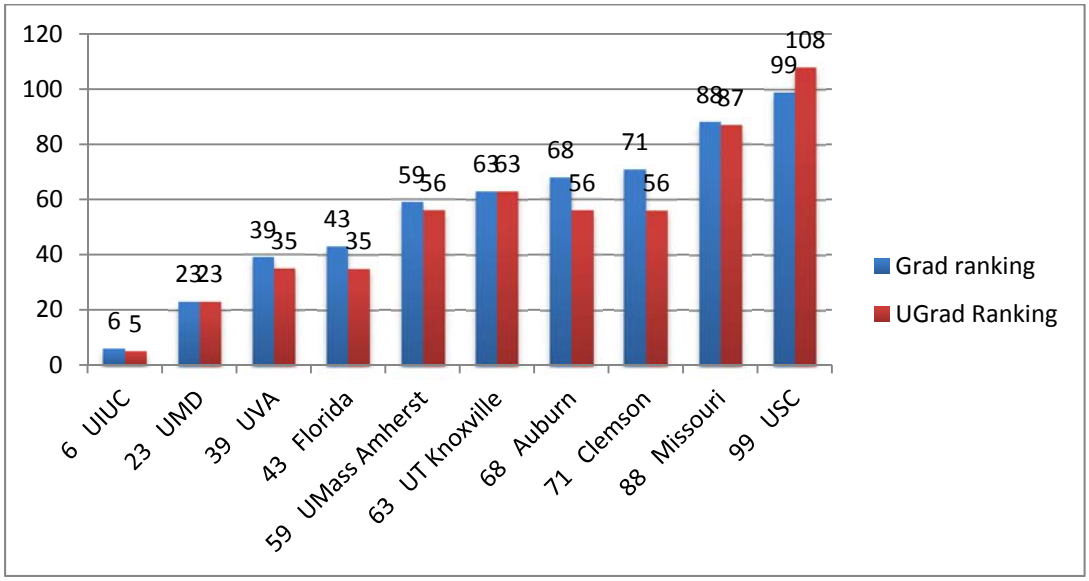


Figure2. Comparison of G and UG US News rankings of the peer and peer aspirant schools

USC is the only school on the list whose undergraduate program is ranked lower than its graduate program (108 vs. 99). *For all other universities the undergraduate program is ranked higher*.

While tracing the root of this complex development is challenging, and as H.L. Mencken noted "for every complex problem there is a solution that is clear, simple, and wrong"; nonetheless, we posit that the perennial under-investment in, and underfunding of, engineering at USC compared with the peers has now begun to adversely affect the quality of the undergraduate program. The requested additional fee will help not only repair that development, but also make the program competitive.

Undergraduate/faculty ratio will reach 28 in 5 years, based on a student count of 3,000 (accounting for and non majors, etc.), and a faculty size of 107, which will be the count including retirements, but adding the positions that are part of the dean's startup. This size is smaller than the current size of 113. The desired UG student to faculty ratio for engineering nationally is closer to 20. With a faculty size of 143 in 5 years, the ratio will get to 21. As shown in the appended excel sheet, an annual addition of $5.85M is needed to enable the hiring that is needed to get CEC from 113 faculty to 143 in 5 years, and do so sustainably, while allowing for replacement of retirements. This requested additional fee helps achieve this growth by halving the gap in per-student funding between USC and Clemson or Missouri. ***USC will still continue to have the lowest amount of per-student funding among its peers. But we trust that through our economic engagement and other innovative initiatives, we will more than make up the difference, and provide world-class opportunities for our students and stakeholders.***
Additionally, lowering of the student faculty ratio will allow CEC to:

- Develop interdisciplinary academic programs that will place our students at the forefront of tomorrow's knowledge and jobs landscape,
- Add value far above the marginal additional expense to the students/parents,

- Create the critical mass of faculty necessary to allow CEC to be competitive in pursuing large center-level research grants (as demonstrated by the SmartState Chairs program), and significantly increase funding and opportunities for students to participate in research,
- Engage with SC Technical Colleges and sister USC campuses to create more 2+2 paths for advancement for the workforce.

What are the potential adverse effects?

We do not expect there to be a drop in enrollment. There is ever increasing demands for engineers in South Carolina (and nationally), and employment prospects and salaries are higher than most professions. Furthermore, the stakeholders seem to recognize the value of this landscape, and view differential tuitions or fees as a well-justified investment.

Nelson (2008)[3] examined differential tuition by undergraduate major at 165 public research institutions. He found that the most prevalent programs with differential tuition/fees by undergraduate program were business and engineering.

- Business programs: 69% of the institutions which had undergraduate tuition differentials and 32% of all public research institutions
- Engineering programs: 65% of the institutions that had undergraduate tuition differentials and 30% of all public research institutions (N.B. *Many more programs have instituted fees since 2008, which is the date of the study*).

The reasons cited for implementing differential tuition/fees were:

- Cover the cost for more expensive programs (55%)
- Maintain or enhance the quality of programs (19%)
- Raise additional revenue for targeted initiatives (19%)
- Make up for the decline in state support (7%)

The reasons cited for not implementing differential tuition/fees where it was considered were:

- Potential impact on access and affordability (39%)
- Legislative barriers (26%)
- Procedural issues and complexity of implementation (17.5%)
- Still under consideration for adoption (17.5%)

[3] Nelson, Glen R. *Differential Tuition by Undergraduate Major: Its Use, Amount, and Impact at Public Research Universities*. Ph.D. dissertation, University of Nebraska, 2008, Ann Arbor, MI: Proquest LLC.

Rank	Public University/College	Differential Tuition/Fees
6	University of Illinois	$5004
7	University of Michigan	
	Lower Division	$900
	Upper Division	$3020
8	Purdue University	$2050
12	University of Texas	$868
13	University of Wisconsin	$1400
13	Virginia Tech	$948
17	Pennsylvania State University	$1662
17	Texas A&M University	$2000
39	University of Virginia	$4000

Table 2. Sample of top-ranked public engineering schools charging differential tuition or fees

The majority of respondents (66%) to Nelson's study did not believe that differential tuition/fees impacted enrollment for the programs where differential tuition was charged to students. A majority of students (54%), faculty (64%), administration (84%), and governing boards (84%) responded favorably to differential tuition/fees. ***For engineering programs, parents and students because of the good job market and significantly higher salaries available to engineering/computing program graduates more readily accept differential tuition/fees. For example, the average starting salary for CEC graduates with no experience is approximately $62,000***.

	Positive (%)	Negative (%)	No Reaction (%)
Students	54	17	29
Faculty	64	8	28
Administration	84	0	16
Governing Boards	84	4	12
Parents	0	24	76
Legislative Officials	0	5	95

Table 3. Reaction of stakeholders to fees

Demand: Bureau of Labor Statistics[4] projects net growth in employment in computer and information technology occupations to be 12% between 2014 and 2024; far faster than national average for all occupations, and translating to a total of additional488,500 jobs. Similarly, for architecture and engineering occupations, the projected average net growth rate is 3% (varying from a negative growth in nuclear engineering to as high as 23% in biomedical engineering), or additional 67,200 jobs

The higher-paying high-skill jobs requiring BS will continue to grow on a rapid rate. Furthermore, engineering profession as a whole, and especially in areas related to manufacturing (which is featured heavily in SC), is experiencing greying workforce (25%+ above the age of 55)[5]. So in addition to the net growth, there is the need to replace 25% of today's engineering workforce in the coming years.

Through our on-campus and to-be-developed 2+2 programs, we expect to provide the education necessary to further meet the demands for engineers and computer scientists, and to provide

[4] http://www.bls.gov/ooh/

[5] http://www.forbes.com/sites/emsi/2014/09/12/the-most-in-demand-and-oldest-engineering-jobs/#1e7112484b4a

advancement paths for them through continuing education and training, to create life-long learners who will continue to work in SC.

Employment and salary:
Table 4 shows the self-reported salaries for CEC graduates. As mentioned, the average salary for engineers continues to be high.

Engineering & Computing (n=2015/2014)	**'15-May**	**'14-May**
Biomedical Engineering (n=3/5)	42,000	38,500
Chemical Engineering (n=10/15)	69,550	69,000
Civil Engineering (n=2/9)	58,750	51,389
Computer Engineering (n=3/6)	55,000	51,667
Computer Information Systems (n=1/7)	57,500	50,357
Computer Science (n=3/12)	63,500	64,792
Electrical Engineering (n=10/7)	56,160	63,214
Mechanical Engineering (n=21/25)	65,155	63,000
AVERAGE SALARY, CEC (n=53/86)	**61,922**	**59,855**

Table 4. Self-reported starting salaries of CEC graduates (49% response rate).

Financial Aid: Federal financial aid (like Pell Grants), lottery, institutional and private scholarships, as well as loans, can all be applied to any expense the University charges –including fees like this-- up to the cost of attendance. CEC advancement will also actively seek to raise funds to ensure that access to CEC education remains open to all.

Communication: Care will be taken to communicate clearly and openly the increase in fees, and to explain the reasons, and how the additional funds will be spent. Today's funding to CEC per student is not sufficient to enable us to sustain offering an excellent engineering and computing education, and to ensure the success of all our graduates. A readjustment of the fees is needed. Once the fees are readjusted, then we will maintain a measured and nominal rate of increase.

What if fees are not increased?

Particularly in the face of enrollment growth, CEC faces several challenges in provisioning academic and personal support services to students. In order to improve or maintain a reasonable level of academic instruction and service to its students, CEC will invest the revenue obtained from fees in such areas as: 1) laboratory upgrades, 2) professional student advising services, 3) international experience programs, 4) career and diversity services, 5) high-impact experiential programs, 6) undergraduate student participation in research, 7) instructional and laboratory support, and 7) faculty hiring.

The proposal for fee increase will begin to provide the resources necessary to invest in areas that will enable CEC to remain competitive with peer institutions, and provide the type of high-quality and student-centered academic programs expected by its students and fitting for the University of South Carolina. If increasing the fees is not approved or the CEC's funding issues are not addressed in some other manner, the consequences will likely be: 1) inadequate laboratories and related instructional technology, 2) continued trend towards larger class sizes and higher student/faculty ratios; 3) further

reduction in student services; 4) loss of top faculty to other institutions; and 5) possibility of reservations about re-accreditation by ABET during the forthcoming visit next year: College funding was deemed inadequate during the 2005 visit, and the provost needed to provide written commitments for $1.5M for operations on a recurring basis. Visiting teams normally look for recent past deficiencies, and how they have been mitigated.

Reiterating verbatim from the appendix, if the fee is approved though, as shown in Table 2A (appendix) the student faculty ratio will approach 21 by 2021. Furthermore, by 2021, 48 of the 143 faculty members in CEC (34%) will have been hired since 2016. This evolution in size and makeup, coupled with the exciting landscape of manufacturing, aerospace, energy, and cybersecurity in South Carolina, paints a very bright future for CEC, USC, and the state, where our graduates will help set the course for the future of engineering and computing.

Appendix 1. Calculation of the fee, based on the student faculty ratio

A main factor contributing to the amount of the requested increase in fees is that the undergraduate program in the college has been under-funded for some time; especially since the enrollment has more than doubled since 2006 (from 1100 to 2700+ today). This is not to place blame, or search for the cause; but merely stating the facts. ***Through the present proposal, we are going to put the college on a path of being able to offer excellent academic programs, sustainably into the indefinite future.***

The number of undergraduates in CEC in 5 years will be 3,000 (growing from over 2,700 today). Today the faculty count is 113. Without the development of a new revenue stream, the total faculty count in 5 years will be 107 (smaller than today's 113), even after accounting for the 15 positions promised the dean. The deficit will have been eliminated, but the debt will have grown over these five years, and it will take a number of years to pay down the debt.

The table below shows the revenue and expenses for CEC.

REVENUES	
Recurring Budget	
Unit Base Budget	$19,837,496
Permanent Transfer In	$930,236
Subtotal	**$20,767,732**
Other Sources	
1 Time Transfer In	$112,884
1 Time Start-up from Provost	$479,510
Summer Tuition	$1,025,973
Fees	$2,634,934
Sales / Receipts	$490,683
Sponsored Awrds / Contracts	$21,098,431
F&A	$1,491,342
Endowment & Gifts	$1,473,542
Subtotal	**$28,807,299**
Total Revenues FY15	**$49,575,031**

EXPENSES	
Salaries/Fringe	
Classified Salaries & Fringe	$2,990,886
Faculty Salaries & Fringe	$16,268,469
Other Fac/ Staff Wages	$1,133,758
GTA / UG Wages	$2,260,866
Subtotal	**$22,653,979**
OTPS, etc.	
One time transfer out	$87,405
Grants and Contracts	$21,098,431
Endowment / Gifts	$1,473,542
General OTPS	$732,684
Research OTPS	$934,500
UG Lab Equipment	$116,686
Grad Financial Aid	$501,485
Start-Up Expenses	$659,279
Other Commitments	$560,468
Other Expenses	$1,893,663
Subtotal	**$28,058,143**
Total Expenses (FY15)	**$50,712,122**

Table 1A. FY15 revenue and expenses for CEC.

It is observed that today there is an annual deficit of $1,137,091. Furthermore, there is an accumulated startup commitment of $4,956,171, offset by a carryover of $2,039,863, leading to a current commitment (debt) of $2,916,308.

The implementation of the requested fees allows for lowering the student faculty ratio to 21 by 2021, elimination of the debt by 2024, and running an annual surplus of $3.5M starting in 2021, which will

allow for the renewal and upkeep of the ever more sophisticated laboratories and technologies needed to offer a leading-edge and world-class engineering education.

AY	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
beginning debt ($K's)		2900	1500	700	500	150	250	1100	750	400	50	-300	-650	-1000
beginning deficit ($K's)		1100	1850	2150	2750	2600	3050	3500	3500	3500	3500	3500	3500	3500
FTE (#'s)														
begin		112	120	125	132	134	140	143	143	143	143	143	143	143
retire		0	3	1	6	2	5	5	5	5	5	5	5	5
hire		8	8	8	8	8	8	5	5	5	5	5	5	5
recurring ($K's)														
Dean startup		-450	-450	-450	-450	-450								
net FTE expense		1200	750	1050	300	900	450	0	0	0	0	0	0	0
other		0	0	0	0	0	0	0	0	0	0	0	0	0
one time ($K's)														
special		-300												
Dean startup (3*300K)		-900	-900	-900	-900	-900								
USC (1/3rd startup)		-1000	-1000	-1000	-1000	-1000	-1600	-1000	-1000	-1000	-1000	-1000	-1000	-1000
CEC (2/3rd startup)		4800	4800	4800	4800	4800	4800	3000	3000	3000	3000	3000	3000	3000
fees		-5850	-5850	-5850	-5850	-5850	-5850	-5850	-5850	-5850	-5850	-5850	-5850	-5850
year end deficit ($K's)	1100	1850	2150	2750	2600	3050	3500	3500	3500	3500	3500	3500	3500	3500
year end debt ($K's)	2900	1500	700	500	150	250	1100	750	400	50	-300	-650	-1000	-1350
year end faculty size (#)	***112***	***120***	***125***	***132***	***134***	***140***	***143***	***143***	***143***	***143***	***143***	***143***	***143***	***143***
S/F (3000 UGs)	27	25	24	23	22	21	21	21	21	21	21	21	21	21
# new hires		8	16	24	32	40	48	53	58	63	68	73	78	83
fraction new FTE		7%	13%	18%	24%	29%	34%	37%	41%	44%	48%	51%	55%	58%

Table 2A. Multi-year projection of evolution of student faculty ratio.

Table 2A shows the approach of the student faculty ratio to 21 by 2021. It also shows that by 2021, 48 of the 143 faculty members in CEC (34%) will have been hired since 2016. This evolution in size and makeup, coupled with the exciting landscape of manufacturing, aerospace, energy, and cybersecurity in South Carolina, paints a very bright future for CEC, USC, and the state, where our graduates will help set the course for the future of engineering and computing.