ELECTRIC POWER ENGINEERING EDUCATION RESOURCES: 2015-16 US AND CANADIAN UNIVERSITY SURVEY RESULTS

REPORT FROM THE POWER AND ENERGY EDUCATION COMMITTEE OF THE IEEE POWER & ENERGY SOCIETY

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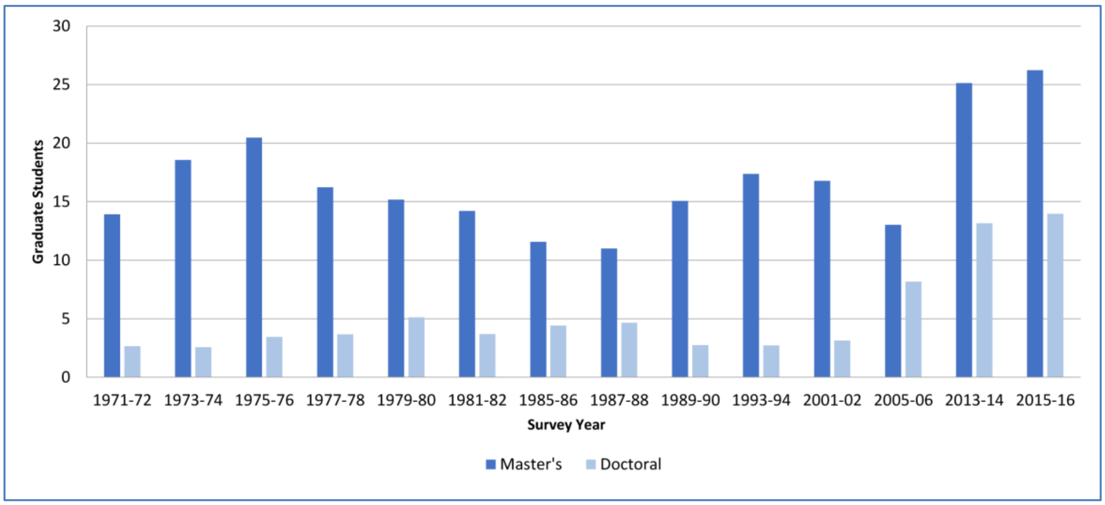
Executive Summary

This report provides insights into the status of power engineering education in the US and Canada for the 2015-2016 academic year. The report focuses on accredited engineering programs at universities that replied voluntarily to an online survey between July and December 2016. For the 137 universities (127 US, 10 Canadian) that submitted data on their electric power engineering programs, the report contains information on faculty and staff providing instruction, student enrollments and degrees granted, course offerings and enrollments, and research areas and funding levels. Analyses incorporate the results of fifteen prior university surveys of power engineering education resources since 1969-1970. The results show substantial growth in student interest, and in the number of faculty and staff providing instruction. Course subjects are also evolving in response to the changing education needs of the next generation of power engineers.

Degree Offerings: Undergraduate engineering degrees were offered by all of the responding universities, and the students can take mandatory and elective power engineering courses to prepare for power engineering careers. Some universities let undergraduate students select a power engineering specialty, such as by providing track or certificate options. All Canadian universities offered master's and doctoral degrees while about 88% and 75% respectively of the US universities did. Online graduate degree opportunities, most often for master's degrees, were reported at a number of universities. Most universities encouraged coop experiences for undergraduates.

Student Enrollments and Degrees Granted: Student interest in power engineering careers has grown substantially. Graduate student enrollments are shown in the chart below. In the US, there has been about a doubling of master's, international, and full-time students between the 2005-6 and 2015-16 academic years. In 2015-16, international students were about 78% and 73% of full-time doctoral students in the US and Canada respectively. Domestic students had the highest percentage of part-time students, reaching 80% and 91% of master's students in the US and Canada respectively. Many part-time students were likely pursuing an advanced degree while working. Although most graduate students were international, a little over 80% of undergraduate students were domestic.



Average Number of Graduate Students Enrolled in Universities Reporting Non-Zero Enrollments

The following table gives the Survey Team's estimates of the number of degrees granted in 2015-16.

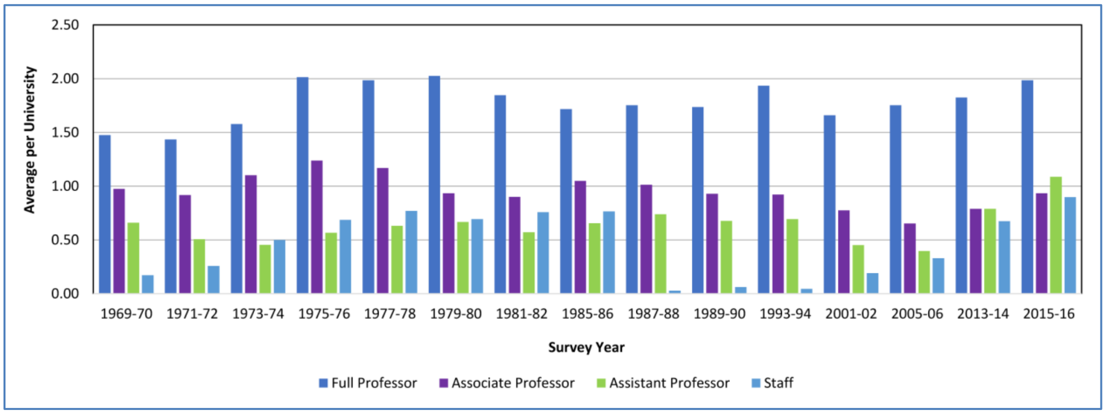
Estimated Degrees Granted In The 2015-16 Academic Year

Category	Canada	US
Undergraduates	420	2,889
Master's	184	1,362
Doctoral	91	365

As mentioned above, a little over 80% of the undergraduates were domestic students. The Survey Team found that between 2013-14 and 2015-16, the number of degrees granted to undergraduate and graduate students grew in the US and Canada. However, for universities responding to both surveys, enrollments of domestic master's students declined and enrollments by domestic doctoral students were about the same.

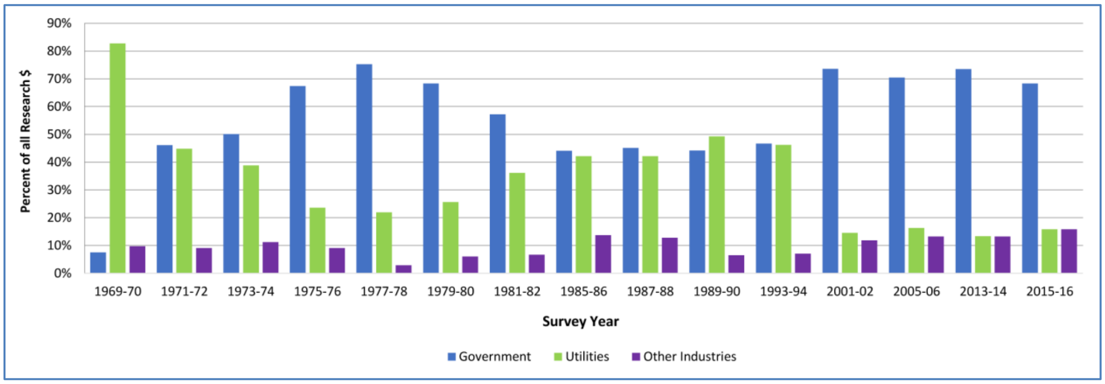
Courses: Over 1,500 undergraduate and graduate courses were reported. Power and energy systems courses were frequently identified, but the universities were also offering courses in various new technology subjects, particularly courses related to power electronics and renewable generation. Distance education enrollments in one or more undergraduate and/or graduate courses were reported by 18% and 32% of universities respectively.

Instructional Faculty and Staff: As shown in the chart below, the number of instructional faculty and staff has been growing steadily since the 2005-6 survey. The higher number of young faculty members bodes well for the sustainability of university power programs as the universities prepare for senior faculty retirements. Almost 40% of faculty and staff were reported to be eligible for retirement by 2026. Universities have also increased their use of staff members, such as adjunct professors, instructors, and lecturers, probably to meet increased student enrollments while bringing engineers with industry experience in new technologies to the classroom. Most faculty and staff were in electrical and computer engineering, but the breadth of power engineering education has expanded with the use of faculty and staff in new disciplines for power engineering education.



Average Number of Faculty and Staff per University

Research Activities and Funding: Inflation-adjusted research expenditures increased by some 75% between the 2001-2 and 2015-16 surveys. Government funding played a central role in that expansion, as shown in the chart below. The two most frequently reported university research areas were intelligent grid and renewable generation. The growth in research funding has been essential to creatively addressing the challenges of new technologies and to supporting the faculty who met the substantial rise in the number of students taking power engineering courses.



Funding from Government, Utilities, and Other Industries (%)

Challenges: The survey results suggest that three key challenges in university power engineering education are:

- Motivating domestic students to pursue graduate degrees with a focus on power engineering
- Evolving curricula to address the challenges and changes facing the evolving electric power industry
- Maintaining sufficient research funding needed to sustain innovation to advance electric power and energy technologies, and to support young faculty members who will eventually replace retiring faculty.

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Electric Power Engineering Education Resources: 2015-16 US and Canada Survey Results

I. Introduction

The Survey Team of the Power & Energy Education Committee (PEEC) was appointed to survey US and Canadian universities to report on the status of power engineering education resources consistent with 15 previous such efforts [1-15]. This report includes information on faculty and staff, education programs, students, courses, and research areas and funding. The Survey Team has not ranked or categorized programs in terms of their quality nor does it encourage the use of the data to do so. The information is provided to help universities, industry, government, and students to better understand the status of power engineering education to improve power engineering education and inform decisions on educational opportunities.

Four-year university institutions in the US and Canada awarding accredited (e.g., ABET accreditation in the US) degrees in electrical engineering were invited to participate in an online survey. The text of the survey is given in the attachment to this report. The survey was conducted between July and December of 2016. Faculty at 137 universities responded (127 US and 10 Canadian universities). Appendix Table 1 lists the responding universities, identifies the faculty members who submitted their university's survey, and provides background information on each university. The background information includes location (i.e., state/province and country), college/school with the lead department of the power engineering program, and relevant research centers.

Faculty respondents were asked to provide data from the 2015-16 academic year of July 1, 2015 to June 30, 2016. The survey covers instruction and research topics focused on electric power engineering associated with grid operations, planning, and maintenance. Power electronics was included. Other engineering topics, such as communications and IT, were to be included to the extent that they addressed power engineering challenges and were included in power engineering education at the responding universities. As a discipline, power engineering is requiring more diverse skills and knowledge. As a consequence, it was expected that courses and research topics outside of the traditional core areas of power engineering education would be in the survey responses.

The data in the following categories were provided by the respondents: (1) general program information; (2) power faculty and staff; (3) undergraduate and graduate education; (4) course offerings; (5) degrees granted (i.e., graduations) and enrollments; and (6) research expenditures and topic areas. University-specific survey response data are given in the Appendix. Results of data analyses are provided in the text. In some cases, the analyses incorporate data from prior surveys as far back as the first PEEC survey for the 1969-70 academic year. Survey data from Canadian universities began to be collected in the 1989-1990 survey.

The data requested in PEEC surveys over the years has typically been somewhat different from survey to survey. Changes in requested survey data were more pronounced when the surveys began to be delivered online rather than by paper. Online surveys began with the 2001-02 survey. Changes continued to be made in the 2015-16 survey to make completion less time-consuming, to make it clearer what information was being requested, to make interpretation of responses less ambiguous, to drop information requests that seem to be less important now, and to respond to new information needs. However, certain fundamental information requested in the 2015-16 survey remained the same to enable assessment of power education and research trends over time.

The focus of the survey was on power engineering education. As a consequence, listed faculty and staff were expected to have spent time delivering course instruction as part of their university responsibilities. The courses that were listed should have been courses that were in the curriculum to help students prepare for a career in power engineering. Including such specialties as nuclear engineering courses was not encouraged.

To assess overall trends in student interest in power engineering, survey respondents were asked to estimate the number of students who were entering the power engineering career field whether for jobs in industry, government or academia. Respondents were asked to provide the best estimates that they could of the number of degrees granted and enrollments. Estimates were particularly needed for undergraduate students pursuing power engineering careers because universities typically do not offer undergraduate degrees in power engineering per se.

Although there were 137 survey respondents, not all of them provided data for all survey sections. Therefore, we often indicate the number of respondents for particular data. In some cases, universities accurately reported zero ("0") as a response, but, never-the-less, that response was not used in computing certain metrics. As a result, interpretation of provided metrics will depend upon which universities were included in computing the metric. Some metrics cover all responding universities. Other metrics only include universities with positive (i.e., non-zero) responses to certain data, such as all universities reporting a positive number of graduate student enrollments. Hopefully, the text is clear about how to interpret the metrics.

Trend analyses of the PEEC survey data can help to identify changes in key metrics such as number of students and research expenditures, but they are subject to survey limitations. Differences in the responses from one survey to the next may be due to a number of reasons:

- Actual data changes revealing true underlying trends
- Revisions made by the universities unrelated to actual changes, perhaps due to a different faculty member completing the survey
- Changes in which universities responded.

For instance, 15 universities that responded to 2013-14 survey did not respond to the 2015-16 survey. In addition, there were 20 universities responding to the 2015-16 survey that did not respond to the 2013-14 survey. As a result, changes in metrics such as number of students between 2013-14 and 2015-16 are likely due, in part, to the differing characteristics of the sets of survey respondents. This source of volatility in the metrics is particularly true for the Canadian university data because of the small number of Canadian universities in the survey. In general, there will likely be somewhat more confidence in conclusions based on trends across multiple surveys than comparisons between two concurrent surveys. To try to control for this source of volatility when assessing near-term trends, in a few cases, analyses were limited to universities that responded to both the 2013-14 and 2015-16 surveys.

II. Electric Power Engineering Instructional Faculty And Staff

Appendix Table 2 lists the faculty and staff active in electric power engineering education at each university in the 2015-16 academic year. Listed faculty and staff were expected to have spent time delivering course instruction. The faculty list includes full, associate, and assistant (i.e., untenured) professors. For the purposes of this survey, individuals listed as staff were to include adjunct professors, emeritus professors, and instructors/lecturers. For each faculty member listed, the table provides (1) name, (2) department, (3) rank or position, (4) highest degree obtained, (5) PES membership, (6) IEEE Fellow status, (7) full-time or part-time academic year appointment, and (8) years of career experience in academia, the power industry, and other (non-power) industries. Academic focus on the power engineering area should have been reported only as academic experience rather than power industry experience. All 137 responding universities listed their faculty and staff. However, there are missing data, particularly on career experience.

Table 1 below summarizes the responses for academic position, highest degree, IEEE Fellow, and PES membership. There were 549 faculty and 123 staff engaged in instruction during the 2015-16 academic year. Most were in departments associated with electrical engineering, but others were in such departments as computer science, industrial engineering, economics and policy, mechanical engineering, math, materials science, engineering technology, bioengineering, philosophy, energy and resources, mining, civil engineering, informatics, and computing and cyber systems. The involvement by faculty in departments other than electrical engineering reflects the growing interdisciplinary cooperation needed to address research and instructional needs in today's electric power career field.

Table 1. Faculty and Staff by Position, Highest Degree, IEEE Fellow, and PES Membership

		ACADEMIC POSITION						HIGHEST DEGREE					
	All Faculty And Staff	Professor	Associate Professor	Assistant Professor	Adjunct Professor	Instructor or Lecturer	Emeritus	PhD	Master	Bachelor	Other	Fellow	PES Member
Number	672	272	128	149	61	46	16	629	38	4	1	156	529
Percent	100.0	40.5	19.0	22.2	9.1	6.8	2.4	93.6	5.7	0.6	0.1	23.2	78.7

Figure 1 gives the average number of faculty and staff per responding university by survey year beginning in 1969-1970. Figure 2 provides related percentages of total for faculty and staff. Taken together, the figures show that universities have been adding faculty over the last decade, particularly younger faculty (i.e., associate and assistant professors). The total number of faculty reported in the surveys rose from 339 at 125 universities in 2005-6 to 549 at 137 universities in 2015-16. Given the rise in the number of students as discussed later in the report and the prospects of senior faculty retirements, this is a positive trend that will help sustain power engineering education over time. As shown later in this report, hiring of younger faculty has occurred in the context of higher research funding and higher numbers of students in power engineering classes.

At the same time, the rising number of students and the increasing breadth requirements in the curriculum to prepare students for today's power industry appear to have also motivated increased staff hiring, including adjunct professors, instructors, and lecturers. When emeritus faculty (many of whom continue teaching after retirement) are included as staff, over 18 percent of all instruction personnel were staff. There was decline in the use of staff in the 1980s as shown in Figures 1 and 2. This decline was likely a result of a decline in the number of students in power engineering specifically and in engineering in general in that period. Staff are generally not tenured so their numbers are more likely than faculty to change as education needs and budgets change.

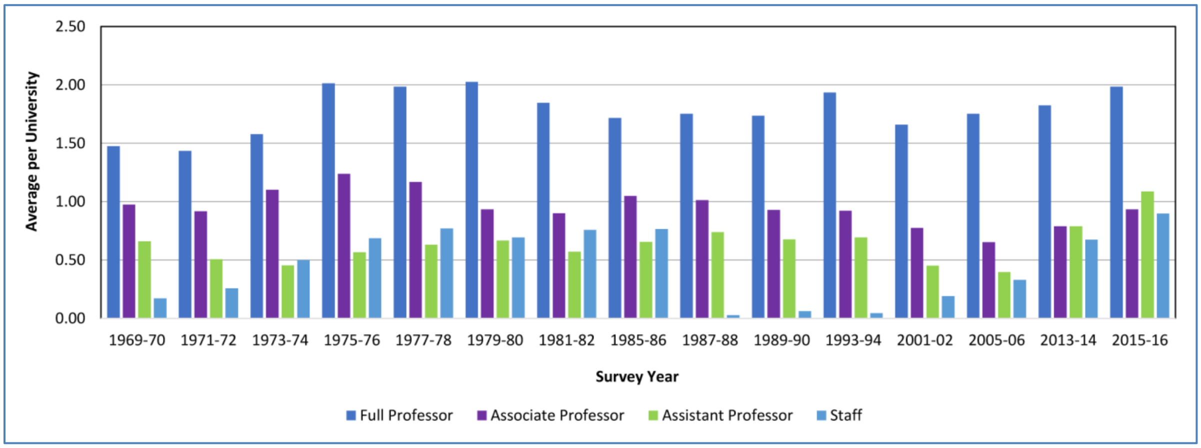

Figure 1. Average Number of Faculty and Staff Per University by Survey Year

Note: These averages are over all responding universities.

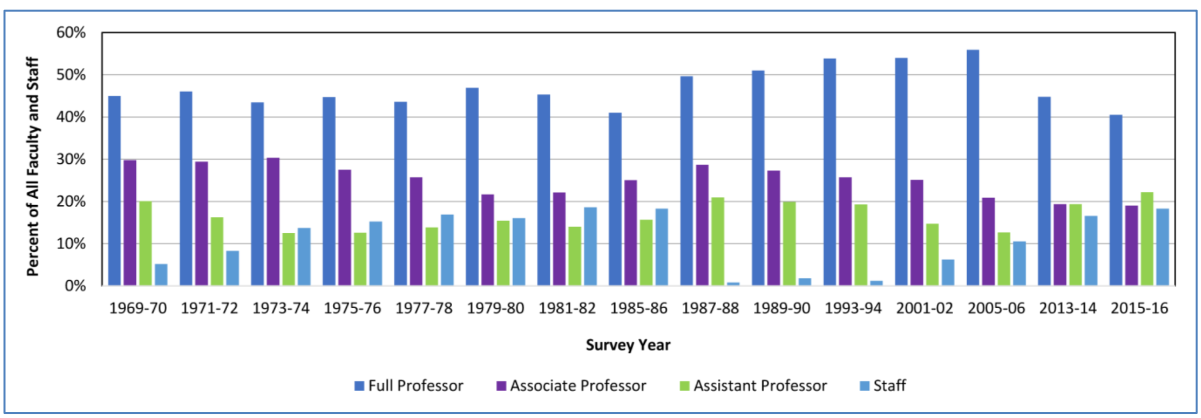

Figure 2. Percentages of Faculty and Staff by Survey Year

That the number of faculty and staff has been rising is also indicated by the reported hiring and departure data for all responding universities shown in Table 2. On average, the universities reported hiring two faculty and staff for each one that left.

Table 2. Total Personnel Changes

	Canada	US	Both
Faculty/Staff Left	5	39	44
Faculty/Staff Hired	8	81	89

Table 3 provides the average number of years of experience in academia, in the power industry, and in the other (non-power) industries for faculty and staff. It also gives the distribution of retirement eligibility. Not surprisingly, as shown in past surveys, faculty and staff in general have more experience in academia than industry.

In terms of retirement eligibility, the table also indicates that some 37% of faculty and staff were retirement eligible in 2015-16 or will be within the next ten years. The 37% metric may be a low estimate of retirement eligibility due to missing data since some 31 universities reported zero ('0") faculty and staff were retirement eligible over the period. Awareness of retirement eligibility is important for planning faculty and staff hires, particularly given that it may take six years for an assistant professor to get tenure and the process of doing so requires the mentorship of senior faculty.

Table 3. Career Experience and Retirement Eligibility

Experience (Average Number of Years)			Retirement Eligibility			
Academia	Power Industry	Other Industry	Now	1-5 Years	6-10 Years	Now to 10 Years
16.1	3.9	1.9	12.1%	8.6%	16.5%	37.2%

Note: The average career experiences were computed with data from 444 faculty and staff. Thirty-one universities reported that none of their faculty and staff were now or would be retirement eligible over the ten year period. It is not known whether these were accurate responses or missing data.

Table 4 provides more details about the distribution of faculty and staff by years of career experience in academia. Almost half of the US faculty and staff as compared to about one-quarter of Canadian faculty and staff have ten or fewer years of experience in academia. That almost half of US faculty have ten or fewer years in academic experience reflects the recent growth in faculty hiring.

Table 4. Faculty and Staff Distribution by Years of Academic Experience

	Canada		US		Both	
Years in Academia	**N**	**%**	**N**	**%**	**N**	**%**
1-10	11	25.6%	192	47.9%	203	45.7%
11-20	13	30.2%	77	19.2%	90	20.3%
21-30	11	25.6%	76	19.0%	87	19.6%
31-40	5	11.6%	42	10.5%	47	10.6%
41-50	3	7.0%	11	2.7%	14	3.2%
>50	0	0.0%	3	0.7%	3	0.7%
Total	43	100.0%	401	100.0%	444	100.0%
Average Academic	20.6		15.6		16.1	
Average Power Industry	2.7		4.0		3.9	
Average Other Industry	0.7		2.0		1.9	

Note: The average career experiences were computed with data from 444 faculty and staff.

Table 5 provides more information about the characteristics of the faculty and staff by their academic position. Doctoral degrees (i.e., PhD's) are expected for faculty and emeritus professors (who are former faculty members) so almost 100% of faculty reported PhD as their highest degree. Adjunct professors, instructors, and lecturers were less likely to have PhDs. Only 70% of adjunct professors and 59% of instructors or lectures reported to have a PhD. Not surprisingly, almost all IEEE Fellows were full or emeritus professors. About 79% of all faculty and staff were PES members with high membership percentages across all positions. Faculty and adjunct professors were typically full-time. Part-time faculty and staff tended to be instructors or lecturers, or emeritus professors. Emeritus professors, followed by full professors, had the most academic experience whereas adjunct professors followed by instructors and lecturers had the most industry experience. Many adjunct professors, instructors, and lecturers likely came from industry to teach in academia or were working in industry while teaching part-time. In some case, people from industry may have asked to help with power engineering instruction in subjects that would contribute to career preparations by students.

The survey responses show that the size of power programs as measure by the number of faculty and staff varies considerably across universities. Table 6 gives the faculty and staff distributions by university. The lower 40% of universities have three or fewer faculty and staff while some 12% of responding universities report 10 or more faculty and staff. The average is about five faculty and staff. The university with the largest program reported 16 faculty and staff.

Table 5. Faculty and Staff Characteristics by Academic Position

Characteristic	All Faculty And Staff	ACADEMIC POSITION					
		Professor	Associate Professor	Assistant Professor	Adjunct Professor	Instructor or Lecturer	Emeritus
PhD	94%	99%	98%	99%	70%	59%	100%
Fellow	23%	49%	3%	0%	0%	0%	63%
PES Member	79%	79%	77%	83%	74%	72%	88%
Full-Time*	96%	96%	94%	94%	100%	66%	33%
Average Years Academic Experience	16.1	26.2	14.6	4.4	5.0	8.6	42.8
Average Years of Industry Experience	5.8	4.1	3.9	2.9	20.1	12.2	6.4

Note: Full-time percentages and career experience data were reported for 444 faculty and staff.

Table 6. Distribution of the Number of Faculty and Staff Per University

No. of Faculty and Staff	N	%
1	16	11.7%
2-3	38	27.7%
4-5	39	28.5%
6-9	27	19.7%
10+	17	12.4%
Total	137	100.0%
Average	4.9	
Maximum	16	

Note: The metrics were computed with data from all responding universities.

III. RESEARCH ACTIVITIES AND FUNDING

The survey asked for research expenditures, classified by non-equipment and equipment expenditures, on research by the faculty members entered in the survey. Research awards were not to be included – only actual expenditures. Appendix Table 3 gives the reported research expenditures by funding source (i.e., government, domestic utility, and other domestic industries) and the research areas at each university.

As given in Table 7, 125 of the 137 reporting universities reported positive total research expenditures. All Canadian universities reported positive non-equipment and equipment expenditures. Twelve US universities reported zero research expenditures. Forty-two US universities reported only non-equipment expenditures while seven US universities reported only equipment expenditures. A zero response could indicate either that the university actually had zero expenditures or that the data were not included in that university's response.

Table 7. Research Expenditure Responses

Category	Canada (N)	US (N)	Both (N)
All Responding Universities	10	127	137
Universities Reporting Positive Total Research $	10	115	125
Universities Reporting Positive Non-Equipment $	10	108	118
Universities Reporting Positive Equipment $	10	73	83
Universities Reporting Zero Research $	0	12	12
Universities Reporting Only Non-Equipment $	0	42	42
Universities Reporting Only Equipment $	0	7	7

Table 8 provides information on research expenditures in 2015-16. To put the US and Canadian university expenditures on a comparable basis, the Canadian research expenditures are expressed in US$ using an average conversion rate of one Canadian dollar per 0.755 US dollar. Both averages and medians are reported because universities with very large reported research expenditures skew the averages away from the medians. The averages and medians are reported in two ways: (1) over universities with positive expenditure values for a particular funding category (that is, non-equipment and equipment), and (2) over all universities with positive total research expenditures. Obviously the interpretation of the averages and medians depends upon which universities were included in the calculation.

Here are some observations about the expenditure data.

- For all reporting universities, combined non-equipment research expenditures at around US$143 million far exceed equipment expenditures of about US$29 million.
- Both in the US and Canada, government funding is the dominant funding source providing some two-thirds of the non-equipment funding. However, equipment funding in Canada is almost 90% from government whereas in the US, industry funding constitutes about 29% of equipment expenditures.
- In US$, average expenditures for US universities tend to be higher than Canadian universities, but the median values are lower indicating a greater percentage of US universities have lower research expenditures than in Canada.

Figure 3 shows that the reliance on government versus industry funding sources has varied over time starting with the 1969-1970 survey. The percentage of total research contributions from industry exceeded government contributions during the 80s and early 90s, but in the 21st century, government sources dominated.

Figures 4 and 5 illustrate trends in research expenditures in inflation-adjust (i.e., real) dollars. For the purposes of this report, real research expenditures were computed by adjusting historical research funding figures for inflation using the US Gross Domestic Product price deflator from the US Bureau of Economic Analysis. 2015-16 was the reference year for the price deflator so the averages can be thought of as being in 2015-16 dollars. Also, data from Canadian universities were not included in the university surveys until the 1989-90 survey, thereby somewhat affecting the averages in prior surveys. Canadian expenditures were also converted to US$ for the 2013-14 and 2015-16 surveys using average exchange rates of 0.935 and 0.755 respectively (source: OANDA.com). Research funding by country was not readily available for prior years.

As shown in Figure 4, inflation-adjusted average research funding over all universities reporting positive research expenditures increased substantially in the 21st century from an average of $776K per university in 2001-02 to $1,378K in 2015-16. The increase in average real government funding from $571K to $942K shown in Figure 4 was the major reason for the growth in total research support. Interestingly, since 1993-94, average funding from "other" non-utility domestic industries has grown from $28K to $218K while average funding from utilities only increased from $182K to $218K in real terms. Thus, the funding from the utility industry about kept even with inflation, but other domestic industry funding rose. 2015-16 research funding from other domestic industries actually about equaled funding from utilities. This trend reflects industry changes (such as growth in deployment of smart grid technologies) that brought new businesses into the electric power industry.

Another way to analyze recent research expenditure trends is to focus just on those universities that were in both the 2013-14 and 2015-16 surveys. As indicated in the introduction, changes in which universities responded to the surveys will likely affect the results irrespective of true underlying trends in the data. Table 9 presents the average expenditures in the 2013-14 and 2015-16 surveys for those universities. These expenditures were not corrected for inflation or currency valuation. In comparing Table 9 to Table 8, it appears that the universities that responded to both surveys tended to have a little higher research expenditures than all respondents because the average total expenditures are somewhat higher. As shown in Table 9, for the universities in both surveys, the average research expenditures fell by some 21% for the Canadian universities, but rose by six percent for the US universities. Thus, the overall decline in research expenditures illustrated in Figure 4 appears to be principally due to the decline in reported research expenditures in Canada with an additional negative effect introduced by the reduced value of the Canadian dollar.

As indicated in Table 10, the universities responding to the 2015-16 survey were generally optimistic about their research funding outlook with 39% and 35% of the universities indicating an expectation of rising research funding over the next three and ten years respectively. As might be expected, there is more uncertainty about the long-term outlook. Of course, these perspectives were as of when a survey was submitted so current perspectives on the research funding outlook may be different.

The distribution of research funds at the universities is quite wide as shown in Table 11. 29% of the universities reported total research expenditures between US$1 and US$250,000 while 18% reported expenditures exceeding two million dollars. Table 11 also gives the average number of faculty and staff per expenditure range. Not surprisingly, the average number of faculty and staff rises as the expenditure range rises. The average of 3.5 faculty and staff at universities with an expenditure range of US$1 to US$250,000 rose to 7.6 faculty and staff when expenditures exceeded two million dollars.

Table 8. Research Expenditures (US$)

Category	Canada		US		Both	
NON-EQUIPMENT EXPENDITURES						
Government - Non-Equipment	$ 5,945,550	66.2%	$ 92,402,560	68.9%	$ 98,348,110	68.8%
Domestic Utility - Non-Equipment	$ 2,260,470	25.2%	$ 22,964,021	17.1%	$ 25,224,491	17.6%
Other Domestic Industry - Non-Equipment	$ 774,630	8.6%	$ 18,680,406	13.9%	$ 19,455,036	13.6%
Total Non-Equipment	$ 8,980,650	100.0%	$134,046,987	100.0%	$143,027,637	100.0%
Universities with Positive Non-Equipment Expenditures:						
Average Non-Equipment	$ 898,065		$ 1,241,176		$ 1,212,099	
Median Non-Equipment	$ 633,407		$ 480,000		$ 495,000	
Universities with Positive Total Expenditures:						
Average Non-Equipment	$ 898,065		$ 1,165,626		$ 1,144,221	
Median Non-Equipment	$ 633,407		$ 450,000		$ 450,000	
EQUIPMENT EXPENDITURES						
Government – Equipment	$ 2,158,847	87.5%	$ 17,208,227	64.2%	$ 19,367,074	66.2%
Domestic Utility – Equipment	$ 181,955	7.4%	$ 1,891,500	7.1%	$ 2,073,455	7.1%
Other Domestic Industry – Equipment	$ 126,463	5.1%	$ 7,707,833	28.8%	$ 7,834,296	26.8%
Total Equipment	$ 2,467,265	100.0%	$ 26,807,560	100.0%	$ 29,274,825	100.0%
Universities with Positive Equipment Expenditures:						
Average Equipment	$ 246,726		$ 367,227		$ 352,709	
Median Equipment	$ 144,394		$ 70,000		$ 77,000	
Universities with Positive Total Expenditures:						
Average Equipment	$ 246,726		$ 233,109		$ 234,199	
Median Equipment	$ 144,394		$ 22,000		$ 25,000	
TOTAL RESEARCH EXPENDITURES						
Government – Total	$ 8,104,397	70.8%	$109,610,787	68.1%	$117,715,184	68.3%
Domestic Utility – Total	$ 2,442,425	21.3%	$ 24,855,521	15.5%	$ 27,297,946	15.8%
Other Domestic Industry – Total	$ 901,093	7.9%	$ 26,388,239	16.4%	$ 27,289,332	15.8%
Total Research Expenditures	$ 11,447,914	100.0%	$160,854,547	100.0%	$172,302,461	100.0%
Universities with Positive Total Research Expenditures:						
Average Total Research Expenditures	$ 1,144,791		$ 1,398,735		$ 1,378,420	
Median Total Research Expenditures	$ 750,244		$ 550,000		$ 550,000	

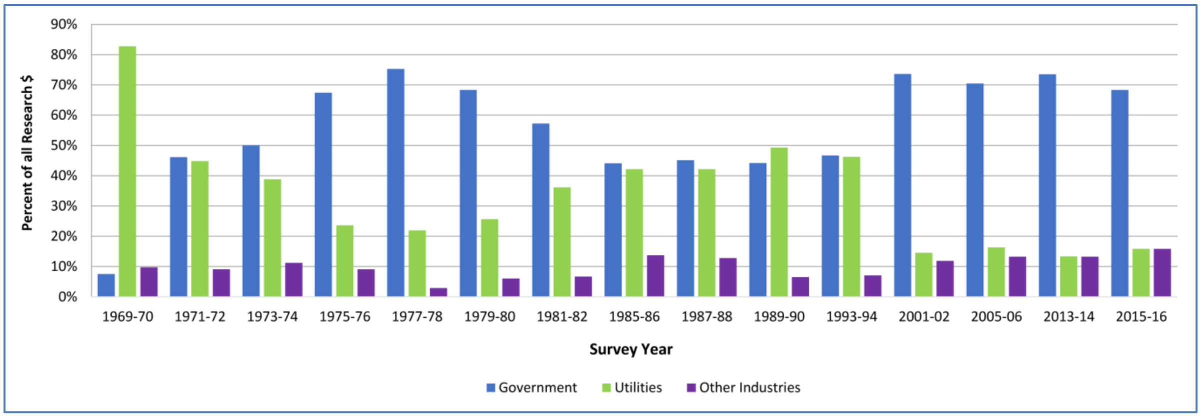

Figure 3. Funding from Government, Utilities, and Other Industries (%)

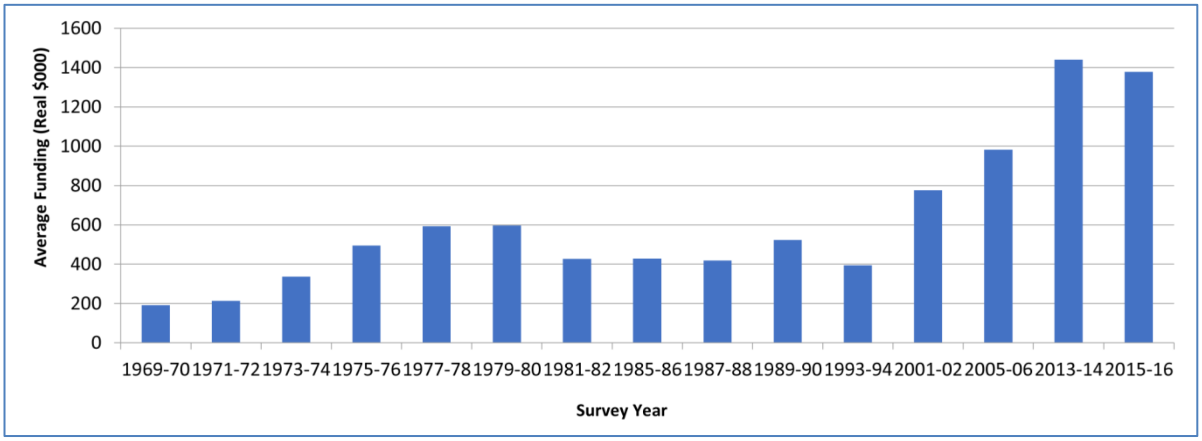

Figure 4. Average Research Funding from Government, Utilities, and Other Industries (Real $000)

Note: The averages were computed with data from the universities reporting positive (i.e., non-zero) total research expenditures.

Table 9. Average Total Research Expenditures by Universities in both the 2013-14 and 2015-16 Surveys

Category	Canada	US
2015-16 Average Total Research Expenditures	CAN$1,650,311	US$1,568,663
2013-14 Average Total Research Expenditures	CAN$2,079,607	US$1,480,727
Percent Change from 2013-14 to 2015-16	-20.6%	+5.9%
Number of Universities with Positive Total Research Expenditures and Responding to Both Surveys	9	98

Note: The average expenditures are in current dollars (i.e., uncorrected for inflation).

Table 10. Research Funding Outlook

	Next 3 Years		Next 10 Years	
	N	%	N	%
Rising	53	38.7%	48	35.0%
Stable	60	43.8%	58	42.3%
Declining	20	14.6%	14	10.2%
Unsure	4	2.9%	17	12.4%
Total	137	97.1%	137	100.0%

Table 11. Distribution of Total Research Expenditures (US$)

Expenditure Range ($)	N	%	Average No. of Faculty and Staff
$0	12	8.8%	2.6
$1-$250,000	40	29.2%	3.5
$250,001-$500,000	18	13.1%	4.3
$500,001-$1,000,000	22	16.1%	4.2
$1,000,001-$2,000,000	20	14.6%	7.1
>$2,000,000	25	18.2%	7.6
All	137	100%	4.9

An important question is whether the growth in research funding has been commensurate with the rising number of faculty since faculty funding adequacy is essential for sustaining electric power engineering programs. Per faculty funding is an indicator of faculty's ability to support graduate students and to meet university research performance expectations, particularly for untenured faculty. The metric of research funding per faculty member over time is shown in Figure 5. The graph indicates that research funding per faculty member has grown in the 21st century, with particularly strong growth in the 2013-14 and 2015-16 survey results. However, Figures 4 and 5 together may suggest that the growth in research funding per faculty member may have peaked if not started to decline. The longer term trend will have to be discerned from analyses with future survey data.

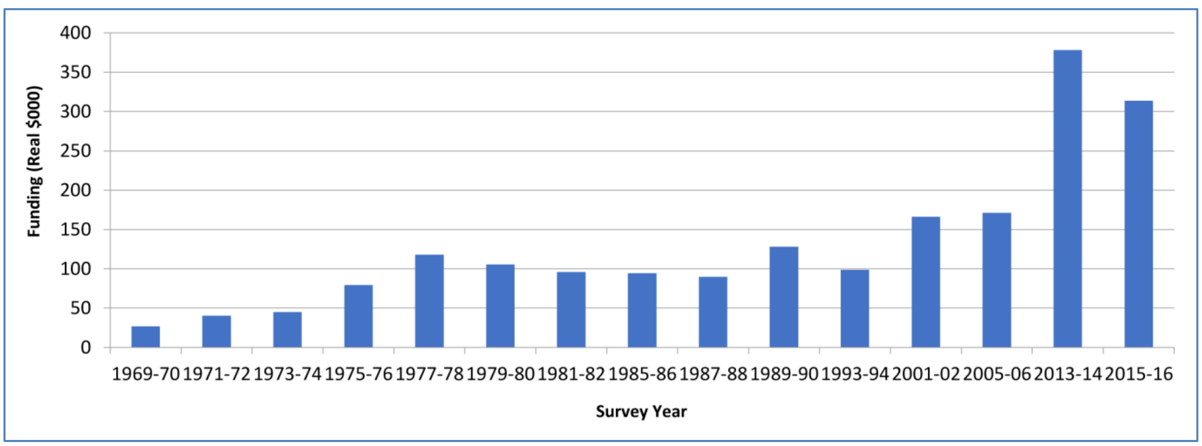

Figure 5. Average Research Funding Per Faculty Member by Survey Year (Real $000)

Note: The averages were computed with data from the universities reporting positive (i.e., non-zero) total research expenditures.

Table 12 gives the per faculty member distribution of non-equipment and total research expenditures for the responding universities. Some 24% of universities averaged between US$1 and US$50,000 per faculty member for non-equipment expenditures. Similarly some 23% of universities averaged between US$1 and US$50,000 for total research expenditures. This is likely inadequate funding to support one graduate student at most universities. If non-equipment expenditures exceeding US$200,000 were an indicator of adequate research support, then only 24.8% of all universities would meet that criterion. Thus, research funding adequacy is a timely topic for further study and discussion among the academic, government, and industry communities.

Table 12. Research Expenditures (US$) Per Faculty Member

Per Faculty Expenditure Range	Non-Equipment Expenditures		Total Expenditures	
$	**N**	**%**	**N**	**%**
$0	19	13.9%	12	8.8%
$1-$50,000	33	24.1%	32	23.4%
$50,001-$100,000	23	16.8%	21	15.3%
$100,001-$200,000	28	20.4%	24	17.5%
$200,001-$350,000	16	11.7%	24	17.5%
>$350,000	18	13.1%	24	17.5%
All	137	100.0%	137	100.0%

The respondents were asked to identify their university's research areas. The research areas from which they were to select generally followed IEEE PES technical committee names, although the list was shortened and generalized for the purposes of this survey. Table 13 indicates the frequency with which research areas were reported by the universities. The most frequently reported research areas were intelligent grid and renewable generation. The least reported were the hardware-oriented areas of transformers, substation automation, switchgear, and surge protection devices.

Table 13. Frequency of Reported Research Areas

Research Area	% of Universities
Intelligent Grid	75.9%
Renewable Generation	73.0%
Power System Computation and Analysis	51.8%
Power Electronics	51.1%
Energy Storage & Stationary Battery	48.2%
Power System Dynamic Performance	38.0%
Power System Operations	38.0%
Electric Machinery	37.2%
Energy Development & Power Generation	35.8%
Power Engineering Education	35.0%
Power System Economics	31.4%
Power System Planning and Implementation	29.9%
Power System Communications & Cybersecurity	25.6%
Distribution System Analysis	21.9%
Power System Relaying	19.0%
Power System Instrumentation and Measurements	16.1%
Reliability, Risk and Probability Applications	14.6%
Transformers	10.2%
Substation Automation	8.8%
Switchgear, Surge Protection Devices	5.1%

IV. EDUCATION OVERVIEW

Degree offerings for students interested in power engineering careers vary across the 137 responding universities. All the universities offer undergraduate electrical engineering degrees. Since undergraduate students typically receive degrees in electrical engineering rather than specifically in power engineering, there are not "power engineering undergraduate degrees" although there are various special program offerings (such as certificates or tracks). Generally speaking, it is not possible to unambiguously identify "power engineering" undergraduate students.

Appendix Table 4 gives the undergraduate education program characteristics of the responding universities. Table 14 summarizes information about the education options for undergraduates in Canada and the US. About 70% of Canadian universities have mandatory courses in power engineering for all engineering students while 46% of US universities have mandatory courses for all students. The percentage of universities requiring a power course in the electrical engineering undergraduate curriculum decreased from an all-time high of about 80% in 1994 to about 65% in 2001-02 to about 59% in 2005-06. Almost all universities have undergraduate elective courses in power engineering. Those universities that do not offer elective courses do offer mandatory courses. Mandatory course for all students in a special track, minor, or certificate are offered at 30% of the Canadian universities and 43% of the US universities. Specific mandatory and elective courses are identified in Appendix Table 6.

Many universities offer special tracks, minors, or certificates beyond just an electrical engineering degree. Appendix Table 6 gives titles of those education opportunities. 40% of the Canadian universities and 28% of US universities offer a special track related to power engineering or power systems. Special tracks at 40 universities were in such areas as power, energy, systems, cyber security, smart grids, engineering management, renewable/sustainable energy, control, energy finance, power electronics, and electric drives. Certificates at 17 universities were (1) for power engineering or systems, (2) for a specialization within power engineering such as power system protection or power electronics, or (3) in broader areas such as renewable or sustainable energy. Minors at eight universities were in broader energy systems and energy resources areas while others were in specialty areas such as power electronics, renewables (e.g., solar and wind), and sustainable energy. In a few cases, universities appear to have reported on graduate rather than undergraduate certificates or minors in their responses.

Coop programs are designed to give industry experience to undergraduate students. As shown in Table 14, all Canadian universities and 70% of US universities offer coop opportunities. When a coop program is available, it is most frequently optional.

Table 14. Undergraduate Education Programs

Offering	Canada		US	
	N	%	N	%
Mandatory courses for all students	7	70.0%	58	45.7%
Elective courses	9	90.0%	125	98.4%
Mandatory course for all students in a special track, minor, certificate, etc.	3	30.0%	52	42.6%
Special track	4	40.0%	36	28.3%
Minor	1	10.0%	7	5.5%
Certificate	0	0.0%	17	13.4%
Coop				
Available (optional)	8	80.0%	87	68.5%
Available (mandatory)	2	20.0%	2	1.6%
Not available	0	0.0%	38	29.9%

Graduate offerings for students interested in power engineering careers varied across the universities. Appendix Table 4 gives the graduate degree offerings reported by each university. Table 15 shows that all Canadian universities offered master's and doctoral degrees. In the US, 88% of universities offered master's degrees while 75% offered doctoral degrees. Online master's graduate degree opportunities exist at one university in Canada and 35 US universities while online doctoral degrees were reported to be available at 13 US universities.

Table 15. Number of Universities Offering Graduate Degrees

Degree	Canada		US	
	N	%	N	%
Number of Responding Univ.	10	100%	127	100%
Offering Master's Degree	10	100%	112	88%
Offering Doctoral Degree	10	100%	95	75%
Offering Online Master's Degree	1	10%	35	28%
Offering Online Doctoral Degree	0	0%	13	10%

Distance education has made inroads into the delivery of university education. Table 16 shows that 18% of universities had distance education undergraduate students and 32% had distance education graduate students in 2015-16. In terms of courses, as shown in Table 17, 9% of undergraduate courses and 28% of graduate courses had distance education students. Some courses had high numbers of distance education students, with about 4% of undergraduate courses and 12% of graduate courses having ten or more distance education students. University courses with distance education students enrolled are identified in Appendix Table 6.

Table 16. Number of Universities Reporting Distance Education Students

Category	N	%
Undergraduate	24	18%
Graduate	43	32%
Total Responding Univ.	136	100%

Table 17. Number of Courses with Distance Education Students

Level	Total No. of Courses	Total Courses with Distance Education Students		Courses with 10 or More Distance Education Students	
	N	N	%	N	%
Undergraduate	749	70	9.3%	29	3.9%
Graduate	809	224	27.7%	95	11.7%

V. STUDENT ENROLLMENTS

Appendix Table 5 gives student enrollment and degrees granted (or graduations) at each university. Student enrollments were classified by master's and doctoral, international vs. domestic, and part-time vs. full-time. No enrollment data were available for undergraduate students for the reasons discussed in Section IV. Fifteen responding universities reported zero graduate student enrollments.

Table 18 provides insights into various categories of enrolled graduate and undergraduate students.

- International students had the highest percentage of full-time graduate students, reaching as high as 78% and 73% of full-time doctoral students in the US and Canada respectively.
- Domestic students had the highest percentage of part-time students reaching 80% and 91% of master's students in the US and Canada respectively. Many of the part-time students were likely trying to get an advanced degree while working.
- Undergraduate students are predominantly domestic students. Canada and US universities estimated that a little over 80% of undergraduate students were domestic.

Table 18. Student Enrollments

Category	Canada		US	
	N	%	N	%
Master's Full-Time Domestic	93	41.7%	582	27.0%
Master's Full-Time International	130	58.3%	1575	73.0%
Total Master's Full-Time	223	100.0%	2157	100.0%
Master's Part-Time Domestic	120	90.9%	547	79.5%
Master's Part-Time International	12	9.1%	141	20.5%
Total Master's Part-Time	132	100.0%	688	100.0%
Doctoral Full-Time Domestic	48	27.1%	304	22.1%
Doctoral Full-Time International	129	72.9%	1072	77.9%
Total Doctoral Full-Time	177	100.0%	1376	100.0%
Doctoral Part-Time Domestic	3	100.0%	92	62.2%
Doctoral Part-Time International	0	0.0%	56	37.8%
Total Doctoral Part-Time	3	100.0%	148	100.0%
Average Estimated % of Enrolled Domestic Undergraduates		81%		83%

Figures 6, 7, and 8 show average enrollment data from the 2015-16 and previous surveys to illustrate graduate student enrollment trends over time. The averages in the graphs were computed over the universities reporting a positive number of graduate students (doctoral and/or master's).

Figure 6 gives the average number of graduate students. The number of master's students declined from the mid-70s to the mid-80s, and then experienced a resurgence through the 1990s. After a decline shown in the 2005-06 survey, the average number of master's students more than doubled from 13.0 to 26.2 in the 2015-16 survey. The number of enrolled doctoral students has been growing since the 1990s, going from a low of 2.7 per university in 1993-94 to 14.0 average students per university in 2015-16.

Figure 7 gives the trends in number of domestic and international students. It shows that the average number of domestic students declined from early 1970s to a low of 7.3 in the 1987-88 survey. The average number of international graduate students did not exceed the number of domestic students until the 1985-86 survey. The resurgence in graduate students from 2005-6 to 2015-16 was mainly due to growth in the number of international students from 11.9 to 25.5 students per university (or 114%) whereas the average number of domestic graduate students grew more modestly from 9.2 to 14.7 (or 60%). The graph suggests that the number of domestic graduate students may have plateaued in recent years while the number of international students continued to grow.

Figure 8 gives the average number of full-time and part-time students. Until the mid-70s, there were actually more part-time than full-time graduate students. Perhaps this is due to an employment growth period for the industry as it responded to power system reliability problems in the late 1960s. As the industry moved into a period of sufficient generation capability in the late 70s and early 80s, hiring likely slowed so the average number of part-time students declined from the peak of 12.7 in 1975-76 to 4.8 in 1987-88.

The average number of full-time students has grown from the 80s (low of 10.3 in 1989-90) to 32.2 in 2015-16. Figure 7 suggests that much of this growth has been due to international students.

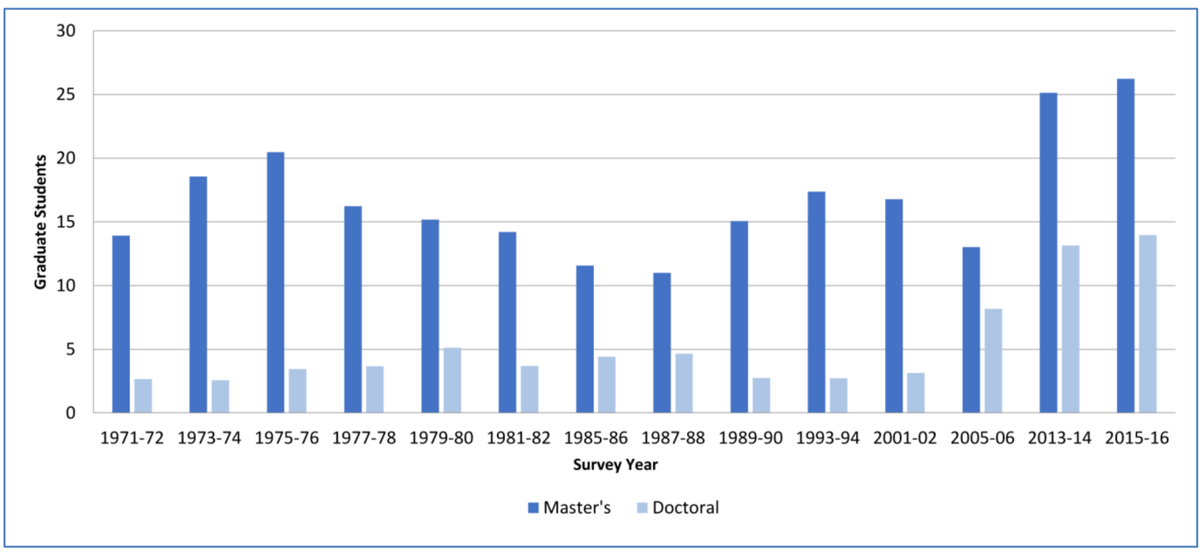

Figure 6. Average Number of Graduate Students Per University – Master's and Doctoral

Note: The averages were computed over all universities reporting a positive number of graduate students.

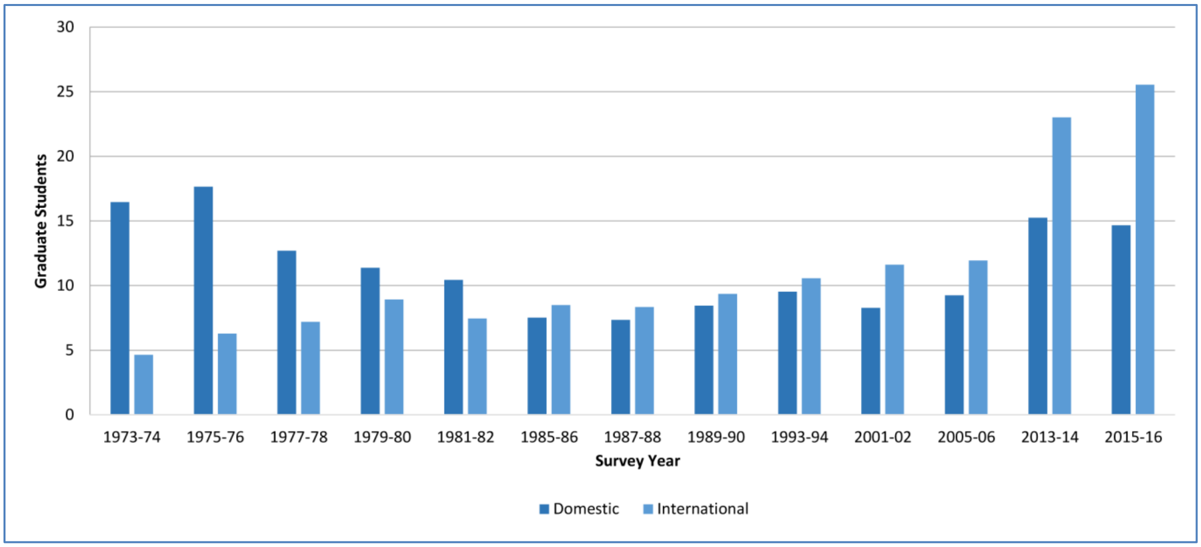

Figure 7. Average Number of Graduate Students Per University – Domestic and International

Note: The averages were computed over all universities reporting a positive number of graduate students.

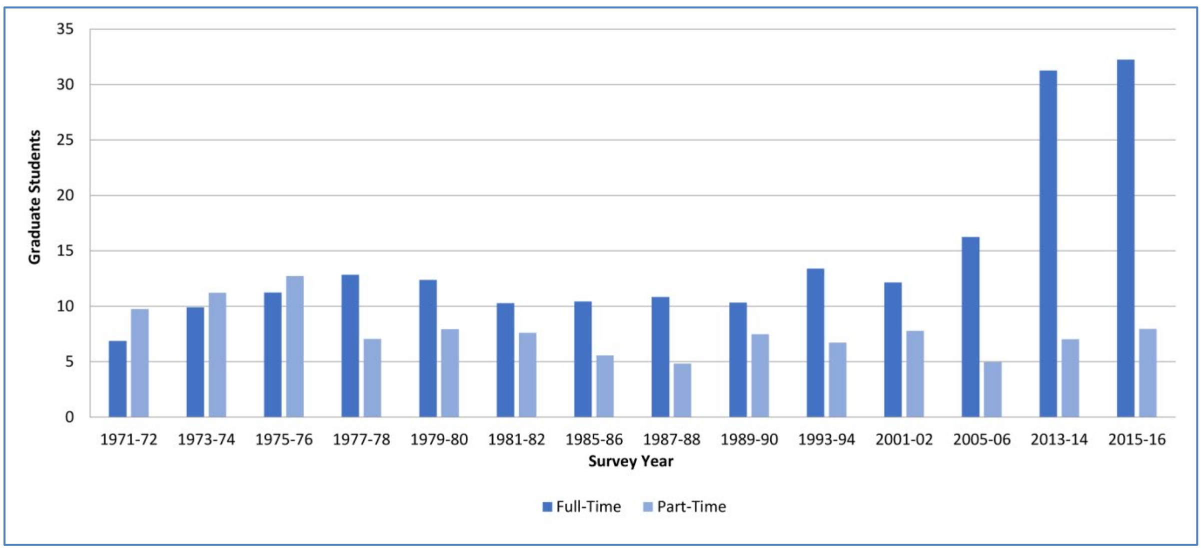

Figure 8. Average Number of Graduate Students Per University – Full-Time and Part-Time

Note: The averages were computed over all universities reporting a positive number of graduate students.

Tables 19 and 20 provide a more detailed look at enrollment trends over the last ten years using data from three surveys. Table 19 gives the ten year graduate enrollment trends in Canada and the US. These metrics are total number of students divided by the number of universities with positive responses within a student category rather than the number with positive total graduate students as was used in Figures 6 through 8. For example, a university reporting a positive number of master's student enrollments but no doctoral enrollments would not have been included in the average of doctoral students given in Table 19, but would have been included in the averages given in the figures.

In the US, there has been about a doubling of the number of master's, international, and full-time students over the last ten years. In Canada there has also been strong growth in the number of master's students, domestic and international students, and part-time students. The extraordinary growth in master's and part-time students reported in Table 19 is mainly due to one Canadian university that was included in the 2015-16 survey, but not in the 2005-6 survey. That university commented that it had strong growth in an online master's program.

Table 19. Graduate Student Enrollments: Ten Year Trend

Category	Average				% Change	
	Canada		US		Canada	US
	2005-6	2015-16	2005-6	2015-16	2005-6 to 2015-16	
Master's	13.9 (7)	35.5 (10)	13.1 (82)	25.4 (112)	156%	94%
Doctoral	14.9 (7)	18.0 (10)	10.3 (61)	16.7 (91)	21%	62%
Domestic	14.1 (7)	26.4 (10)	10.3 (71)	14.5 (105)	87%	41%
International	14.6 (7)	27.1 (10)	13.1 (74)	26.1 (109)	86%	98%
Full-Time	26.1 (7)	40.0 (10)	16.8 (76)	32.7 (108)	53%	95%
Part-Time	3.6 (5)	19.3 (7)	9.1 (47)	10.7 (78)	436%	18%
All Grads	28.7 (7)	53.5 (10)	20.5 (83)	39.0 (112)	86%	90%

Note: In parentheses is the number of universities with positive values for each student category so the averages were computed over that number of universities. This differs from the averages in Figures 6-8 that were computed over the number of universities with positive total of all graduate students.

Table 20 summarizes the combined data for the US and Canada. Overall, 65.3% of graduate students were international in the 2015-16 survey as compared to 61.4% in the 2005-6 survey. Similarly 60.1% of all graduate students were international vs. 56.4% in the 2005-6 survey. Finally, 80.2% of the enrolled students were full-time in 2015-16 survey vs. 76.7% in the 2005-6 survey.

Table 20. Graduate Student Enrollment Percentages in 2005-6 and 2015-16

Graduate Student	2005-6	2015-16
Master's	61.4%	65.3%
Doctoral	38.6%	34.7%
International	56.4%	60.1%
Domestic	43.6%	39.9%
Full-Time	76.7%	80.2%
Part-Time	23.3%	19.8%

VI. DEGREES GRANTED

In surveys before the 2001-02 survey, universities were asked to report the number of graduate degrees granted. In the 2013-14 and 2015-16 surveys, respondents reported the estimated number of degrees conferred to students who were entering the power engineering career field whether in industry, government or academia. Estimates were needed rather than actual counts, particularly in the case of undergraduates who were getting an electrical engineering degree without any academic designation of career direction as noted in Section IV. Specifically, survey respondents were asked to estimate the number of degrees conferred (or graduating students) who were likely to pursue positions in electric power engineering. The wording of this survey data request is given in the text of the survey given in the Attachment. For consistency with past surveys, the terminology that be used in this report is "degrees granted".

Appendix Table 5 gives the estimated degrees granted for the 2015-16 survey for each university. Table 21 shows the aggregate data for the reported number of degrees granted, and averages for Canada and US universities. The average for a particular student category (e.g., undergraduate) was computed over the number of universities reporting a positive number of degrees granted within that category. Thus, the average for doctoral degrees granted does not include universities reporting zero doctoral degrees granted.

Table 21. Estimated Degrees Granted to Students Entering Power Engineering Career Fields

Category	2015-16	
	Canada	US
Total Reported Number of Students		
Undergraduate	410	2,669
Master's	181	1,268
Doctoral	91	352
Average Number of Degrees Granted		
Undergraduate	41.0	21.0
Master's	18.1	11.4
Doctoral	9.1	4.4
Number of Universities with Positive Number of Undergraduate Degrees Granted	10	127
Number of Universities with Positive Number of Master's Degrees Granted	10	111
Number of Universities with Positive Number of Doctoral Degrees Granted	10	81

Note: The average for a particular category only includes universities that had a positive number of degrees granted for that category.

Figure 9 summarizes the average number of degrees granted for graduate students over time. This average was computed over the universities with a positive number of master's and doctoral degrees awarded. For example, a university with zero doctoral degrees granted but a positive number of master's degrees granted would have been included in the computed average of doctoral degrees granted. Between 1993-94 and 2015-16, the average went from 5.5 to 11.9 for master's degrees and from 1.4 to 3.6 doctoral degrees granted. This is additional evidence of the large growth in the number of power engineering students.

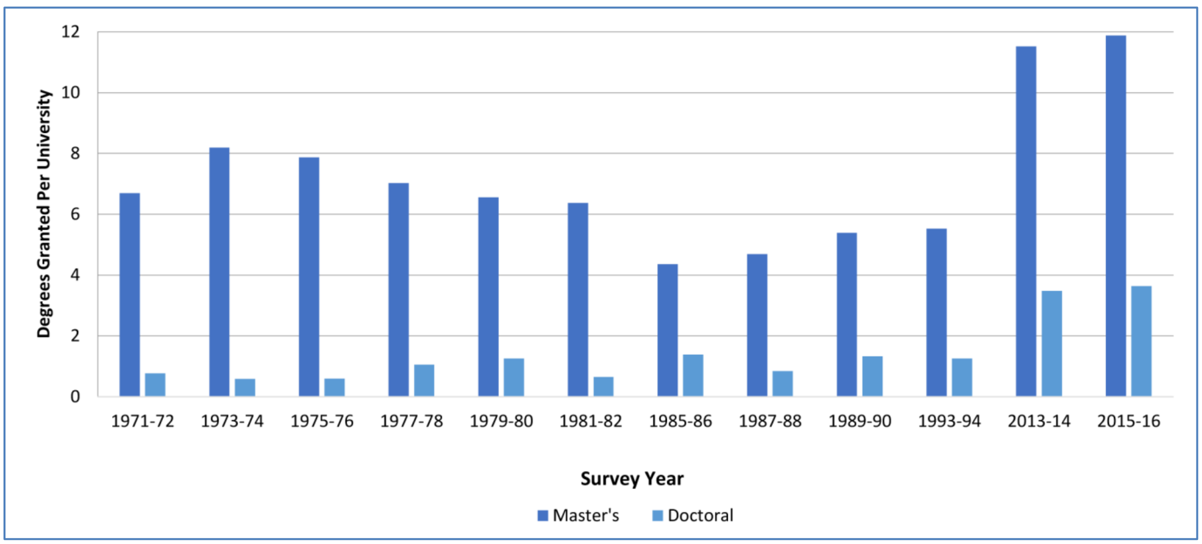

Figure 9. Average Degrees Granted Across Universities Reporting Graduate Students

Note: The averages were computed over the universities with a positive number of total graduate degrees granted.

Of interest is the total estimated number of degrees granted in Canada and the US. The metric reported in Table 21 and Figure 9 only account for the reported degrees granted by the respondents to the 2015-16 survey. Generalizing the result to all universities with students likely to pursue power engineering careers cannot be done without knowing the total number of universities, a number which is not available, and an estimate of the number of degrees granted at all universities. However, fifteen universities responded to the 2013-2014 survey, but did not respond in the 2015-16 survey. Assuming that their reported graduation figures did not change from the figures reported in the 2013-14 survey, the total number of degrees granted can be adjusted to some extent. This revision is reported in Table 22.

The estimated graduations by domestic undergraduate students can be made using the university estimates of percentage of domestic undergraduate student enrollment given in Table 19. For instance, with an average of about

83% of undergraduate students in the US being domestic, the total estimated number of domestic undergraduate students pursuing power engineering careers that graduated in 2015-16 would be about 2,400 (that is, 83% of 2,889).

Table 22. Estimated Degrees Granted in 2015-16 Adjusting for Degrees Granted at Universities that Participated in the 2013-14 Survey but not the 2015-16 Survey*

Category	Canada			US		
	2015-16	Adjustment	Total	2015-16	Adjustment	Total
Undergraduates Total	410	10	420	2669	220	2889
Master's Total	181	3	184	1268	94	1362
Doctoral Total	91	0	91	352	13	365

*The reported degrees granted by 137 universities in the 2015-16 survey were adjusted by adding 15 responses from the 2013-14 survey that were not in the 2015-16 survey. This results in estimated degrees granted based on a total of 11 Canadian and 141 US universities.

The size of student populations varies considerably across universities as shown in Table 23.

- The median values are approximately 19, 9, and 4 for undergraduate, master's, and doctoral students respectively.
- 18% of universities reported 40 or more undergraduate degrees grants.
- 18% of universities reported 20 or more master's degrees granted.
- 20% of universities reported seven or more doctoral degrees granted.

Table 23. Distribution of Degrees Granted Per University

Undergraduate			Master's			Doctoral		
Number	N	%	Range	N	%	Range	N	%
1-9	36	26%	1-4	37	31%	1-2	25	27%
10-19	34	25%	5-9	30	25%	3-4	26	29%
20-29	26	19%	10-14	16	13%	5-6	22	24%
30-39	17	12%	15-19	16	13%	7-8	9	10%
40+	24	18%	20+	22	18%	9+	9	10%
Total	137	100%	Total	121	100%	Total	91	100%

As noted in Section II, the number of instructional faculty and staff rose substantially over the last ten years. This result is reflected in the finding shown in Table 24 that the average number of faculty and staff rose as the number of degrees granted at a university rose. The total number of degrees granted is the sum of degrees granted to undergraduate and graduate students. Some 27 (or 20%) of universities had a range of total degrees granted between one and 10. They averaged 1.9 faculty and staff. On the other hand, six universities reporting more than 100 degrees granted averaged 7.7 faculty and staff. Table 24 also illustrates the wide range in sizes of university programs in electric power engineering. The number of faculty and staff needed to support student education will depend upon the mix of undergraduate and graduate students with graduate students typically using more time of faculty and staff than undergraduate students.

Table 24. Average Number of Faculty and Staff Per Number of Degrees Granted at each University

Total Number of Undergraduate and Graduate Degrees Granted	Number of Universities	%	Average No. of Faculty and Staff
1-10	27	19.7%	1.9
11-20	23	16.8%	3.7
21-30	25	18.2%	5.3
31-50	28	20.4%	6.1
51-100	28	20.4%	6.6
>100	6	4.4%	7.7
All	137	100%	4.9

As noted in Section I, determining near term trends is difficult because, in part, to factors unrelated to the underlying data trends, such as differences in which universities responded to the surveys. To examine the near-term trend in student enrollments and graduations, growth rates between 2013-14 and 2015-16 were calculated just using universities that responded to both surveys. The results are given in Table 25.

- For universities in both surveys, the strongest growth in estimated number of degrees granted was in Canadian doctoral students (22.9%) and US undergraduate students (9.1%).
- In terms of enrollments, both Canadian and US universities had high growth rates of 24.8% and 4.6% respectively for international graduate students.
- Both experienced declines in enrollments of domestic graduate students at a negative 5.1% for Canadian universities and a negative 4.5% for US universities. The decline appears to be mainly due to a decline in enrolled domestic master's students; the number of domestic doctoral students is about level.
- With graduate student enrollments of part-time students not changing at Canadian universities and declining by almost 10% at US universities, it appears that interest in getting advanced power engineering degrees may be waning among people who are already employed. This could be a result of greater job security in a stronger US economy.
- Overall, the average number of graduate student enrollments increased 8.5% in Canada and just 1.1% in the US for those universities in both surveys.

It is worth repeating that Canadian metrics will be volatile due to the low number of responding universities (e.g., nine universities in most categories in this analysis).

Table 25. Growth Rates in Degrees Granted and Enrollments for Universities in both the 2013-14 and 2015-16 Surveys

Category	Canada		US		% Change		N	
	2013-14	2015-16	2013-14	2015-16	Canada	US	Canada	US
Average Graduation Rates								
Undergraduates	36.4	36.7	19.3	21.1	0.6%	9.1%	9	108
Master's	19.0	19.6	11.4	11.7	2.9%	2.5%	9	95
Doctoral	7.8	9.6	4.3	4.5	22.9%	4.0%	9	76
Average Enrollments								
Master's	36.6	38.1	25.4	25.2	4.3%	-0.8%	9	96
Doctoral	15.8	18.7	16.9	17.2	18.3%	2.0%	9	83
Domestic Grad	28.6	27.1	15.2	14.5	-5.1%	-4.5%	9	91
International Grad	23.8	29.7	25.7	26.9	24.8%	4.6%	9	94
Full-Time	37.3	41.8	33.3	34.6	11.9%	3.9%	9	93
Part-Time	19.3	19.3	10.5	9.5	0.0%	-9.7%	7	66
All Grads	52.3	56.8	39.6	40.1	8.5%	1.1%	9	96

Note: Averages in each category were computed over universities with positive (non-zero) responses in that category. The "N" is the number of universities over which the averages were computed in 2015-16. The number of universities in 2013-14 may slightly differ due to zero responses in a category.

One of the ways to sustain student interest in power engineering is to help with recruiting high school students. Table 26 summarizes the university responses to the question “Did power faculty participate in any power-related outreach events designed to attract K-12 students into the power engineering career field or to help K-12 teachers?” 40% of the Canadian universities and 71% of the US universities reported participation.

Table 26. Universities with Power Faculty Working to Attract K-12 Students or to Help K-12 Teachers

Canada Only		US Only	
N	%	N	%
4	40%	90	71%

VII. COURSES

Appendix Table 6 gives the reported electric power engineering course offerings of each responding university. 749 undergraduate and 809 graduate courses were reported by 136 responding universities (with 134 providing undergraduate course information). For each course, the table gives the course title, undergraduate or graduate level, frequency with which it is offered, whether the course is mandatory or an elective, credit hours, whether there is lab associated with the course, and class enrollments by in-class, distance education, and total students.

The number of undergraduate students in courses with the highest enrollment at each university provides an indicator of interest in power engineering and of exposure of engineering students to power engineering concepts. This metric is available from past surveys. Table 27 summarizes the highest enrollment classes (one per university) for the 2015-16 survey. Almost 7,500 students were reported to have participated in one of the classes. The highest enrollment classes at 66 of the 134 universities reporting undergraduate course information were mandatory so they attracted undergraduate students who may or may not have been interested in power engineering as a career. The trend in size of the highest enrollment classes is illustrated in Figure 10. The rising average of students in the highest enrollment classes is further evidence that student interest has grown over the ten years from the 2005-6 survey to the 2015-16 survey.

Table 27. Undergraduate Classes with Highest Enrollment at a University

Category	N
Number of Universities Reporting Undergrad Course Data	134
Total Number of Students in Highest Enrollment Classes	7,488
Number of Mandatory Classes with Highest Enrollment	66
Average Highest Enrollment Class Size	55.9
Highest Enrollment Class Size Over All Universities	334

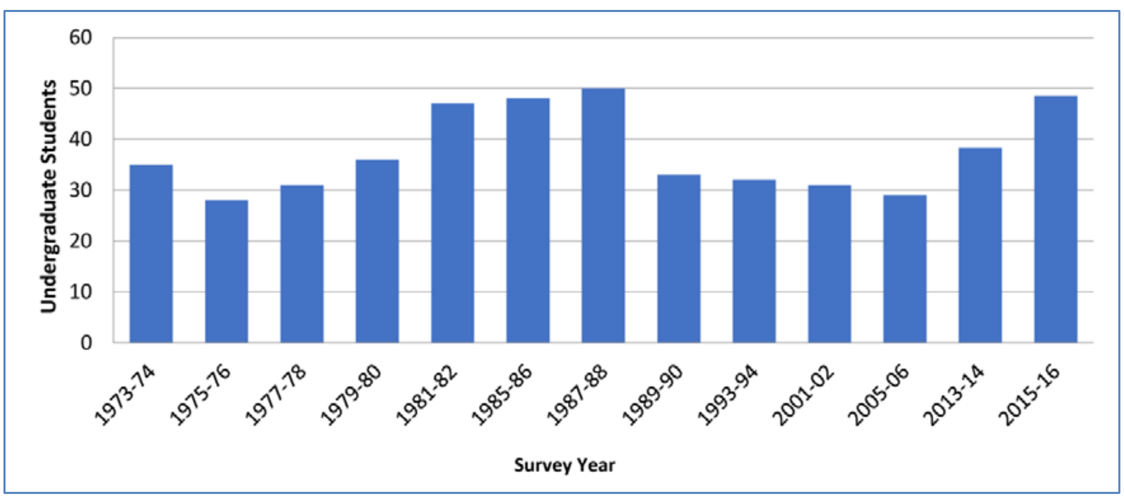

Figure 10. Average Number of Students in Elective Undergraduate Power Classes with Highest Enrollment at Each University

The size and course titles of the 14 largest classes reported in the 2015-16 survey are given in Table 28.

- There were on common electrical engineering topics (power/electric circuits, electromechanics, machines, basic electronics and electric power).
- Four were on (electric) energy systems.
- Three were on green or sustainable energy, or energy and society.
- Three were on power engineering or power systems.

Of course, based on the survey responses alone, it is not possible to characterize the high enrollment courses in any more detail than what is suggested by the course titles. Beyond the basic courses, it is interesting to see the student interest in broader technological and policy areas, such as renewable energy. Eight of the 14 classes were mandatory.

Table 28. Largest Undergraduate Classes

University	Course Title	Class Size
University of Illinois at Urbana-Champaign	Power Circuits and Electromechanics (elective)	334
Georgia Institute of Technology	Electric Energy Systems (mandatory)	250
Purdue University, West Lafayette	Electromechanics (elective)	250
University of Arkansas	Electric Circuits and Machines (elective)	223
University of Saskatchewan	Basic Electronics & Electric Power (mandatory)	211
University of Illinois at Urbana-Champaign	Green Electric Energy (elective)	181
Ohio State University	Sustainable Energy and Power Systems I (mandatory)	180
University of California, Berkeley	Energy and Society (elective)	180
University of Calgary	Energy Systems (mandatory)	170
Arizona State University	Energy Systems and Power Electronics (mandatory)	160
McGill University	Power Engineering (mandatory)	150
University of Toronto	Fundamentals of Electrical Energy Systems (elective)	150
University of Alberta	Introduction of Power Engineering (mandatory)	120
University of Waterloo	Power Systems and Components (mandatory)	120

Details about all 749 undergraduate and 809 graduate course topics are not available in the survey responses. Some insights into the focus of the courses can be found by examining word counts for selected keywords and their derivatives. For instance, a search for "Communication" would include counts of "Communications." The results of this analysis are given in Table 29. For the selected keywords, "power system" is not surprisingly the most common. Words associated with broader concepts in today's electric power industry, such as "smart" from smart grid or "policy", are much less frequently observed. However, it may well be that such topics are taught as part of fundamental power engineering courses.

Table 29. Course Topics Based on Occurrence of Selected Keywords in 749 Undergraduate and 809 Graduate Course Titles

Keyword	Number of Undergraduate Course Title Occurrences	Number of Graduate Course Title Occurrences
Communication	2	7
Distributed	4	14
Economic	5	15
Electronic	130	102
Energy System	56	39
Machine	52	44
Policy	1	1
Power System	217	271
Renewable	23	22
Smart	21	36
Solar	6	7
Storage	3	5
Sustainable	14	14
Vehicle	9	6
Wind	4	14

VIII. Perspectives on Why Student Enrollments Increased Over The Last Ten Years

The Survey Team contacted a few of the universities with the highest student counts and asked them why their programs had grown so much over the last ten to fifteen years. Most of the responses pertained to graduate students, but some to undergraduate students as well.

University 1

- The online and full-time Master of Engineering programs are a good part of the reason.
- More successful research grants/contracts by the faculty. Most of the faculty are IEEE Fellows.

University 2

- Increased funding of research projects by industry (especially through an Industry/University Cooperative Research Center), other National Science Foundation efforts, and US Department of Energy. This stimulus came from, in part, new faculty hires into the program bringing expertise, energy and willingness to compete in large research efforts. Also, generous support of educational efforts by local industry in the form of equipment and other assets.
- A significant international growth in technologies that relate to wind and solar energy resources. This encourages students to work in this field, and it provides new problem areas for faculty research.
- Commitment by university and departmental administration (e.g., energetic hiring in the power area with a firm commitment to the area, naming power/energy as a targeted priority area campus-wide).
- Considerable growth of online educational programs in power engineering.
- Better inclusion of relatively new topic areas into the educational and research programs (e.g., power electronics, power markets). This was largely done by new faculty hires in these areas.
- Significant growth of a diversified job market in power engineering, substantially expanding traditional employers (e.g., software developers, employers that focus on renewable resources, the Independent System Operators, electronics manufacturers)
- Publicity and professional society activities by our faculty, and holding professional society meetings on campus.
- Stimulus in the undergraduate educational program (e.g., revision of traditional undergraduate courses, funds for students to participate in conferences, capstone design projects in power engineering, IEEE PES scholarship money).

University 3

- Increased level of research funding by involved faculty and the building of research facilities such as a smart grid testbed and solar facilities
- The leadership and record of the involved faculty
- The international programs and collaborative agreements with several countries
- The graduate school and the scholarship support provided to students.

IX. CONCLUSIONS

This report provides information on education resources in the US and Canada for the 2015-16 academic year. It shows that there have been demonstrable changes in power engineering education over the last ten years, including:

- Substantial growth in student enrollments and graduations, particularly by international students in graduate programs
- Growth in the number of faculty in all ranks, but particularly tenure-track assistant professors
- Expanded use of adjunct professors and lecturer/instructors who were likely needed to meet the new instructional needs brought about by more students and by technological changes in the industry
- Strong growth in research funding by government, funding by utilities that has more than kept pace with inflation, and continuation of a longer-term trend of increased funding by non-utility domestic industries that are playing a greater role in today's diversified electric power industry
- Use of distance education that expands the ways that education is delivered
- Diversification of the engineering curriculum into non-traditional topics, such as sustainable energy.

The survey results suggest that three key challenges in university power engineering education are:

- Maintaining sufficient research funding needed to sustain innovation to advance electric power and energy technologies, and to support young faculty members who will eventually replace retiring faculty
- Motivating domestic students to pursue graduate degrees with a focus on power engineering
- Evolving curricula to address the challenges and changes facing the evolving electric power industry.

The IEEE, the Power & Energy Society, and the Power & Energy Education Committee do not intend to communicate any value judgment as to the quality of any program included in the report. The Survey Team feels that, although data is part of making value judgments, other factors not reducible to metrics are vital considerations in evaluating electric power engineering programs.

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APPENDIX

Appendix Table 1. Universities Responding to the 2015-2016 PEEC Survey

University	State/Province	Country	Survey Contact	College/School	Lead Department	Research Centers
Arizona State University	Arizona	US	Gerald Heydt	Engineering	Electrical, Computer and Energy Engineering	Quantum Energies and Sustainable Solar Technologies (QESST), Future Renewable Electric Energy Distribution Management Center (FREEDM), Power Systems Engineering Research Center, Power America
Auburn University	Alabama	US	Mark Nelms	Samuel Ginn College of Engineering	Electrical & Computer Engineering	
Baylor University	Texas	US	Kwang Lee	School of Engineering and Computer Science	Electrical and Computer Engineering	Renewable Energy Lab, Power and Energy Systems Lab
Boise State University	Idaho	US	Said Ahmed-Zaid	College of Engineering	Electrical and Computer Engineering	
Buffalo State - State University of New York	New York	US	Ilya Grinberg	Engineering Technology	Engineering Technology	
California Polytechnic State University, San Luis Obispo	California	US	Taufik Taufik	College of Engineering	Electrical Engineering	Electric Power Institute
California State University, Fresno	California	US	Nagy Bengiamin	Lyles College of Engineering	Electrical and Computer Engineering	
California State University, Northridge	California	US	Bruno Osorno	College of Engineering and Computer Science	Electrical and Computer Engineering	
California State University, Sacramento	California	US	Mahyar Zarghami	College of Engineering and Computer Science	Electrical and Electronic Engineering	
Carnegie Mellon University	Pennsylvania	US	Marija Ilic	College of Engineering	Electrical and Computer Engineering	Electric Energy Systems Group, Carnegie Mellon Electricity Industry Center, Power Systems Engineering Research Center,
Case Western Reserve University	Ohio	US	Mingguo Hong	Case School of Engineering	Electrical Engineering and Computer Science	Great Lake Energy Institue
Clarkson University	New York	US	Thomas Ortmeyer	Coulter School of Engineering	Electrical and Computer Engineering	
Clemson University	South Carolina	US	Keith Corzine	College of Engineering, Computing and Applied Sciences	Electrical and Computer Engineering	Real-Time Power and Intelligent Systems Laboratory, Power and Energy Systems Focus Area, Clemson University Electrical Power Research Association (CUEPRA)
Cleveland State University	Ohio	US	Hongxing Ye	Washkewicz College of Engineering	Electrical and Computer Engineering	
Colorado School of Mines	Colorado	US	Salman Mohagheghi	College of Engineering and Computational Sciences	Electrical Engineering and Computer Science	Power Systems Engineering Research Center
Colorado State University	Colorado	US	Siddharth Suryanarayanan	Walter Scott, Jr. College of Engineering	Electrical and Computer Engineering	Advanced Power Engineering Laboratory (APEL), Energy Institute
Concordia University	Quebec	Canada	Pragasen Pillay	Faculty of Engineering & Computer Science	Electrical and Computer Engineering	
Cornell University	New York	US	Eilyan Bitar	College of Engineering	School of Electrical and Computer Engineering	David R. Atkinson Center for a Sustainable Future (ACSF), Power Systems Engineering Research Center (PSERC)
Drexel University	Pennsylvania	US	Dagmar Niebur	College of Engineering	Electrical and Computer Engineering	Institute for Energy and the Environment, Center for Electric Power Engineering
FAMU-FSU College of Engineering	Florida	US	Omar Faruque	College of Engineering	Electrical and Computer Engineering	Center for Advanced Power Systems
Florida International University	Florida	US	Osama Mohammed	College of Engineering and Computing	Electrical and Computer Engineering	Energy Systems Research Laboratory
Gannon University	Pennsylvania	US	Lin Zhao	College of Engineering and Business	Electrical and Computer Engineering	
Georgia Institute of Technology	Georgia	US	Ronald Harley	College of Engineering	School of Electrical and Computer Engineering	
Gonzaga University	Washington	US	Peter McKenny	School of Engineering and Applied Science	Electrical and Computer Engineering	Transmission and Distribution Program
Howard University	District of Columbia	US	James Momoh	College of Engineering, Architecture, and Computer Sciences	Electrical and Computer Engineering	Center for Energy Systems and Control (CESaC), Power Systems Engineering Research Center
Illinois Institute of Technology	Illinois	US	Zuyi Li	Armour College of Engineering	Electrical and Computer Engineering	Robert W. Galvin Center for Electricity Innovation
Indiana University - Purdue University Indianapolis	Indiana	US	Steven Rovnyak	School of Engineering and Technology	Electrical and Computer Engineering	Richard G. Lugar Center for Renewable Energy
Iowa State University	Iowa	US	Venkataramana Ajjarapu	College of Engineering	Elelctrical and Computer Engineering	Power Systems Engineering Research Center, Electric Power Research Center
John Brown University	Arkansas	US	Ted Song	John Brown University	Engineering	
Kansas State University	Kansas	US	Anil Pahwa	College of Engineering	Electrical and Computer Engineering	Electric Power Affiliate Program
Kennesaw State University	Georgia	US	Bill Diong	College of Engineering and Engineering Technology	Electrical Engineering	Alternative Energy Innovation Center
Lake Superior State University	Michigan	US	Paul Weber	School of Engineering & Technology	Electrical and Computer Engineering	
Lamar University	Texas	US	Reza barzegaran	College of Engineering	Electrical Engineering	Lamar Renewable Energy Microgrid Laboratory
Lawrence Technological University	Michigan	US	Richard Johnston	College of Engineering	Electrical and Computer Engineering	
Louisiana State University and A&M College	Louisiana	US	Amin Kargarian	College of Engineering	Electrical and Computer Engineering	Center of Energy Studies, Electric Power And Energy Group (EPEG)
Marquette University	Wisconsin	US	Edwin Yaz	College of Engineering	Electrical and Computer Engineering	

University	State/Province	Country	Survey Contact	College/School	Lead Department	Research Centers
Massachusetts Institute of Technology	Massachusetts	US	David Perreault	School of Engineering	Electrical Engineering and Computer Science	MIT Energy Initiative, MIT Microsystems Technology Laboratories, MIT Laboratory for Electromagnetic and Electronic Systems, MIT Power Electronics Research Group, MIT Research Laboratory of Electronics
McGill University	Quebec	Canada	Francois Bouffard	Faculty of Engineering	Electrical and Computer Engineering	Institute of Electric Power Engineering
Memorial University of Newfoundland	Newfoundland and Labrador	Canada	Benjamin Jeyasurya	Faculty of Engineering and Applied Science	Electrical and Computer Engineering	
Miami University	Ohio	US	Mark Scott	College of Engineering and Computing	Electrical and Computer Engineering	Miami University's Power and Energy Research Laboratory
Michigan State University	Michigan	US	Joydeep Mitra	College of Engineering	Electrical and Computer Engineering	
Michigan Technological University	Michigan	US	Leonard Bohmann	College of Engineering	Electrical Engineering	Center for Agile and Interconnected Microgrids (AIM), Power and Energy Research Center (PERC)
Minnesota State University, Mankato	Minnesota	US	Vincent Winstead	College of Science, Engineering & Technology	Electrical and Computer Engineering and Technology	
Mississippi State University	Mississippi	US	Yong Fu	Bagley College of Engineering	Electrical and Computer Engineering	Institute of Clean Energy Technology
Missouri University of Science and Technology	Missouri	US	Mehdi Ferdowsi	Engineering	Electrical and Computer Engineering	
Montana State University, Bozeman	Montana	US	Hashem Nehrir	Engineering	Electrical and Computer Engineering	
New Jersey Institute of Technology	New Jersey	US	Mengchuu Zhou	Newark College of Engineering	Electrical and Computer Engineering	
New Mexico State University	New Mexico	US	Sukumar Brahma	College of Engineering	Klipsch School of Electrical Computer Engineering	Electric Utility Management Program, CREST Interdisciplinary Center of Research Excellence in Design of Intelligent Technologies for Smart Grids (iCREDITS)
New York University Polytechnic School of Engineering	New York	US	Francisco De Leon	Tandon School of Engineering	Electrical and Computer Engineering	
North Carolina State University at Raleigh	North Carolina	US	Mesut Baran	College of Engineering	Electrical and Computer Engineering	CAPER (Center for Advanced Power Engineering Research), FREEDM (Future Renewable Electric Energy Delivery and Management) Systems Center
North Dakota State University	North Dakota	US	Rajesh Kavasseri	College of Engineering	Electrical and Computer Engineering	
Northeastern University	Massachusetts	US	Ali Abur	College of Engineering	Electrical and Computer Engineering	CURENT ERC Partner School
Northern Arizona University	Arizona	US	Venkata Yaramasu	College of Engineering, Forestry, and Natural Sciences	School of Informatics, Computing, and Cyber Systems	
Ohio Northern University	Ohio	US	Srinivasa Vemuru	College of Engineering	Electical and Computer Engineering and Computer Science	
Ohio State University	Ohio	US	Jin Wang	College of Engineering	Electrical and Computer Engineering	Center for High Performance Power Electronics
Oklahoma State University	Oklahoma	US	Rama Ramakumar	College of Engineering Architecture and Technology	School of Electrical and Computer Engineering	Engineering Energy Laboratory
Old Dominion University	Virginia	US	Yucheng Zhang	Batten College of Engineering & Technology	Electrical and Computer Engineering	Power Research Lab
Oregon State University	Oregon	US	Eduardo Cotilla-Sanchez	College of Engineering	Electrical Engineering and Computer Science	Cyber Resilient Energy Delivery Consortium, Northwest National Marine Renewable Energy Center
Pennsylvania State University, Harrisburg	Pennsylvania	US	Peter Idowu	School of Science, Engineering and Technology	Electrical Engineering	PPL Electric Utilities Power Laboratory
Portland State University	Oregon	US	Robert Bass	Maseeh College of Engineering & Computer Science	Electrical & Computer Engineering	
Purdue University Northwest	Indiana	US	Constantin Apostoaia	College of Engineering and Sciences	Electrical and Computer Engineering	Power and Energy Systems
Purdue University, West Lafayette	Indiana	US	Dionysios Aliprantis	College of Engineering	School of Electrical and Computer Engineering	
Rensselaer Polytechnic Institute	New York	US	Joe Chow	School of Engineering	Electrical, Computer, and Systems Engineering	New York State Center of Future Energy Systems, NSF/DOE CURENT Engineering Research Center
Ryerson University	Ontario	Canada	Amirnaser Yazdani	Faculty of Engineering and Architectural Science	Electrical and Computer Engineering	Centre for Urban Energy (CUE)
San Jose State University	California	US	Ping Hsu	College of Engineering	Electrical Engineering	
Santa Clara University	California	US	Maryam Khanbaghi	School of Engineering	Electrical Engineering	Sustainable Energy Program
Seattle University	Washington	US	Henry Louie	Science and Engineering	Electrical and Computer Engineering	
South Dakota School of Mines and Technology	South Dakota	US	Scott Rausch	South Dakota School of Mines & Technology	Electrical & Computer Engineering	
South Dakota State University	South Dakota	US	Reinaldo Tonkoski	Engineering	Electrical Engineering and Computer Science	Center for Power Systems Studies
Suffolk University	Massachusetts	US	Lisa Shatz	School of Arts and Science	Engineering	Technology and Science Initiative
Syracuse University	New York	US	Prasanta Ghosh	College of Engineering and Computer Science	Electrical Engineering and Computer Science	
Temple University	Pennsylvania	US	Saroj Biswas	College of Engineering	Electrical and Computer Engineering	
Tennessee State University	Tennessee	US	Satinderpaul Devgan	College of Engineering	Electrical and Computer Engineering	Master of Engineering with emphasis in Electrical Power Systems
Texas A&M University	Texas	US	Hamid Toliyat	Engineering	Electrical and Computer Engineering	Smart Grid Center, Power Systems Engineering Research Center

University	State/Province	Country	Survey Contact	College/School	Lead Department	Research Centers
Texas Tech University	Texas	US	Michael Giesselmann	Edward E. Whitacre College of Engineering	Electrical and Computer Engineering	
Tufts University	Massachusetts	US	Alex Stankovic	College of Engineering	Electrical and Computer Engineering	
United States Military Academy	New York	US	Aaron St. Leger	United States Military Academy	Electrical Engineering and Computer Science	
University of Alabama at Birmingham	Alabama	US	David Green	School of Engineering	Electrical and Computer Engineering	
University of Alaska Fairbanks	Alaska	US	Richard Wies	College of Engineering and Mines	Electrical and Computer Engineering	Institute of Northern Engineering, Alaska Center for Energy and Power
University of Alberta	Alberta	Canada	Venkata Dinavahi	Faculty of Engineering	Electrical and Computer Engineering	
University of Arkansas	Arkansas	US	Yue Zhao	College of Engineering	Electrical Engineering	Cybersecurity Center for Secure Evolvable Energy Delivery Systems, Power Optimization of Electro-Thermal Systems, National Center for Reliable Electric Power Transmission, High Density Electronics Center, Vertically Integrated Center for Transformative Energy Research, Center for Grid Connected Advanced Power Electronics
University of Calgary	Alberta	Canada	Majid Pahlevani	Schulich School of Engineering	Electrical and Computer Engineering	Cpower Lab (Calgary Power Electronic Lab)
University of California, Berkeley	California	US	Josephine Williamson	College of Engineering	Electrical Engineering and Computer Sciences	SinBerBEST, Department of Nuclear Engineering, Energy Biosciences Institute, Center for Information Technology Research in the Interest of Society, Center for Research in Energy Systems Transformation, Energy and Resources Group, Power Systems Engineering Research Center
University of California, Los Angeles	California	US	Rajit Gadh	Henry Samueli School of Engineering and Applied Science	Mechanical and Aerospace Engineering	
University of Central Florida	Florida	US	Zhihua Qu	Engineering and Computer Science	Electrical and Computer Engineering	FEEDER center
University of Denver	Colorado	US	David Gao	Ritchie School of Engineering and Computer Science	Electrical and Computer Engineering	
University of Houston	Texas	US	Masoud Barati	Cullen College of Engineering	Electrical and Computer Engineering	Electric Power Analytics Consortium
University of Idaho	Idaho	US	Brian Johnson	College of Engineering	Electrical and Computer Engineering	
University of Illinois at Urbana-Champaign	Illinois	US	Peter Sauer	College of Engineering	Electrical and Computer Engineering	Power Affiliates Program, Grainger Center for Electric Machinery and Electromechanics (CEME), Power Systems Engineering Research Center (PSERC)
University of Kentucky	Kentucky	US	Yuan Liao	College of Engineering	Electrical and Computer Engineering	Power and Energy Institute of Kentucky
University of Maine	Maine	US	Paul Villeneuve	College of Engineering	School of Engineering Technology / Electrical and Computer Engineering	
University of Maryland College Park	Maryland	US	Alireza Khaligh	A. James Clark School of Engineering	Electrical and Computer Engineering	
University of Memphis	Tennessee	US	Mohd Hasan Ali	College of Engineering	Electrical and Computer Enginnering	
University of Michigan – Dearborn	Michigan	US	Wencong Su	College of Engineering and Computer Science	Electrical and Computer Engineering	The Institute for Advanced Vehicle Systems (IAVS), DTE Power Electronics and Electric Drive Laboratory, DOE GATE Center for Electric Drive Transportation, Smart Grid Laboratory
University of Michigan, Ann Arbor	Michigan	US	Ian Hiskens	College of Engineering	Electrical Engineering and Computer Science	Michigan Power and Energy Laboratory
University of Minnesota -Twin Cities	Minnesota	US	Ned Mohan	College of Science and Engineering	Electrical and Computer Engineering	
University of Missouri – Columbia	Missouri	US	Gayla Neumeyer	College of Engineering	Electrical and Computer Engineering	Energy Systems & Resources Program (ESRP), Power Electronics Research Center (PERC)
University of Missouri - Kansas City	Missouri	US	Kevin Kirkpatrick	School of Computing and Engineering	Computer Science Electrical Engineering	Missouri Center for Advanced Power (MCAP) Lab
University of Nebraska – Lincoln	Nebraska	US	Sohrab Asgarpoor	College of Engineering	Electrical and Computer Engineering	Power and Energy Systems Laboratory
University of Nevada, Reno	Nevada	US	Hanif Livani	College of Engineering	Electrical and Biomedical Engineering	Electric Drives Laboratory, Electrical Power and Renewable Energy System Research Laboratory
University of New Haven	Connecticut	US	Junhui Zhao	Tagliatela College of Engineering	Electrical and Computer Engineering and Computer Science	
University of North Carolina at Charlotte	North Carolina	US	Badrul Chowdhury	William States Lee College of Engineering	Electrical & Computer Engineering	The Center on Grid Engineering Education, Energy Production & Infrastructure Center (EPIC)
University of North Dakota	North Dakota	US	Hossein Salehfar	College of Engineering and Mines	Electrical Engineering	Renewable Hydrogen H2Power Laboratory, Secure Cyber Physical Systems and Data Sciences Lab, Renewable Energy Systems Laboratory at University of North Dakota
University of Oklahoma	Oklahoma	US	John Jiang	Gallogly College of Engineering	Electrical & Computer Engineering	
University of Pittsburgh	Pennsylvania	US	Gregory Reed	Swanson School of Engineering	Electrical and Computer Engineering	Center for Energy, Energy GRID Institute, Electric Power Power Systems Lab
University of Saskatchewan	Saskatchewan	Canada	Ramakrishna (Rama) Gokaraju	College of Engineering	Electrical & Computer Engineering	

University	State/Province	Country	Survey Contact	College/School	Lead Department	Research Centers
University of South Carolina	South Carolina	US	Roger Dougal	College of Engineering and Computing	Electrical Engineering	NSF I/UCRC for Grid-connected Advanced Power Electronic Systems
University of South Florida	Florida	US	Lingling Fan	College of Engineering	Electrical Engineering	
University of Southern Maine	Maine	US	Carlos Luck	College of Science, Technology, and Health	Engineering	
University of St. Thomas	Minnesota	US	Prof. Greg Mowry	School of Engineering	School of Engineering	REAL; the Renewable Energy and Alternatives Laboratory
University of Tennessee, Chattanooga	Tennessee	US	N Sisworahardjo	College of Engineering & Computer Science	Electrical Engineering	
University of Tennessee, Knoxville	Tennessee	US	Hector Pulgar	College of Engineering	Electrical Engineering and Computer Science	Oak Ridge National Laboratory, Graduate Wide Bandgap Traineeship, Center for ultra-wide area resilient electric energy transmission networks
University of Texas at Arlington	Texas	US	Ali Davoudi	College of Engineering	Electrical Engineering	
University of Texas at Austin	Texas	US	Ross Baldick	Cockrell School of Engineering	Electrical and Computer Engineering	Center for Electromechanics
University of Texas at El Paso	Texas	US	Paras Mandal	College of Engineering	Electrical and Computer Engineering	
University of Texas at San Antonio	Texas	US	Hariharan Krishnaswami	College of Engineering	Electrical and Computer Engineering	Texas Sustainable Energy Research Institute
University of the Pacific	California	US	Cherian Mathews	School of Engineering and Computer Science	Electrical and Computer Engineering	
University of Toronto	Ontario	Canada	Zeb Tate	Faculty of Applied Science & Engineering	Electrical and Computer Engineering	
University of Utah	Utah	US	Masood Parvania	College of Engineering	Electrical and Computer Engineering	U-Smart (Utah Smart Energy Lab)
University of Vermont	Vermont	US	Paul Hines	College of Engineering and Mathematical Sciences	Electrical and Biomedical Engineering	The Energy Systems Laboratory in Vermont (TESLa-VT), UVM Smart Grid IGERT program
University of Washington	Washington	US	Daniel Kirschen	College of Engineering	Electrical Engineering	Electric Energy Industrial Consortium
University of Waterloo	Ontario	Canada	Claudio Canizares	Faculty of Engineering	Electrical and Computer Engineering	Waterloo Institue for Sustainable Energy (WISE)
University of West Florida	Florida	US	Bhuvana Ramachandran	College of Science and Engineering	Engineering	
University of Western Ontario	Ontario	Canada	Rajiv Varma	Faculty of Engineering	Electrical and Computer Engineering	
University of Wisconsin - Madison	Wisconsin	US	Christopher DeMarco	College of Engineering	Electrical and Computer Engineering	Wisconsin Public Utilities Institute, Wisconsin Energy Institute, Wisconsin Electric Machines and Power Electronics Consortium, Power Systems Engineering Research Center
University of Wisconsin - Milwaukee	Wisconsin	US	Robert Cuzner	College of Engineering and Applied Science	Electrical Engineering and Computer Science	Center for Sustainable Electrical Energy Systems
University of Wisconsin - Platteville	Wisconsin	US	Gholamreza Dehnavi	College of Engineering, Mathematics and Science	Electrical Engineering	
University of Wyoming	Wyoming	US	John Pierre	College of Engineering and Applied Sciences	Electrical and Computer Engineering	
Valparaiso University	Indiana	US	Doug Tougaw	College of Engineering	Electrical and Computer Engineering	
Virginia Polytechnic Institute and State University	Virginia	US	Virgilio Centeno	College of Engineering	Electrical and Computer Engineering	VT Advanced Research Institute, Future Energy Electronics Center, Center for Power Electronics, Center for Power and Energy
Washington State University	Washington	US	Jody Opheim	Voiland College of Engineering and Architecture	School of Electrical Engineering and Computer Science	Energy Systems Innovation Center, Power Systems Engineering Research Center
Wayne State University	Michigan	US	Caisheng Wang	College of Engineering	Electrical and Computer Engineering	
West Virginia University	West Virginia	US	Muhammad Choudhry	Statler College of Engineering and Mineral Resources	Lane Computer Science and Electrical Engineering	Advanced Power and Electricity Research Center
West Virginia University Institute of Technology	West Virginia	US	Kenan Hatipoglu	Leonard C. Nelson College of Engineering and Sciences	Electrical and Computer Engineering	
Western Carolina University	North Carolina	US	Hayrettin Karayaka	College of Engineering and Technology	School of Engineering and Technology	
Wichita State University	Kansas	US	Ward Jewell	College of Engineering	Electrical Engineering and Computer Science	Center for Energy Studies, Power Systems Engineering Research Center
Worcester Polytechnic Institute	Massachusetts	US	John Orr	Worcester Polytechnic Institute	Electrical and Computer Engineering	

Appendix Table 2. Faculty and Staff Engaged in Power Engineering Instruction in 2015-2016

Abbreviations used in Appendix Table 2

Rank
P: Full Professor and Sponsored Power Chair
ACP: Associate Professor
ATP: Assistant Professor
ADJ: Adjunct Professor
EP: Emeritus Professor
L/I: Lecturer/Instructor

Faculty Member's Department
AG: Biosystems and Agricultural Engineering
AEO: Aerospace
BIO: Bio Engineering; Biomedical Engineering
CHE: Chemical Engineering
CHP: Chemistry and Physics
CIV: Civil Engineering; Civil and Environmental Engineering
CS: Computer Science; Infomatics, Computing, and Cyber Systems
ECE: Electrical and Computer Engineering
ECN: Economics; Applied Economics
EE: Electrical Engineering
EEE: Electrical and Electronic Engineering
EECS: Electrical Engineering and Computer Science; Computer Science and Electrical Engineering
ENG: Engineering
ENV: Environmental Engineering; Biological Engineering
EPD: Engineering Professional Development; Continuing Professional Education
EPP: Engineering Public Policy
ERG: Energy; Energy Resources; Electric Energy; Energy Engineering
ET: Engineering Technology; Technology
IE: Industrial Engineering; Industrial and Manufacturing Systems Engineering; Integrated Systems Engineering
ME: Mechanical Engineering
MG: Engineering Management; Management
MNG: Mining Engineering
MTH: Math; Applied Math and Statistics; Scientific Computation
MTL: Materials Engineering; Material Science and Engineering
NUC: Nuclear Engineering
PHL: Philosophy
SYS: Systems Engineering
TD: Transmission and Distribution

Highest Degree
B – Bachelors O – Other
M – Master's – M D – PhD

IEEE Membership
Y – Yes N – No

IEEE Fellow
Y – Yes N – No

Full-Time or Part-Time
F – Full-Time P – Part-Time

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
Arizona State University									
Ayyanar	ACP	ECE,ERG	PhD	Y	N				
Gorur	P	ECE,ERG	PhD	Y	Y				
Hedman	ATP	ECE,ERG	PhD	Y	N				
Heydt	P	ECE,ERG	PhD	Y	Y	F	42	3	0
Holbert	ACP	ECE,ERG	PhD	Y	N				
Karady	P	ECE,ERG	PhD	Y	Y				
Lei	ATP	ECE,ERG	PhD	Y	N	F	1	4	0
Qin	ATP	ECE,ERG	PhD	Y	N	F	1	4	0
Sankar	ATP	ECE,ERG	PhD	N	N				
Tylavsky	ACP	ECE,ERG	PhD	Y	N	F			
Undrill	P	ECE,ERG	PhD	Y	Y				
Vittal	P	ECE,ERG	PhD	Y	Y				
Zhang	P	ECE,ERG	PhD	N	Y				
Auburn University									
Gross	EP	ECE	PhD	Y	Y				
Halpin	P	ECE	PhD	Y	Y				
Nelms	P	ECE	PhD	Y	Y				
Baylor University									
Chiasson	ACP	ECE	PhD	N	Y	F	28	3	4
Grady	P	ECE	PhD	Y	Y				
Lee	P	ECE	PhD	Y	Y				
Boise State University									
Ahmed-Zaid	ACP	ECE	PhD	Y	N	F	29	4	0
Chiasson	ACP	ECE	PhD	N	Y	F	28	3	4
Stubban	ADJ	ECE	PhD	Y	N	P	2	8	16
Buffalo State - State University of New York									
Fiume	L/I	ET	M	N	N	P	3	35	3
Grinberg	P	ET	PhD	Y	N	F	21	20	0
Zahm	L/I	ET	M	N	N	P	1	38	0
California Polytechnic State University, San Luis Obispo									
Ahlgren	ACP	EE	PhD	Y	N	F	17	15	0
Dolan	ACP	EE	PhD	Y	N	F	12	2	0
MacCarley	P	EE	PhD	N	N	F	25	10	0
Nafisi	P	EE	PhD	Y	N	F	35	5	0
Poshtan	L/I	EE	PhD	Y	N	F	15	2	0
Shaban	P	EE	PhD	Y	N	F	34	5	0
Taufik	P	EE	PhD	Y	N	F	17	3	0
California State University, Fresno									
Bengiamin	P	ECE	PhD	N	N	F	36	1	0
Na	ATP	ECE	PhD	Y	N	F	2	2	0
California State University, Northridge									
Osorno	P	ECE	PhD	Y	N				
Sedghisigarchi	ATP	ECE	PhD	Y	N				
California State University, Sacramento									
Belkhouche	ACP	EEE	PhD	N	N	F	11	0	0
Mearns	L/I	EEE	B	N	N	P	3	38	1
Mensah-Bonsu	L/I	EEE	PhD	Y	N	P	7	17	0
Rahimi Ardabily	L/I	EEE	M	N	N	P	2	2	1
Saghaimaroof	L/I	EEE	M	N	N	P	8	20	10
Tatro	L/I	EEE	M	Y	N	P	16	0	24
Toups	ATP	EEE	PhD	Y	N	F	1	1	0
Vaziri	ATP	EEE	PhD	Y	N	F	24	26	0
Yazdani	ATP	EEE	PhD	Y	N	F	2	13	0
Zarghami	ATP	EEE	PhD	Y	N	F	5	13	0
Carnegie Mellon University									
Ilic, J.	ACP	ECE	PhD	Y	N	F	10	2	2
Ilic, M.	P	ECE, EPP	PhD	Y	Y	F	40	0	0
Kar	ATP	ECE	PhD	Y	N	F	5	0	0
Kolter	ATP	CS	PhD	N	N	F	3	0	0
Rowe	ACP	ECE	PhD	Y	N	F	10	0	0
Sinopoli	ACP	ECE	PhD	Y	N	F	10	0	0
Case Western Reserve University									
Hong	ACP	EECS	PhD	Y	N				
Loparo	P	EECS	PhD	Y	Y				
Prica	ATP	EECS	PhD	Y	N				

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
Clarkson University									
Li	ATP	ECE	PhD	Y	N				
McGrath	P	ECE	PhD	Y	N				
Ortmeyer	P	ECE	PhD	Y	Y				
Wu	ATP	ECE	PhD	Y	N				
Clemson University									
Corzine	P	ECE	PhD	Y	N				
Makram	P	ECE	PhD	Y	Y				
Singh	P	ECE	PhD	N	Y				
Venayagamoorthy	P	ECE	PhD	Y	N				
Cleveland State University									
Alexander	P	ECE	PhD	Y	Y				
Morinec	ADJ	EECS	PhD	Y	N	P	2	33	0
Stankovic	P	ECE	PhD	Y	N				
Villaseca	P	ECE	PhD	Y	N				
Ye	ATP	EECS	PhD	Y	N	F	8	0	0
Colorado School of Mines									
Ammerman	L/I	EECS	PhD	Y	N				
Arkadan	P	EECS	PhD	Y	N	F	20	0	0
Mohagheghi	ATP	EECS	PhD	Y	N				
Sen	P	EECS	PhD	Y	Y				
Simoes	ACP	EECS	PhD	Y	N				
Colorado State University									
Collins	P	ECE	PhD	N	Y				
Suryanarayanan	ACP	ECE	PhD	Y	N				
Yang	P	ECE	PhD	N	N				
Young	P	ECE	PhD	N	N				
Zimmerle	ADJ	ERG	M	Y	N	P	8	2	25
Concordia University									
Lopes	ACP	ECE	PhD	N	N	F	20	0	0
Pillay	P	ECE	PhD	Y	Y	F	28	1	0
Rathore	ACP	ECE	PhD	N	N	F	7	0	0
Cornell University									
Anderson	ATP	ENV	PhD	Y	N				
Bitar	ATP	ECE	PhD	Y	N	F	5	0	0
Chiang	P	ECE	PhD	Y	Y				
Cowen	P	CIV,ENV	PhD	N	N	F	19	0	3
Mount	EP	ECN,MG	PhD	Y	N				
Schuler	EP	ECN	PhD	Y	N				
Schulze	P	ECN,MG	PhD	N	N				
Thomas	EP	ECE	PhD	Y	Y	F	40	0	0
Tong	P	ECE	PhD	Y	Y				
Zhang	ACP	ME,AEO	PhD	Y	N				
Drexel University									
Ferrese	ADJ	ECE	PhD	N	N	P	0	12	10
Fischl	EP	ECE	PhD	Y	Y	P	50	0	0
Halpin	ADJ	ECE	PhD	Y	N	P	0	0	36
Liddy	ADJ	ECE	B	Y	N	P	0	23	0
Miu	P	ECE	PhD	Y	N	F	18	0	0
Niebur	ACP	ECE	PhD	Y	N	F	20	0	4
Nwankpa	P	ECE	PhD	Y	Y	F	24	2	0
Scoles	ACP	ECE	PhD	Y	N	F	34	0	0
FAMU-FSU College of Engineering									
Argandeh	ATP	ECE	PhD	Y	N	F	4	2	0
Edrington	P	ECE	PhD	Y	N	F	12	0	4
Faruque	ATP	ECE	PhD	Y	N	F	7	0	3
Li	P	ECE	PhD	Y	N	F	14	0	0
Ordonez	P	ME	PhD	N	N	F	12	0	0
Pamidi	ACP	ECE	PhD	N	N	F	20	0	0
Steurer	P	ECE	PhD	Y	N	F	20	0	0
Florida International University									
Berzoy	L/I	ECE	M	Y	N	P	10	5	5
Dube	ADJ	ECE	M	N	N				
Farah	ADJ	ECE	M	Y	N				
Mohammed	P	ECE	PhD	Y	Y	F	38	5	5
Sarwat	ACP	ECE	PhD	Y	N	F	15	10	5
Youssef	L/I	ECE	M	Y	N	P	10	5	9
Gannon University									
Mak	P	ECE	PhD	N	N				
Zhao	ACP	ECE	PhD	N	N				
Georgia Institute of Technology									
Divan	P	ECE	PhD	Y	Y	F	26	10	0
Graber	ATP	ECE	PhD	Y	N	F	2	5	0
Grijalva	ACP	ECE	PhD	Y	N				
Habetler	P	ECE	PhD	N	Y				
Harley	P	ECE	PhD	Y	Y				

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
Meliopoulos	P	ECE	PhD	Y	Y				
Rincon-Mora	P	ECE	PhD	N	Y				
Rohatgi	P	ECE	PhD	Y	Y				
Saeedifard	ATP	ECE	PhD	Y	N				
Gonzaga University									
Flerchinger	ADJ	TD	M	Y	N				
Gers	ADJ	TD	PhD	Y	N				
Henville	ADJ	TD	M	Y	Y				
McKinstry	ADJ	TD	M	N	N				
McKenny	P	MG	PhD	Y	N				
Miller	ADJ	TD	M	Y	N				
Pacini	ADJ	TD	M	Y	N				
Proteau	ADJ	TD	M	N	N				
Santora	L/I	ECE	PhD	Y	N	F	5	0	5
Schennum	P	ECE	PhD	Y	N	F	30	0	5
Sidhu	P	TD	PhD	Y	Y				
Smith	ADJ	TD	M	N	N				
Yenumula	ADJ	TD	PhD	N	N				
Howard University									
Bofah	P	EE	PhD	Y	Y	F	35	8	0
Kim	P	EE	PhD	Y	N	F	25	5	0
Momoh	P	ECE	PhD	Y	Y	F	33	33	0
Rubaai	P	EE	PhD	Y	Y	F	25	5	0
Illinois Institute of Technology									
Bahramirad	ADJ	ECE	PhD	Y	N	P	0	10	0
Bekiarov	ADJ	ECE	PhD	Y	N				
Bettler	ADJ	ECE	PhD	Y	N				
Brown	ATP	ECE	PhD	Y	N				
Desai	ADJ	ECE	PhD	Y	N				
Flueck	ACP	ECE	PhD	Y	N				
Ganji	ADJ	ECE	PhD	Y	N	P	0	5	0
Krishnamurthy	ACP	ECE	PhD	Y	N				
Li	P	ECE	PhD	Y	N				
Shahidehpour	P	ECE	PhD	Y	Y				
Shanechi	L/I	ECE	PhD	Y	N				
Shen	P	ECE	PhD	Y	Y				
Zhong	P	ECE	PhD	Y	N	F	20	0	0
Indiana University - Purdue University Indianapolis									
Dos Santos	ATP	ECE	PhD	N	N	F	9	0	0
Rovnyak	ACP	ECE	PhD	Y	N				
Iowa State University									
Ajjarapu	P	ECE	PhD	Y	Y	F	31	0	0
Dobson	P	ECE	PhD	Y	Y	F	22	0	5
Govindarasu	P	ECE	PhD	Y	Y	F	17	0	0
Khaitan	ADJ	ECE	PhD	Y	N	F	4	0	0
McCalley	P	ECE	PhD	Y	Y	F	24	5	0
Tesfatsion	P	ECN, MTH,ECE	PhD	Y	N	F	35	0	0
Wang	ACP	IE	PhD	N	N	F	8	0	0
Wang	ATP	ECE	PhD	Y	N	F	1	0	0
Vaidya	ACP	ECE	PhD	N	N	F	10	0	2
John Brown University									
Song	ATP	ENG	PhD	Y	N				
Kansas State University									
Douglas-Miller	ACP	ECE	PhD	Y	N	F	26	0	0
Mirafzal	ACP	ECE	PhD	Y	N	F	8	4	0
Morcos	P	ECE	PhD	Y	N	P	30	0	15
Pahwa	P	ECE	PhD	Y	Y	F	32	3	0
Starrett	ACP	ECE	PhD	Y	N	P	20	0	0
Kennesaw State University									
Diong	ACP	EE	PhD	N	N				
Lake Superior State University									
McDonald	P	ECE	M	N	N	F	43	3	3
Lamar University									
Barzegaran	ATP	EE	PhD	Y	N	F	2	2	0
Baumann	P	ECE	PhD	N	N	F	24	0	1
Moening	ACP	ECE	PhD	Y	N	F	6	0	0
Weber	ACP	ECE	PhD	Y	N	F	10	0	0
Lawrence Technological University									
Johnston	P	ECE	PhD	Y	N				
Louisiana State University and A&M College									
Czarnecki	P	EECS	PhD	N	Y				
Farasat	ATP	EECS	PhD	N	N				
Kargarian	ATP	ECE	PhD	Y	N	F	2	0	0
McAnelly	L/I	EECS	M	N	N				
Mehraeen	ATP	EECS	PhD	N	N				

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
Marquette University									
Demerdash	P	ECE	PhD	Y	Y				
Ionel	ADJ	ECE	PhD	Y	Y				
Weise	ATP	ECE	PhD	Y	N				
Yaz	P	ECE	PhD	Y	N				
Massachusetts Institute of Technology									
Kirtley	P	EECS	PhD	Y	Y	F	40	5	0
Lang	P	EECS	PhD	N	Y	F	35	0	0
Leeb	P	EECS	PhD	Y	Y	F	20	3	3
Perreault	P	EECS	PhD	Y	Y	F	18	1	0
McGill University									
Bouffard	ACP	ECE	PhD	Y	N	F	10	0	1
Joos	P	ECE	PhD	Y	Y	F	38	3	0
Kamwa	ADJ	ECE	PhD	Y	Y	P	0	25	0
Wang	ATP	ECE	PhD	Y	N	F	1	0	0
Memorial University of Newfoundland									
Iqbal	P	EE	PhD	N	N	F	25	5	5
Jeyasurya	P	EE	PhD	Y	N	F	32	2	0
Liang	ATP	EE	PhD	N	N	F	3	0	12
Quaicoe	P	EE	PhD	N	N	F	36	0	1
Rahman	P	EE	PhD	Y	Y	F	50	5	5
Miami University									
Scott	ATP	ECE	PhD	Y	N	F	1	2	0
Ucci	P	ECE	PhD	N	N				
Michigan State University									
Mitra	ACP	ECE	PhD	Y	N	F	16	0	5
Peng	P	ECE	PhD	N	Y	F	18	0	8
Strangas	P	ECE	PhD	Y	N	F	33	1	5
Wang	ATP	ECE	PhD	Y	N	F	8	2	4
Michigan Technological University									
Bohmann	P	ECE	PhD	Y	N	P	27	2	0
Gauchia	ATP	ECE	PhD	Y	N	F	7	0	0
Hassell	L/I	ECE	M	Y	N	P	4	0	8
Lukowski	ACP	ECE	M	Y	N	F	32	0	5
Mork	P	ECE	PhD	Y	N	F	24	5	0
Paudyal	ATP	ECE	PhD	Y	N	F	4	0	0
Pearce	ACP	MTL	PhD	N	N	P	12	0	0
Ten	ACP	ECE	PhD	Y	N	F	7	0	5
Weaver	ACP	ECE	PhD	Y	N	F	9	5	0
Minnesota State University, Mankato									
Winstead	ACP	ECE,ET	PhD	Y	N	F	10	0	0
Zeng	ATP	ECE,ET	PhD	N	N	F	1	1	0
Mississippi State University									
Fu	ACP	ECE	PhD	Y	N	F	10	0	0
Karimi-Ghartemani	ACP	ECE	PhD	Y	N				
Kluss	ATP	ECE	PhD	Y	N	F	5	0	0
Mazzola	P	ECE	PhD	Y	N				
Molen	P	ECE	PhD	Y	N				
Missouri University of Science and Technology									
Crow	P	ECE	PhD	Y	Y				
Ferdowsi	ACP	ECE	PhD	Y	N				
Kimball	ACP	ECE	PhD	Y	N				
Shamsi	ATP	ECE	PhD	Y	N				
Montana State University, Bozeman									
Gao	ACP	ECE	PhD	N	N				
Nehrir	P	ECE	PhD	Y	Y	F	40	1	0
New Jersey Institute of Technology									
Ansari	P	ECE	PhD	N	Y	F	28	0	0
David	ADJ	ECE	PhD	Y	N				
Grebel	P	ECE	PhD	Y	N				
Hubbi	ACP	ECE	PhD	Y	N				
Khreishah	ATP	ECE	PhD	Y	N				
Ko	ATP	ECE	PhD	Y	N	F	2	0	0
Levkov	L/I	ECE	PhD	N	N				
Nguyen	ATP	ECE	PhD	Y	N	F	2	0	0
Rojas-Cessa	ACP	ECE	PhD	Y	N				
Zhou	P	ECE	PhD	Y	Y				
New Mexico State University									
Brahma	ACP	ECE	PhD	Y	N	F	24	2	0
Harrel	ADJ	ECE	PhD	N	N	P	9	5	8
Prasad	ACP	ECE	PhD	N	N	F	30	18	0
Ranade	P	ECE	PhD	Y	N	F	34	2	0
New York University Polytechnic School of Engineering									
Czarkowski	ACP	ECE	PhD	Y	N	F	20	0	1
De Leon	ACP	ECE	PhD	Y	Y	F	22	6	0
Campisi	L/I	ECE	M	N	N	F	10	0	5

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							Academic	Power Industry	Other Industry
Dvorkin	ATP	ECE	PhD	Y	N	F	5	2	1
Zabar	P	ECE	PhD	Y	N	F	43	0	0
North Carolina State University at Raleigh									
Baran	P	ECE	PhD	Y	Y	F	25	2	0
Bhattacharya	P	ECE	PhD	Y	Y	F	15	5	0
Chakrabortty	ATP	ECE	PhD	Y	N	F	14	0	0
Hopkins	P	ECE	PhD	Y	Y	F	30	0	0
Huang	P	ECE	PhD	Y	Y	F	20	0	0
Husain	P	ECE	PhD	Y	Y	F	20	0	0
Lu	ACP	ECE	PhD	Y	N	F	7	7	0
Lubkeman	P	ECE	PhD	Y	Y	F	22	7	0
Lukic	ACP	ECE	PhD	Y	N	F	10	0	0
North Dakota State University									
Chaudhuri	ATP	ECE	PhD	Y	N	F	2	5	0
Kavasseri	ACP	EE	PhD	Y	N	F	14	1	0
Northeastern University									
Abur	P	ECE	PhD	Y	Y	F	31	0	0
Amirabadi	ATP	ECE	PhD	Y	N	F	3	0	0
Lehman	P	ECE	PhD	Y	N	F	24	1	0
Northern Arizona University									
Yaramasu	ATP	CS	PhD	Y	N	F	1	0	0
Ohio Northern University									
Al-Olimat	P	ECE	PhD	Y	N				
Vemuru	P	ECE	PhD	Y	N				
Ohio State University									
Conejo	P	IE	PhD	Y	Y	F	26	0	0
Illindala	ATP	ECE	PhD	Y	N	F	5	8	0
Kasten	EP	ECE	PhD	Y	N	P	40	4	0
Luo	L/I	ECE	PhD	N	N	F	6	1	0
Sebo	EP	ECE	PhD	Y	Y	P	55	4	0
Wang	ACP	ECE	PhD	Y	N	F	9	0	2
Wang	ATP	ECE	PhD	Y	N				
Xu	P	ECE	PhD	Y	Y	F	28	8	0
Oklahoma State University									
Ekneligoda	ATP	ECE	PhD	Y	N	F	4	1	0
Ramakumar	P	ECE	PhD	Y	Y				
Guo	ATP	ECE	PhD	Y	N	F	2	0	0
Old Dominion University									
Isaac	ACP	ET	PhD	Y	N	F	15	17	0
Lakdawala	ACP	ECE	PhD	N	N	F	40	10	0
Moses	ATP	ET	PhD	Y	N	F	2	4	0
Xiao	ACP	ECE	PhD	N	N	F	20	5	0
Zhang	ATP	ECE	PhD	Y	N	F	6	1	0
Oregon State University									
Bobba	ATP	EECS	PhD	Y	N	F	10	0	0
Brekken	ACP	EECS	PhD	Y	N				
Cotilla-Sanchez	ATP	EECS	PhD	Y	N				
Kim	ATP	EECS	PhD	Y	N	F	5	0	0
Von Jouanne	P	EECS	PhD	Y	Y				
Zhang	ATP	EECS	PhD	Y	N				
Pennsylvania State University, Harrisburg									
Idowu	P	EE	PhD	Y	N				
Khazaei	ATP	EE	PhD	Y	N	F	2	2	0
Tonningen	L/I	EE	PhD	N	N	F	30	0	2
Portland State University									
Bass	ACP	ECE	PhD	Y	N	F	12	0	0
Bird	ACP	ECE	PhD	Y	N	F	7	2	0
Purdue University Northwest									
Apostoaia	ACP	ECE	PhD	Y	N	F	35	0	3
Kozel	P	ECE	PhD	Y	N	F	27	0	0
Kramer	P	CHP	PhD	N	N	F	10	30	0
Xu	ATP	ECE	PhD	Y	N	F	2	0	0
Purdue University, West Lafayette									
Aliprantis	ACP	ECE	PhD	Y	N	F	10	0	1
Liu	ACP	IE	PhD	N	N	F	6	4	0
Ong	P	ECE	PhD	Y	Y	F	45	1	0
Pekarek	P	ECE	PhD	Y	Y	F	20	0	0
Sudhoff	P	ECE	PhD	Y	Y	F	25	0	0
Wasynczuk	P	ECE	PhD	Y	Y	F	36	0	0
Rensselaer Polytechnic Institute									
Chow	P	ECE,SYS	PhD	Y	Y	F	30	9	0
Parsa	ACP	ECE,SYS	PhD	Y	N	F	12	0	0
Sun	P	ECE,SYS	PhD	Y	Y	F	16	6	0
Wang	ATP	ECS,SYS	PhD	Y	N	F	4	0	0

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							Academic	Power Industry	Other Industry
Ryerson University									
Cheung	P	ECE	PhD	N	N	F	27	3	0
Karim	P	ECE	PhD	Y	N	F	40	6	0
Venkatesh	P	ECE	PhD	Y	N	F	22	1	0
Wu	P	ECE	PhD	Y	Y	F	30	1	0
Xu	P	ECE	PhD	N	N	F	15	4	0
Yazdani	ACP	ECE	PhD	Y	N	F	10	7	0
San Jose State University									
Badawy	ATP	EE	PhD	Y	N	F	1	0	0
Hsu	P	EE	PhD	Y	N				
Reischl	P	EE	PhD	Y	N				
Santa Clara University									
Baratta	ADJ	EE	M	N	N	P	15	0	40
Edris	ADJ	EE	PhD	Y	Y	P	0	30	5
Ghadiri	ADJ	EE	Law	N	N	P	3	0	6
Ghosh	ADJ	EE	PhD	Y	N	P	2	5	15
Healy	P	EE	PhD	Y	N	F	50	0	0
Khanbaghi	ATP	EE	PhD	Y	N	F	5	0	15
Krishnan	P	EE	PhD	Y	N	F	15	0	5
McElfresh	ADJ	EE	PhD	N	N	P	20	5	10
Mobed-Miremadi	L/I	BIO	PhD	N	N	F	8	0	11
Mourad	P	EE	PhD	Y	Y	F	40	0	0
Vallor	P	PHL	PhD	N	N	F	15	0	0
Seattle University									
Louie	ATP	ECE	PhD	Y	N	F	8	3	1
South Dakota School of Mines and Technology									
Baghsorkhi	ADJ	ECE	PhD	Y	N	P	1	3	0
Rausch	ADJ	ECE	B	Y	N	F	9	0	30
South Dakota State University									
Galipeau	EP	EECS	PhD	N	N	P	25	5	0
Hansen	ATP	EECS	PhD	Y	N	F	1	1	0
Hietpas	P	EECS	PhD	Y	N				
Tonkoski	ATP	EECS	PhD	Y	N	F	4	1	0
Ni	ATP	EECS	PhD	Y	N	F	1	0	0
Suffolk University									
Christensen	ACP	ENG	PhD	Y	N	F	20	0	4
Shatz	P	ENG	PhD	Y	N	F	22	0	2
Syracuse University									
Bujanovic	ACP	EECS	PhD	N	N				
Eftekharnejad	ATP	EECS	PhD	Y	N	F	2	2	0
Ghosh	P	EECS	PhD	N	N				
Temple University									
Biswas	P	ECE	PhD	Y	N	F	30	0	0
Tennessee State University									
Devgan	P	ECE	PhD	Y	N				
Marpaka	ACP	ECE	PhD	N	N				
Texas A&M University									
Balog	ACP	ECE	PhD	Y	N	F	7	0	6
Begovic	P	ECE	PhD	Y	Y	F	30	0	0
Butler-Purry	P	ECE	PhD	Y	N	F	22	0	2
Ehsani	P	ECE	PhD	Y	Y	F	36	0	4
Enjeti	P	ECE	PhD	Y	Y				
Huang	P	ECE	PhD	Y	N				
Kezunovic	P	ECE	PhD	Y	Y	F	30	15	0
Singh	P	ECE	PhD	Y	Y				
Toliyat	P	ECE	PhD	Y	Y	F	25	3	1
Xie	ACP	ECE	PhD	Y	N	F	7	1	0
Texas Tech University									
Bayne	P	ECE	PhD	N	N	F	8	0	0
Dickens	P	ECE	PhD	N	N	F	21	0	0
Giesselmann	P	ECE	PhD	Y	N	F	30	0	0
He	ATP	ECE	PhD	Y	N	F	3	0	0
Neuber	P	ECE	PhD	N	Y	F	20	0	0
Tufts University									
Stankovic	P	ECE	PhD	Y	Y				
United States Military Academy									
Barry	L/I	EECS	M	Y	N	F	1	0	7
St. Leger	ACP	EECS	PhD	Y	N	F	8	3	1
Spruce	L/I	EECS	M	Y	N	F	3	0	8
University of Alabama at Birmingham									
Franklin	ACP	ECE	PhD	Y	N	F	9	9	0
Haider	ATP	ECE	PhD	N	N	F	6	0	1
Olson	ADJ	ECE	M	N	N	P	1	16	5
Shih-Min	ADJ	ECE	PhD	Y	N	P	1	19	0
University of Alaska Fairbanks									
Bogosyan	P	ECE	PhD	Y	N				

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
Wies	ACP	ECE	PhD	Y	N	F	17	0	0
University of Alberta									
Dinavahi	P	ECE	PhD	Y	N				
Khajehoddin	ATP	ECE	PhD	Y	N				
Kish	ATP	ECE	PhD	Y	N	F	1	3	0
Li	P	ECE	PhD	Y	N	F	12	1	0
Liang	ATP	ECE	PhD	Y	N	F	3	0	0
Mohamed	ACP	ECE	PhD	Y	N				
Pirooz Azad	ATP	ECE	PhD	Y	N	F	2	0	0
Salmon	P	ECE	PhD	Y	N				
Xu	P	ECE	PhD	Y	Y				
University of Arkansas									
Ang	P	EE	PhD	N	Y	F	28	8	0
Balda	P	EE	PhD	Y	N	F	30	0	0
Mantooth	P	EE	PhD	Y	Y	F	18	8	0
McCann	P	EE	PhD	Y	N	F	10	0	15
Zhao	ATP	EE	PhD	N	N	F	2	1	0
University of Calgary									
Jazayeri	ATP	EE	M	Y	N				
Knight	P	ECE	PhD	Y	N				
Nowicki	ACP	ECE	PhD	N	N				
Pahlevani	ATP	ECE	PhD	Y	N	F	5	14	0
Rosehart	P	ECE	PhD	Y	N				
Zareipour	ACP	ECE	PhD	Y	N				
University of California, Berkeley									
Arias	ACP	EECS	PhD	N	N	F	5	2	8
Callaway	ACP	EI	PhD	N	N	F	10	3	0
Chang-Hasnain	P	EECS	PhD	N	Y	F	24	0	5
Culler	P	EECS	PhD	N	Y	F	27	0	0
Javey	ACP	EECS	PhD	N	Y	F	11	0	0
Rabaey	P	EECS	PhD	N	Y	F	29	0	4
Salahuddin	ACP	EECS	PhD	N	N	F	8	0	0
Sanders	P	EECS	PhD	Y	Y	F	27	0	0
Von Meier	ADJ	EECS	PhD	N	N	F	17	0	0
Yablonovitch	P	EECS	PhD	N	Y	F	34	0	11
University of California, Los Angeles									
Gadh	P	ME, AEO	PhD	N	N	F	25	0	2
University of Central Florida									
Batarseh	P	ECE	PhD	N	Y	F	25	0	0
Dimitriovski	ACP	ECE	PhD	Y	N	F	7	12	0
Qu	P	ECE	PhD	Y	Y	F	26	0	0
Sun	ATP	ECE	PhD	Y	N	F	3	2	0
Vosoughi	ACP	ECE	PhD	N	N	F	10	0	0
Wu	P	ECE	PhD	Y	N	F	17	0	0
Zhou	ATP	ECE	PhD	Y	N	F	2	2	0
University of Denver									
Gao	ACP	ECE	PhD	Y	N	F	15	0	0
Khodaei	ACP	ECE	PhD	Y	N	F	6	0	0
Zhang	ATP	ECE	PhD	N	N	F	7	0	0
University of Houston									
Barati	L/I	ECE	PhD	Y	N				
Rajashekara	P	ECE	PhD	Y	Y	F	50	0	0
Shireen	P	ET	PhD	Y	N				
University of Idaho									
Hess	P	ECE	PhD	Y	N	F	23	1	0
Johnson	P	ECE	PhD	Y	N	F	24	0	0
Law	ACP	ECE	PhD	Y	N	P	28	2	0
University of Illinois at Urbana-Champaign									
Bose	ATP	ECE	PhD	Y	N	F	2	2	0
Dominguez-Garcia	ACP	ECE	PhD	Y	N	F	8	2	0
Gross	P	ECE	PhD	Y	Y	F	23	20	0
Haran	ACP	ECE	PhD	Y	Y	F	3	14	0
Krein	P	ECE	PhD	Y	Y	F	29	4	0
Overbye	P	ECE	PhD	Y	Y	F	25	5	0
Pai	EP	ECE	PhD	Y	Y	P	51	5	0
Pilawa-Podgurski	ATP	ECE	PhD	Y	N	F	4	0	0
Sauer	P	ECE	PhD	Y	Y	F	40	4	0
Zhu	ATP	ECE	PhD	Y	N	F	4	0	2

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
University of Kentucky									
Cheng	P	CHE MTL	PhD	N	N	F	8	0	20
Colliver	P	AG	PhD	N	N	F	37	4	0
Cramer	ATP	ECE	PhD	Y	N	F	6	0	3
Dolloff	ADJ	ECE	PhD	Y	N	P	13	17	1
Holloway	P	ECE	PhD	Y	N	F	24	0	1
Ionel	P	ECE	PhD	Y	Y	F	7	25	0
Liao	P	ECE	PhD	Y	N	F	11	5	0
Parker	ACP	ME	PhD	N	N	F	19	6	0
Singh	P	ECE	PhD	N	N	F	33	0	7
Sottile	P	MNG	PhD	Y	N	F	25	0	0
Taylor	ATP	CIV	PhD	N	N	F	12	4	5
University of Maine									
Dunning	P	ET	PhD	Y	N	F	25	5	0
Pearse	P	ET	M	N	N	F	15	0	15
Villeneuve	P	ET	M	Y	N	F	14	10	5
University of Maryland College Park									
Abed	P	ECE	PhD	N	Y				
Gabriel	P	CIV,ENV, MTH	PhD	N	N				
Goldsman	P	ECE	PhD	N	N				
Khaligh	ATP	ECE	PhD	Y	N				
Mayergoyz	P	ECE	PhD	N	Y				
McCluskey	P	ME	PhD	N	N				
University of Memphis									
Ali	ATP	ECE	PhD	Y	N				
Lim	ADJ	ECE	M	Y	N				
Wyatt	L/I	ECE	M	Y	N				
University of Michigan - Dearborn									
Bai	ACP	ECE	PhD	Y	N	F	6	1	0
Kim	ACP	ECE	PhD	N	N				
Su	ATP	ECE	PhD	Y	N				
Wang	ATP	ECE	PhD	Y	N	F	2	0	0
University of Michigan, Ann Arbor									
Avestruz	ATP	EECS	PhD	Y	N	F	4	5	0
Hiskens	P	EECS	PhD	Y	Y				
Hofmann	ACP	EECS	PhD	N	N				
Mathieu	ATP	EECS	PhD	Y	N				
University of Minnesota -Twin Cities									
Dhople	ATP	ECE	PhD	Y	N				
Imbertson	L/I	ECE	PhD	Y	N				
Mohan	P	ECE	PhD	Y	Y				
Wollenberg	P	ERG	PhD	Y	Y				
University of Missouri - Columbia									
Devaney	EP	ECE	PhD	Y	N	P	46	4	0
Druce	L/I	ECE	PhD	N	N	F	5	2	0
Heise	ADJ	ECE	PhD	N	N	P	3	1	0
Gahl	P	ECE,NUC	PhD	N	N	F	30	0	0
Kovaleski	P	ECE	PhD	N	N	F	13	4	0
O'Connell	P	ECE	PhD	Y	N	F	20	0	0
University of Missouri - Kansas City									
Goli	L/I	EECS	PhD	Y	N	F	1	0	0
Kelly	L/I	EECS	B	Y	N	F	11	40	0
Khan	ACP	EECS	PhD	Y	N	F	10	0	0
Kirkpatrick	L/I	EECS	M	Y	N	F	20	10	5
Sankar	ADJ	EECS	PhD	Y	N	F	0	20	0
Siddiki	L/I	EECS	PhD	Y	N	F	4	0	0
University of Nebraska – Lincoln									
Asgarpoor	P	ECE	PhD	Y	N	F	27	3	0
Choobineh	P	ECE	PhD	Y	N	P	37	0	3
Hudgins	P	ECE	PhD	Y	Y	F	29	0	0
Hui	ACP	ECE	PhD	Y	N	F	10	3	0
Patterson	ADJ	ECE	PhD	Y	Y	P	39	0	3
Qiao	ACP	ECE	PhD	Y	N	F	8	0	0
Qu	ATP	ECE	PhD	Y	N	F	5	2	0
University of Nevada, Reno									
Ben Idris	ATP	EE,BIO	PhD	Y	N	F	2	0	0
Etezadi-Amoli	P	EE,BIO	PhD	Y	N				
Fajri	ATP	EE,BIO	PhD	N	N	F	2	2	0
Livani	ATP	EE,BIO	PhD	Y	N				
Trzynadlowski	P	EE,BIO	PhD	Y	Y				
University of New Haven									
Lpizra	ADJ	ECE,CS	PhD	Y	N	P	5	10	0
Manla	L/I	ECE,CS	PhD	Y	N	F	4	0	0
Zhao	ATP	ECE,CS	PhD	Y	N	F	6	1	0

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
University of North Carolina at Charlotte									
Badrul	P	ECE	PhD	Y	N				
Cecchi	ATP	ECE	PhD	Y	N				
Cox	ACP	ECE	PhD	Y	N				
Enslin	P	ECE	PhD	Y	Y				
Lukic	P	ECE	PhD	Y	N	F	42	0	0
Manjrekar	ACP	ECE	PhD	Y	N				
Parkhideh	ATP	ECE	PhD	N	N				
Rodriguez-Medina	L/I	ECE	PhD	Y	N	F	2	6	0
Sukumar	ACP	ECE	PhD	Y	N				
Zhao	ATP	ECE	PhD	Y	N	F	1	6	0
University of North Dakota									
Nejadpak	ATP	EE	PhD	Y	N	F	2	2	0
Ranganathan	ATP	EE	PhD	Y	N	F	10	0	0
Salehfar	P	EE	PhD	Y	N	F	22	3	0
University of Oklahoma									
Cheung	ADJ	ECE	PhD	Y	Y				
Jiang	ACP	ECE	PhD	Y	N				
Runolfsson	P	ECE	PhD	N	N				
Tang	ACP	ECE	PhD	N	N				
Wu	L/I	ECE	PhD	Y	N				
University of Pittsburgh									
El Nokali	ACP	ECE	PhD	Y	N	F	35	0	0
Grainger	L/I	ECE	PhD	Y	N	P	2	1	0
Kerestes	L/I	ECE	PhD	Y	N	F	0	3	10
Kusic	ACP	ECE	PhD	N	N	F	40	5	0
Kwasinski	ACP	ECE	PhD	Y	N	F	20	3	0
Mao	ACP	ECE	PhD	Y	N	F	15	0	0
McDermott	ADJ	ECE	PhD	Y	Y	P	5	28	0
Paserba	ADJ	ECE	M	Y	Y	P	0	30	0
Reed	P	ECE	PhD	Y	N	F	10	25	0
Stanchina	P	ECE	PhD	N	N	F	20	20	0
University of Saskatchewan									
Chowdhury	ACP	ECE	PhD	Y	N	F	27	0	0
Chung	P	ECE	PhD	Y	Y	F	16	1	0
El-Serafi	EP	ECE	PhD	Y	Y	F	45	0	0
Faried	P	ECE	PhD	Y	N	F	20	1	1
Gokaraju	P	ECE	PhD	Y	N	F	13	2	2
Karki	P	ECE	PhD	Y	N	F	15	2	0
Roy	EP	ECE	PhD	Y	Y	F	50	2	0
Sachdev	EP	ECE	PhD	Y	Y	F	40	17	0
University of South Carolina									
Benigni	ATP	EE	PhD	N	N	F	3	0	0
Dougal	P	EE	PhD	Y	N	F	33	0	0
Ginn	ACP	EE	PhD	Y	N	F	14	0	0
Islam	L/I	EE	PhD	Y	N	F	1	0	0
Santi	ACP	EE	PhD	Y	N	F	20	0	2
University of South Florida									
Fan	ACP	EE	PhD	Y	N				
Fehr	L/I	EE	PhD	Y	N				
Miao	ATP	EE	PhD	Y	N				
University of Southern Maine									
Luck	ACP	ENG	PhD	Y	N				
University of St. Thomas									
Chakravarty	ADJ	EE	PhD	Y	N	F	5	25	0
Greene	ACP	EE	PhD	Y	N	F	15	5	20
Hardie	ADJ	EE	PhD	N	N	F	3	5	25
Mowry	P	EE	PhD	Y	N	F	13	2	25
Satyanarayan	ADJ	EE	M	Y	N	F	2	25	0
University of Tennessee, Chattanooga									
Ahmed	ATP	EE	PhD	Y	N	F	7	0	6
Eltom	P	EE	PhD	Y	N	F	32	7	0
Karrar	L/I	EE	PhD	Y	N	F	24	7	0
Kobet	L/I	EE	M	Y	N	P	0	27	0
Loveless	ATP	EE	PhD	N	N	F	3	0	4
Manning	ADJ	EE	PhD	N	N	P	2	0	37
Ofoli	ACP	EE	PhD	Y	N	F	6	0	4
Reising	ATP	EE	PhD	N	N	F	3	0	12
Sisworahardjo	ATP	EE	PhD	Y	N	F	11	0	0
Thomason	EP	EE	PhD	N	N	P	42	0	14

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
University of Tennessee, Knoxville									
Costinett	ATP	EECS	PhD	N	N				
Li	ACP	EECS	PhD	Y	N				
Liu	P	EECS	PhD	Y	Y				
Pulgar	ATP	EECS	PhD	Y	N	F	15	0	0
Sun	ATP	EECS	PhD	Y	N				
Tolbert	P	EECS	PhD	Y	Y				
Tomsovic	P	EECS	PhD	Y	Y				
Wang	P	EECS	PhD	Y	Y				
University of Texas at Arlington									
Davoudi	ACP	EE	PhD	Y	N	F	6	0	0
Kenarangui	L/I	EE	PhD	Y	N	F	36	0	0
Lee	P	EE	PhD	Y	Y	F	31	0	0
Madani	ATP	EE	PhD	Y	N	F	1	0	0
Wetz	ACP	EE	PhD	Y	N	F	6	0	0
University of Texas at Austin									
Baldick	P	ECE	PhD	Y	Y	P	24	2	0
Santoso	ACP	ECE	PhD	Y	N	F	14	6	1
University of Texas at El Paso									
Mandal	ATP	ECE	PhD	Y	N	F	11	0	0
University of Texas at San Antonio									
Ahmed	ATP	ECE	PhD	N	N	F	1	5	0
Gatsis	ATP	ECE	PhD	Y	N	F	3	0	0
Johnson	ADJ	ECE	PhD	N	N	P	0	20	0
Krishnaswami	ACP	ECE	PhD	Y	N	F	7	4	0
University of the Pacific									
Mathews	P	ECE	PhD	Y	N				
Rahim	P	ECE	PhD	N	N				
University of Toronto									
Dawson	P	ECE	PhD	Y	Y				
Iravani	P	ECE	PhD	Y	Y				
Lehn	P	ECE	PhD	Y	N				
Prodic	P	ECE	PhD	Y	N				
Tate	ATP	ECE	PhD	Y	N				
Taylor	ATP	ECE	PhD	N	N				
Timorabadi	ATP	ECE	PhD	N	N	F	15	3	3
Trescases	ATP	ECE	PhD	Y	N				
University of Utah									
Stolp	L/I	ECE	M	N	N	F	20	0	0
Merrill	ADJ	ECE	PhD	Y	N	P	4	41	0
Palmer	ADJ	ECE	PhD	Y	N	P	10	2	8
Bodson	P	ECE	PhD	Y	Y	F	30	0	0
Parvania	ATP	ECE	PhD	Y	N	F	3	0	0
Ardakani-Sahraei	ATP	ECE	PhD	Y	N	F	1	3	0
University of Vermont									
Almasalkhi	ATP	EE	PhD	Y	N	F	6	2	2
Hines	ACP	EE	PhD	Y	N	F	14	3	1
University of Washington									
Christie	ACP	EE	PhD	Y	N				
El Sharkawi	P	EE	PhD	Y	Y				
Kirschen	P	EE	PhD	Y	Y				
Nagel	ADJ	EE	PhD	Y	N	P	0	22	0
Ortega-Vazquez	ATP	EE	PhD	Y	N				
Schneider	ADJ	EE	PhD	Y	N	P	0	11	6
Zhang	ATP	EE	PhD	Y	N				
University of Waterloo									
Bhattacharya	P	ECE	PhD	Y	N	F	20	2	0
Canizares	P	ECE	PhD	Y	Y	F	27	1	0
El-Saadany	P	ECE	PhD	Y	N	F	16	0	0
El-Shatshat	L/I	ECE	PhD	Y	N	F	16	0	0
Jayaram	P	ECE	PhD	Y	Y	F	24	0	0
Kazerani	P	ECE	PhD	Y	N	F	20	0	0
Salama	P	ECE	PhD	Y	Y	F	30	0	0
University of West Florida									
Ramachandran	ATP	ENG	PhD	Y	N	F	21	0	0
University of Western Ontario									
Ajaei	ATP	ECE	PhD	Y	N	F	1	0	0
Jiang	P	ECE	PhD	Y	N	F	28	0	0
Moschopoulos	P	ECE	PhD	N	N	F	18	3	0
Varma	P	ECE	PhD	Y	N	F	28	0	0
University of Wisconsin - Madison									
DeMarco	P	ECE	PhD	Y	N				
Farrell	ATP	ECE	PhD	N	N	F	2	0	1
Fredette	ADJ	ECE	PhD	Y	N				
Han	ATP	ECE	PhD	N	N				
Jahns	P	ECE	PhD	Y	Y				
Lesieutre	P	ECE	PhD	Y	N				
Ludois	ATP	ECE	PhD	Y	N				
Sarlioglu	ATP	EPD	PhD	Y	N				
Venkataramanan	P	ECE	PhD	Y	N				
University of Wisconsin - Milwaukee									
Cuzner	ATP	EECS	PhD	N	N	F	2	24	0
Nasiri	P	EECS	PhD	Y	N	F	8	7	0
Wang	ACP	EECS	PhD	Y	N	F	5	3	0
Yu	P	EECS	PhD	Y	N	F	30	6	0
University of Wisconsin - Platteville									
Dehnavi	ATP	EE	PhD	N	N	F	2	9	0
Muslu	P	EE	PhD	N	N				
Yang	ATP	EE	PhD	Y	N				
University of Wyoming									
Duan	ATP	ECE	PhD	Y	N				
Muknahallipatna	P	ECE	PhD	N	N	F	20	0	1
Pierre	P	ECE	PhD	Y	Y	F	25	0	2
Valparaiso University									
White	ATP	ECE	PhD	N	N	F	3	0	0
Virginia Polytechnic Institute and State University									
Broadwater	P	ECE	PhD	Y	N	F	38	0	0
Burgos	ATP	ECE	PhD	Y	N	F	4	4	3
Centeno	ACP	ECE	PhD	Y	N				
DeLaRee-Lopez	ACP	ECE	PhD	Y	N	F	30	2	0
Kekatos	ATP	ECE	PhD	Y	N	F	3	1	0
Lai	P	ECE	PhD	Y	Y	F	20	0	7
Mili	P	ECE	PhD	Y	N	F	28	0	0
Phadke	EP	ECE	PhD	Y	Y	P	30	22	0
Rahman	P	ECE	PhD	Y	Y	F	38	0	0
Tam	ACP	ECE	PhD	Y	N				
Thorp	P	ECE	PhD	Y	Y	P	54	0	0
Washington State University									
Bose	P	EECS	PhD	Y	Y	F	33	10	3
Carper	ACP	EECS	M	Y	N	P	0	21	0
Dubey	ATP	EECS	PhD	Y	N	F	1	0	0
Guerrero	ATP	EECS	PhD	Y	N	F	9	2	0
Hahn	ATP	EECS	PhD	Y	N	F	2	0	8
Hauser	ACP	EECS	PhD	N	N	P	15	0	21
Kakar	P	EECS	PhD	Y	N	F	40	0	0
Liu	P	EECS	PhD	Y	Y	F	32	0	1
Lotfifard	ATP	EECS	PhD	Y	N	F	5	0	0
Mehrizi-Sani	ATP	EECS	PhD	Y	N	F	5	0	0
Olsen	P	EECS	PhD	Y	Y	P	41	2	0
Pedrow	ACP	EECS	PhD	N	N	F	30	5	0
Roy	P	EECS	PhD	N	N	F	13	0	0
Schulz	P	EECS	PhD	Y	Y	F	22	0	1
Srivastava	ACP	EECS	PhD	Y	N	F	13	1	0
Venkatasubramanian	P	EECS	PhD	Y	Y	F	24	0	1
Wayne State University									
Lin	P	ECE	PhD	N	Y	F	28	0	0
Nazri	L/I	ECE	PhD	Y	N	F	11	27	27
Wang	ACP	ECE	PhD	Y	N	F	10	5	0
Wang	P	ECE	PhD	N	Y	F	26	0	0
West Virginia University									
Choudhry	P	EECS	PhD	Y	N				
Famouri	P	EECS	PhD	Y	N				
Feliachi	P	EECS	PhD	Y	N				
Kushalani-Solanki	ATP	EECS	PhD	Y	N				
West Virginia University Institute of Technology									
Hatipoglu	ATP	ECE	PhD	Y	N	F	4	1	1
Western Carolina University									
Karayaka	ATP	ET	PhD	Y	N				
Wichita State University									
Aravinthan	ATP	EECS	PhD	Y	N				
Jewell	P	EECS	PhD	Y	Y				
Pang	ATP	EECS	PhD	Y	N				
Tamtam	L/I	EECS	PhD	Y	N	F	3	0	0

Last Name	Rank or Position	Department	Highest Degree	PES Membership	IEEE Fellow	Full/Part Time	Experience (Years)		
							Academic	Power Industry	Other Industry
Worcester Polytechnic Institute									
Clements	EP	ECE	PhD	Y	Y				
Dykes	L/I	ECE	PhD	Y	N				
Emanuel	P	ECE	PhD	Y	Y				
Mahmoud	ATP	ECE	PhD	Y	N	F	1	3	0
McGrail	ADJ	ECE	PhD	Y	N				
Mirheydar	ADJ	ECE	PhD	Y	N				
Orr	P	ECE	PhD	Y	Y				
Pajic	ADJ	ECE	PhD	Y	N				
Sorensen	L/I	ECE	M	Y	N				
Thompson	ADJ	ECE	PhD	Y	N				
Uzunovic	ADJ	EPD	PhD	Y	N				

Appendix Table 3. Power Program Research Activities and Funding in 2015-16

UNIVERSITY	RESEARCH AREA																				EXPENDITURES ($000)							
	Distribution System Analysis	Electric Machinery	Energy Development & Pwr Generation	Energy Storage	Intelligent Grid	Power Electronics	Power Engineering Education	Pwr Sys Communications & Cybersecurity	Pwr Sys Computation and Analysis	Pwr Sys Dynamic Performance	Pwr Sys Economics	Pwr Sys Instrumentation & Measurements	Pwr Sys Operations	Pwr Sys Planning and Implementation	Pwr Sys Relaying	Reliability, Risk & Probability. Applications	Renewable Generation	Substation Automation	Switchgear, Surge Protection Devices	Transformers	Government		Domestic Utility		Other Domestic Industry		Total	
																					Non-Equip.	Equip.	Non-Equip.	Equip.	Non-Equip.	Equip.	Non-Equip.	Equip.
Alabama at Birmingham					x	x															0	0	80	0	0	0	80	0
Alaska Fairbanks		x	x	x	x				x	x	x						x				150	500	0	0	0	0	150	500
Alberta	x				x	x			x			x			x		x				600	300	200	10	50	20	850	330
Arizona State	x		x		x	x	x	x	x												1771	0	1413	0	100	0	3284	0
Arkansas				x	x	x								x			x			x	1600	0	400	0	0	0	2000	0
Auburn	x					x			x			x									100	0	200	0	0	0	300	0
Baylor			x		x	x			x		x			x			x				300	25	0	0	300	25	600	50
Boise State		x			x				x	x							x				5	0	68	0	0	0	73	0
Buffalo State	x				x		x								x						10	25	0	0	0	0	10	25
Calgary		x	x	x	x	x	x		x												800	700	400	100	250	50	1450	850
California Polytechnic	x		x	x	x	x		x	x	x		x			x		x		x		200	20	15	0	50	5	265	25
California State, Fresno						x							x				x	x	x		0	45	2	0	0	0	2	45
California State, Northridge					x																0	20	0	0	0	0	0	20
California State, Sacramento	x	x				x	x								x		x				12	17	0	0	20	40	32	57
California, Berkeley		x		x	x			x									x				1300	55	25	12	425	10	1750	77
California, Los Angeles					x	x															0	0	0	0	0	0	0	0
Carnegie Mellon				x	x			x	x	x	x	x	x								3000	500	1000	0	1000	100	5000	600
Case Western Reserve	x			x	x	x	x		x	x	x		x				x				300	0	300	0	0	1000	600	1000
Central Florida			x		x					x							x				1200	0	40	0	50	0	1290	0
Clarkson	x	x			x		x														425	0	30	0	0	0	455	0
Clemson			x	x	x		x	x	x	x							x				582	300	95	199	262	60	939	559
Cleveland State	x	x	x		x	x	x	x	x	x	x		x	x			x				0	0	20	10	0	0	20	10
Colorado School of Mines		x		x	x			x					x			x	x				0	0	50	0	150	10	200	10
Colorado State			x		x			x	x		x		x	x			x				2393	0	0	0	0	0	2393	0
Concordia		x		x													x				682	115	80	10	66	83	828	208
Cornell				x	x				x		x		x	x		x	x				1500	0	0	0	0	0	1500	0
Denver					x				x		x			x			x				500	0	0	0	0	0	500	0
Drexel			x	x	x	x			x		x		x	x			x				300	300	0	0	0	0	300	300
FAMU-FSU		x			x				x	x							x	x			5448	178	0	0	490	193	5938	371
Florida International		x		x	x	x		x	x	x			x				x				9000	100	7000	30	500	500	16500	630
Gannon		x	x					x									x				0	0	0	0	0	0	0	0
Georgia Inst. of Technology			x		x	x		x		x	x		x				x			x	2000	0	6000	0	2000	0	10000	0
Gonzaga							x														0	0	0	5	0	0	0	5
Houston						x															0	0	0	0	0	0	0	0
Howard					x												x		x		500	600	40	26	0	0	540	626
Idaho	x	x	x	x		x	x	x		x			x		x	x	x			x	190	0	160	0	140	55	490	55
Illinois at Urbana-Champaign	x	x	x		x	x	x	x	x	x	x	x	x	x			x				2150	300	240	25	75	10	2465	335
Illinois Inst. of Technology		x	x	x	x		x	x	x	x	x	x	x	x	x		x	x			2000	8000	100	500	200	1000	2300	9500
Indiana, Purdue Indianapolis					x	x				x						x					80	0	0	0	20	0	100	0
Iowa State	x		x	x	x			x	x	x	x		x	x			x				1350	150	315	0	650	20	2315	170
John Brown					x											x	x				0	0	0	3	0	0	0	3
Kansas State					x	x	x		x		x		x	x			x				300	0	60	0	0	0	360	0
Kennesaw State																	x				15	0	0	0	0	0	15	0
Kentucky		x			x	x	x		x						x						1000	100	50	0	100	0	1150	100
Lake Superior State																	x				0	0	0	0	4	3	4	3
Lamar		x	x		x	x											x				100	300	0	100	0	0	100	400
Lawrence Technological							x									x					0	0	0	0	0	0	0	0
Louisiana State, A&M College		x	x	x	x	x	x		x	x	x		x	x	x		x	x		x	50	2	70	20	0	0	120	22
Maine					x										x			x			0	0	0	0	20	600	20	600
Marquette		x																			20	0	0	0	100	20	120	20
Maryland College Park			x	x		x	x		x		x										1000	0	0	0	700	0	1700	0
Massachusetts Inst. of Tech.	x	x	x		x	x	x														1500	200	0	0	1000	100	2500	300
McGill					x	x			x		x		x	x	x		x				300	175	100	0	0	0	400	175
Memorial, Newfoundland		x			x	x				x					x						95	4	0	0	0	0	95	4
Memphis				x	x					x							x			x	0	0	83	0	0	0	83	0
Miami	x	x	x		x	x	x										x				0	0	0	0	0	0	0	0
Michigan State		x	x	x	x	x			x	x				x			x				224	0	56	0	421	0	701	0
Michigan Tech.	x			x	x			x	x	x			x		x		x			x	721	0	288	0	19	30	1028	30
Michigan, Ann Arbor	x	x		x	x	x			x	x	x		x	x			x				650	0	0	0	225	10	875	10
Michigan, Dearborn				x	x		x									x	x				500	0	100	0	100	0	700	0
Minnesota State, Mankato		x	x		x				x												0	0	0	0	0	45	0	45
Minnesota, Twin Cities							x			x	x	x	x	x	x		x				20	0	120	70	0	0	140	70
Mississippi State				x	x		x				x		x	x			x				490	0	263	0	248	0	1001	0
Missouri, Columbia			x	x	x		x										x				208	0	85	0	23	0	316	0
Missouri, Kansas City						x															20	30	0	0	0	0	20	30
Missouri, Science and Tech.						x			x												2300	25	60	80	0	35	2360	140
Montana State, Bozeman			x	x		x			x												200	0	0	0	0	0	200	0
Nebraska, Lincoln	x	x		x	x	x			x	x			x	x			x				850	25	120	0	150	0	1120	25
Nevada, Reno					x	x								x			x				100	0	50	130	0	0	150	130

UNIVERSITY	RESEARCH AREA																				EXPENDITURES ($000)							
	Distribution System Analysis	Electric Machinery	Energy Development & Pwr Generation	Energy Storage	Intelligent Grid	Power Electronics	Power Engineering Education	Pwr Sys Communications & Cybersecurity	Pwr Sys Computation and Analysis	Pwr Sys Dynamic Performance	Pwr Sys Economics	Pwr Sys Instrumentation & Measurements	Pwr Sys Operations	Pwr Sys Planning and Implementation	Pwr Sys Relaying	Reliability, Risk & Probability. Applications	Renewable Generation	Substation Automation	Switchgear, Surge Protection Devices	Transformers	Government		Domestic Utility		Other Domestic Industry		Total	
																					Non-Equip.	Equip.	Non-Equip.	Equip.	Non-Equip.	Equip.	Non-Equip.	Equip.
New Haven	x		x	x	x	x							x	x			x				0	0	0	0	15	5	15	5
New Jersey Inst. of Tech.			x	x	x			x	x								x				2500	300	50	25	500	150	3050	475
New Mexico State	x				x			x	x				x		x	x	x				600	0	100	0	0	0	700	0
New York, Polytechnic	x	x		x	x	x				x	x			x		x	x			x	250	0	0	0	200	0	450	0
North Carolina State, Raleigh	x	x		x	x		x	x	x	x	x		x	x			x	x			4000	0	500	0	500	0	5000	0
North Carolina, Charlotte		x	x	x			x		x				x			x	x				1014	0	140	0	1154	0	2308	0
North Dakota	x		x	x	x	x	x	x	x		x	x	x	x			x	x			1500	700	0	0	300	500	1800	1200
North Dakota State						x		x	x	x			x								115	0	0	0	8	0	123	0
Northeastern	x		x		x	x	x	x	x												300	10	120	0	320	50	740	60
Northern Arizona		x			x	x											x				0	0	0	0	0	0	0	0
Ohio Northern		x			x	x	x										x				0	0	0	0	0	0	0	0
Ohio State		x			x	x	x		x		x		x			x	x				2200	40	0	0	250	0	2450	40
Oklahoma	x		x		x				x	x	x	x	x	x			x				50	0	110	6	60	0	220	6
Oklahoma State			x		x	x				x	x					x	x				26	0	30	0	10	0	66	0
Old Dominion	x		x	x	x	x	x	x	x							x	x	x	x		50	500	20	20	0	0	70	520
Oregon State		x			x	x		x	x	x		x			x		x				4000	0	250	250	75	75	4325	325
Pacific							x										x				0	0	0	0	0	0	0	0
Pennsylvania State, Harrisburg					x				x			x					x				30	0	25	0	0	35	55	35
Pittsburgh	x	x	x		x	x							x	x	x	x	x				50	0	250	0	300	300	600	300
Portland State		x		x	x		x										x				150	0	150	0	0	0	300	0
Purdue, Northwest		x	x	x		x			x	x	x	x	x				x				161	0	0	0	0	0	161	0
Purdue, West Lafayette		x		x	x	x				x	x						x			x	800	0	0	0	150	50	950	50
Rensselaer Polytechnic Inst.		x		x	x	x	x	x	x	x	x	x	x				x				1880	10	125	10	0	0	2005	20
Ryerson				x	x	x											x				250	10	10	0	40	0	300	10
San Jose State						x															0	20	0	0	0	0	0	20
Santa Clara				x	x					x							x				0	0	0	0	0	0	0	0
Saskatchewan				x	x				x	x	x		x	x	x		x				200	5	300	1	0	5	500	11
Seattle			x		x				x								x				39	0	0	0	0	0	39	0
South Carolina				x	x	x			x			x		x	x		x			x	2000	0	100	0	50	0	2150	0
South Dakota, Mines and Tech.		x	x	x	x												x				0	0	0	10	0	0	0	10
South Dakota State				x	x				x	x			x	x	x		x				440	30	10	1	20	0	470	31
South Florida				x	x																100	0	200	0	0	750	300	750
Southern Maine				x	x		x														10	0	0	0	20	50	30	50
St. Thomas	x			x		x	x						x		x	x					0	0	700	150	250	100	950	250
Suffolk		x															x			x	0	0	0	0	0	0	0	0
Syracuse	x						x	x				x	x	x			x			x	500	0	0	0	50	0	550	0
Temple						x		x	x	x											180	84	0	0	0	0	180	84
Tennessee State							x														77	2	0	0	0	0	77	2
Tennessee, Chattanooga	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x		x	556	0	225	0	0	1200	781	1200
Tennessee, Knoxville		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	6900	75	0	0	450	10	7350	85
Texas A&M		x		x	x				x	x	x			x	x		x				2000	20	100	50	2000	100	4100	170
Texas at Arlington				x	x											x	x		x		355	600	71	0	263	0	689	600
Texas at Austin	x				x	x			x		x		x	x		x	x				500	0	0	0	50	0	550	0
Texas at El Paso	x		x	x	x	x	x				x		x	x			x				85	0	0	0	155	0	240	0
Texas at San Antonio	x		x		x	x							x				x				250	0	50	0	0	0	300	0
Texas Tech				x	x	x											x				250	2000	0	0	150	0	400	2000
Toronto			x	x	x		x		x	x	x	x	x			x	x				1000	400	500	0	500	0	2000	400
Tufts					x				x	x											500	30	0	0	0	0	500	30
US Military Academy					x				x		x	x					x				0	220	0	0	0	0	0	220
Utah	x	x	x	x	x		x				x		x	x		x	x				250	0	150	0	50	0	450	0
Valparaiso						x	x														0	0	0	0	0	0	0	0
Vermont					x		x			x						x					150	0	50	0	0	0	200	0
Virginia Polytechnic				x	x	x			x	x		x	x		x		x				2074	158	0	0	0	0	2074	0
Washington	x			x				x	x		x		x	x			x				1000	400	0	0	0	0	1000	400
Washington State		x	x		x	x	x	x	x	x			x	x			x				1394	28	0	0	0	0	1394	28
Waterloo				x	x				x	x	x		x	x			x			x	3500	1100	1000	100	100	0	4600	1200
Wayne State		x	x	x	x				x	x			x	x			x				400	0	0	0	50	0	450	0
West Florida	x	x	x	x	x				x		x						x				92	0	0	0	0	0	92	0
West Virginia	x	x			x					x					x			x			367	0	0	0	0	0	367	0
West Virginia, Inst. of Tech.						x	x		x				x				x				35	25	0	0	0	0	35	25
Western Carolina			x	x																	3	0	0	0	0	0	3	0
Western Ontario	x		x	x		x			x	x		x			x		x	x			448	50	404	20	20	10	872	80
Wichita State				x	x			x	x		x	x	x	x			x				100	0	120	60	0	0	220	60
Wisconsin, Madison	x	x		x	x	x	x	x	x	x	x	x	x	x			x				2344	140	321	0	1497	78	4162	218
Wisconsin, Milwaukee	x	x		x	x	x		x		x							x		x		446	0	0	100	241	370	687	470
Wisconsin, Platteville		x	x		x	x	x		x								x				0	0	0	0	0	0	0	0
Worcester Polytechnic				x	x												x				200	0	0	0	0	0	200	0
Wyoming								x	x	x											900	0	0	0	0	15	900	15

Appendix Table 4. Education Program Characteristics

Abbreviations used in Appendix Table 4:

Calendar:
S: Semester
Q: Quarter
O: Other (see notes at end table)

Cooperative Program:
O: Optional
M: Mandatory
N: Not available

University	Undergraduate Program											Master's Degree	Doctoral Degree	Master's Online Degree	Doctoral Online Degree	Provided K-12 Help
	Calendar	Mandatory Courses for All	Mandatory Courses in Selected Offerings	Elective Courses	Special Track	Special Track Title	Minor Offering	Minor Offering Title	Certificate	Certificate Title	Coop Program					
Alabama at Birmingham	S	x		x					x	ECE Power System Certificate	O	x	x			
Alaska Fairbanks	S	x	x	x							N	x	x			x
Alberta	S			x							O	x	x			
Arizona State	S	x		x							N	x	x	x		x
Arkansas	S	x		x					x	Graduate Certificate in Sustainability with Emphasis in Electric Energy Systems	O	x	x	x		x
Auburn	S	x		x							O	x	x	x		
Baylor	S			x							N	x	x			x
Boise State	S			x							N	x	x			
Buffalo State	S		x	x	x	Smart Grid Option	x	Energy Systems Minor			N					x
Calgary	S	x		x							O	x	x			x
California Polytechnic	Q			x	x	Power Concentration					O	x				x
California State, Fresno	S		x	x							O	x				x
California State, Northridge	S			x							O	x				
California State, Sacramento	S	x	x	x					x	Power Certificate	N	x				x
California, Berkeley*	S			x			x	Undergraduate Minor in Energy and Resources			O	x	x			x
California, Los Angeles*	Q					Power System with Solar Power Plant		Solar Wind Hybrid Power Plant	x	UCLA Online Power Systems Certificate	N	x		x		x
Carnegie Mellon	S			x							N	x	x			x
Case Western Reserve	S		x	x	x	Energy					O	x	x	x		
Central Florida	S		x	x	x	Power and Energy Systems					O	x	x			x
Clarkson	S	x	x	x					x	Undergraduate Concentration in Power Engineering	O	x	x	x	x	
Clemson	S	x		x							O	x	x			
Cleveland State	S	x		x							O	x	x			x
Colorado School of Mines	S	x		x							N	x	x			x
Colorado State	S			x					x	Power and Energy Certificate	O	x	x	x	x	x
Concordia	Q	x		x							O	x	x			x
Cornell	S			x							O	x	x			
Denver	Q	x		x							N	x	x			x
Drexel	Q			x	x	Power/Systems & Controls					M	x	x	x		x
FAMU-FSU	S			x							N	x	x			x
Florida International	S	x	x	x	x	Cyber Security					N	x	x	x	x	x
Gannon	S			x							O					
Georgia Inst. of Technology	S	x		x							O	x	x			x
Gonzaga	S	x	x	x	x	Engineering Management - Electrical Engineering Track					N	x		x		

University	Undergraduate Program											Master's Degree	Doctoral Degree	Master's Online Degree	Doctoral Online Degree	Provided K-12 Help
	Calendar	Mandatory Courses for All	Mandatory Courses in Selected Offerings	Elective Courses	Special Track	Special Track Title	Minor Offering	Minor Offering Title	Certificate	Certificate Title	Coop Program					
Houston	S		x	x							O	x	x	x		
Howard	S	x		x							N	X	x			x
Idaho	S	x		x	x	Power Emphasis					O	x	x	x	x	x
Illinois at Urbana-Champaign	S			x							O	x	x			x
Illinois Inst. of Technology	S		x	x							O	x	x	x		x
Indiana, Purdue Indianapolis	S			x							O	x	x			
Iowa State	S	x	x	x			x	Wind Energy			N	x	x			
John Brown	S		x	x							N					x
Kansas State	S	x	x	x							O	x	x	x	x	
Kennesaw State	S	x		x							O	x		x		x
Kentucky	S	x	x	x					x	Undergraduate Certificate in Power and Energy	O	x	x			x
Lake Superior State	S	x	x	x	x	Sustainable Energy Concentration					O					x
Lamar	S		x	x							N	x	x	x	x	x
Lawrence Technological	S			x	x	Concentration in Electrical Energy Engineering					O	x				
Louisiana State, A&M College	S	x		x							O	x	x			x
Maine	S	x		x	x	Concentration in Power Systems					O	x	x			x
Marquette	S		x	x							O	x	x			
Maryland College Park	S		x	x	x	Power Systems					O	x	x			x
Massachusetts Inst. of Tech.	S		x	x							O	x	x			x
McGill	S	x		x	x	Enhanced Power Engineering Concentration					O	x	x			
Memorial, Newfoundland	S	x		x							M	x	x			
Memphis	S		x	x							O	x	x			x
Miami	S			x							O	x				x
Michigan State	S	x		x							O	x	x			
Michigan Tech.	S	x	x	x					x	Certificate in Electric Power Engineering	O	x	x	x	x	x
Michigan, Ann Arbor	S			x							N	x	x			x
Michigan, Dearborn	S			x							O	x	x	x		x
Minnesota State, Mankato	S		x	x			x	Electronic Engineering Technology Minor Power Option	x	Renewable Energy Certificate Program	N	x				x
Minnesota, Twin Cities	S			x							N	x	x			x
Mississippi State	S	x		x							O	x	x	x	x	x
Missouri of Science and Tech.	S	x	x	x	x	Power and Energy Emphasis Area			x	Electric Power Systems Engineering; Electric Machines and Drives	O	x	x	x	x	x
Missouri, Columbia	S		x	x	x	Power Track	x	Minor in Energy Engineering			O	x	x			x
Missouri, Kansas City	S	x		x							O	x	x			x
Montana State, Bozeman	S	x		x	x	Power, Energy, Control					O	x	x			x
Nebraska, Lincoln	S		x	x	x	Power and Energy Systems					O	x	x			x
Nevada, Reno	S	x	x	x					x	Renewable Energy, Graduate Certificate	N	x	x			x
New Haven	S			x	x	Electric Power Engineering					O	x				
New Jersey Inst. of Tech.	S	x	x	x	x	Power Systems					O	x	x	x		x
New Mexico State	S	x		x							N	x	x	x	x	x
New York Polytechnic	S		x	x	x	Power					N	x	x			x

University	Undergraduate Program											Master's Degree	Doctoral Degree	Master's Online Degree	Doctoral Online Degree	Provided K-12 Help
	Calendar	Mandatory Courses for All	Mandatory Courses in Selected Offerings	Elective Courses	Special Track	Special Track Title	Minor Offering	Minor Offering Title	Certificate	Certificate Title	Coop Program					
North Carolina State, Raleigh	S		x	x	x	Renewable Electric Energy Systems Concentration			x	Renewable Electric Energy Systems Concentration, Graduate	O	x	x	x		x
North Carolina, Charlotte*	S		x	x							O	x	x			x
North Dakota	S	x	x	x							O	x	x	x	x	x
North Dakota State	S	x		x							O	x	x			x
Northeastern	S			x							O	x	x	x		x
Northern Arizona	S			x							N	x	x			x
Ohio Northern	S	x	x	x	x	Advanced Energy Concentration					O					
Ohio State	S			x							N	x	x			x
Oklahoma	S		x	x	x	Accelerated Energy Finance Program					O	x	x			x
Oklahoma State	S		x	x							N	x	x			
Old Dominion	S	x	x	x							N	x	x			x
Oregon State	Q	x		x							O	x	x			x
Pacific	S	x		x							M					
Pennsylvania State, Harrisburg	S	x		x							N	x		x		x
Pittsburgh	S		x	x	x	Electric Power Engineering Concentration			x	Graduate Electric Power Engineering Certificate Program	O	x	x	x		x
Portland State	Q	x	x	x	x	Power Engineering					O	x	x			
Purdue Northwest	S		x	x			x	Power and Energy Systems			N	x				x
Purdue, West Lafayette	S			x	x	Power & Energy Systems					O	x	x	x		
Rensselaer Polytechnic Inst.	S	x		x	x	Power Engineering Concentration					O	x	x			x
Ryerson	S			x							O	x	x			
San Jose State	S			x							N	x				
Santa Clara	Q		x	x					x	Certificate in Renewable Energy	O	x	x			
Saskatchewan	S	x	x		x	Power & Energy					O	x	x			
Seattle	Q	x		x							N					
South Carolina	S			x							O	x	x	x	x	x
South Dakota State	S			x							O	x	x			x
South Dakota, Mines and Tech.	S	x		x							O	x		x		x
South Florida	S	x		x							O	x	x	x	x	x
Southern Maine	S	x		x							O					x
St. Thomas	S		x	x	x	Power Track			x	Power Systems and Electronics Certificate	O	x				
Suffolk	S	x		x							N					x
Syracuse	S	x	x	x							O	x	x			x
Temple	S			x							O	x	x			x
Tennessee State	S		x	x							O	x	x			x
Tennessee, Chattanooga	S			x	x	Power Systems			x	Power System Protection, Sustainable Electric Energy, Smart Grid, Smart Power Distribution	N	x				x
Tennessee, Knoxville	S	x	x	x	x	Power and Energy Systems			x	Concentration in Power and Energy Systems	O	x	x			x
Texas A&M	S		x	x							O	x	x			
Texas at Arlington	S		x	x							O	x	x			x

University	Undergraduate Program											Master's Degree	Doctoral Degree	Master's Online Degree	Doctoral Online Degree	Provided K-12 Help
	Calendar	Mandatory Courses for All	Mandatory Courses in Selected Offerings	Elective Courses	Special Track	Special Track Title	Minor Offering	Minor Offering Title	Certificate	Certificate Title	Coop Program					
Texas at Austin	S		x	x	x	Energy Systems and Renewable Energy					O	x	x			
Texas at El Paso	S			x							N	x	x			
Texas at San Antonio	S			x							O	x	x			
Texas Tech	S			x							O	x	x			x
Toronto	S		x	x	x	Energy Systems Engineering	x	Sustainable Energy			O	x	x			x
Tufts	S			x							O	x	x			x
US Military Academy	S	x	x	x	x	Alternative Energy					N					
Utah	S			x							O	x	x	x		x
Valparaiso	S			x							O					
Vermont	S			x	x	Energy Systems Track					O	x	x			x
Virginia Polytechnic	S	x		x							O	x	x			x
Washington	Q		x	x	x	Large Scale Power Systems, Sustainable Energy, Power Electronics and Electric Drives					O	x	x			x
Washington State	S	x	x	x	x	Power Engineering					O	x	x	x		
Waterloo	Q	x		x							M	x	x	x		
Wayne State	S			x							O	x	x			x
West Florida	S	x	x	x							N					x
West Virginia	S	x		x							O	x	x			
West Virginia Inst. of Tech.	S	x	x	x	x	Electrical Energy Systems Emphasis					O					x
Western Carolina	S	x			x	Electric Power Engineering					N					
Western Ontario	S	x	x	x	x	Power Systems Option					O	x	x			x
Wichita State	S	x		x							O	x	x			x
Wisconsin, Madison	S			x							O	x	x	x		x
Wisconsin, Milwaukee	S	x		x							O	x	x			x
Wisconsin, Platteville	S		x	x			x	Sustainable and Renewable Energy Systems			O					
Worcester Polytechnic*	O			x							O	x	x	x		x
Wyoming	S	x		x							N	x	x			x

***Notes:**

Calendars: Worchester Polytechnic Institute (WPI) uses quarters for undergraduate education and both 10 week and 14 week schedules for graduate education. The 10 week duration is common for the part-time, working professional graduate students. The 14 week semesters are used for full time graduate students.

Offerings:

- University of California, Berkeley also offers a joint major in EECS and Nuclear Engineering.
- University of California, Los Angeles also offers “Electrical Power Controlling”.
- University of North Carolina, Charlotte also offers a concentration in power engineering.

Appendix Table 5. Estimated Degrees Granted and Student Enrollments in 2015-16

Abbreviations used in Appendix Table 5. U: Undergraduate; M: Master's; D: Doctoral (PhD); FT: Full-Time; PT: Part-Time

University	Est. Degrees Granted			Domestic Graduate Student Enrollment				International Graduate Student Enrollment				Total Graduate Student Enrollment				Est. Domestic Undergraduate Enrollment
				FT		PT		FT		PT		FT		PT		
	U	M	D	M	D	M	D	M	D	M	D	M	D	M	D	%
Alabama at Birmingham	10	3	1	1	0	10	3	0	0	0	0	1	0	10	3	85
Alaska Fairbanks	8	0	0	3	1	0	0	1	0	0	0	4	1	0	0	90
Alberta	70	20	10	5	5	0	0	15	30	0	0	20	35	0	0	85
Arizona State	60	75	18	19	15	0	0	94	60	0	0	113	75	0	0	87
Arkansas	15	8	3	8	3	5	0	25	8	2	0	33	11	7	0	90
Auburn	35	15	5	2	2	0	0	12	5	0	0	14	7	0	0	95
Baylor	5	3	2	2	2	1	1	3	4	0	0	5	6	1	1	90
Boise State	6	2	0	0	0	2	0	4	2	0	0	4	2	2	0	80
Buffalo State	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98
Calgary	50	30	20	9	5	2	1	18	14	0	0	27	19	2	1	82
California Polytechnic	50	15	0	10	0	3	0	2	0	0	0	12	0	3	0	95
California State, Fresno	10	3	0	6	0	1	0	30	0	0	0	36	0	1	0	97
California State, Northridge	25	13	0	3	0	0	0	12	0	0	0	15	0	0	0	70
California State, Sacramento	40	16	0	11	0	3	0	6	0	0	0	17	0	3	0	95
California, Berkeley	20	2	5	6	17	0	0	4	8	0	0	10	25	0	0	85
California, Los Angeles	5	5	0	0	0	5	0	0	0	0	0	0	0	5	0	100
Carnegie Mellon	20	30	10	0	0	0	0	25	10	0	0	25	10	0	0	10
Case Western Reserve	3	4	4	2	1	0	0	4	2	0	0	6	3	0	0	75
Central Florida	20	5	3	1	2	4	2	4	10	0	0	5	12	4	2	95
Clarkson	30	3	0	1	0	1	3	1	7	0	0	2	7	1	3	95
Clemson	30	5	5	5	2	2	0	5	23	1	0	10	25	3	0	90
Cleveland State	20	18	2	5	4	5	4	15	6	0	0	20	10	5	4	90
Colorado School of Mines	20	15	8	4	1	10	2	4	8	0	0	8	9	10	2	90
Colorado State	12	10	4	3	0	5	3	8	10	12	0	11	10	17	3	25
Concordia	55	60	8	1	1	0	1	5	15	0	0	6	16	0	1	40
Cornell	5	20	2	5	1	0	0	15	13	0	1	20	14	0	1	80
Denver	8	6	3	2	0	2	1	10	20	0	0	12	20	2	1	90
Drexel	30	19	0	0	6	14	1	9	3	0	0	9	9	14	1	80
FAMU-FSU	20	10	7	6	3	0	0	20	8	0	0	26	11	0	0	90
Florida International	60	20	8	15	10	25	5	30	35	20	2	45	45	45	7	95
Gannon	5	5	0	10	0	2	0	15	0	0	0	25	0	2	0	50
Georgia Inst. of Technology	30	25	7	12	13	8	0	40	50	0	0	52	63	8	0	75
Gonzaga	6	16	0	0	0	25	0	0	0	4	0	0	0	29	0	86
Houston	20	35	6	10	0	8	1	15	4	5	0	25	4	13	1	90
Howard	10	5	2	3	0	0	0	3	2	0	0	6	2	0	0	75
Idaho	22	19	2	5	0	30	9	11	6	7	2	16	6	37	11	86
Illinois at Urbana-Champaign	80	13	8	12	11	1	1	16	18	1	0	28	29	2	1	75
Illinois Inst. of Technology	10	40	4	1	0	10	0	50	20	0	0	51	20	10	0	60
Indiana, Purdue Indianapolis	3	2	0	1	0	0	0	2	0	0	0	3	0	0	0	60
Iowa State	50	1	4	1	6	0	0	2	19	0	0	3	25	0	0	80
John Brown	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70
Kansas State	15	10	4	1	3	25	2	6	5	0	0	7	8	25	2	80
Kennesaw State	8	2	0	0	0	1	0	1	0	0	0	1	0	1	0	95
Kentucky	20	9	3	5	0	0	2	10	10	0	0	15	10	0	2	90

University	Est. Degrees Granted			Domestic Graduate Student Enrollment				International Graduate Student Enrollment				Total Graduate Student Enrollment				Est. Domestic Undergraduate Enrollment
				FT		PT		FT		PT		FT		PT		
	U	M	D	M	D	M	D	M	D	M	D	M	D	M	D	%
Lake Superior State	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
Lamar	25	50	5	3	1	2	0	45	4	0	0	48	5	2	0	80
Lawrence Technological	8	1	0	0	0	2	0	0	0	0	0	0	0	2	0	80
Louisiana State, A&M College	30	4	2	2	2	0	0	10	10	0	0	12	12	0	0	90
Maine	22	1	2	0	0	0	0	1	2	0	0	1	2	0	0	90
Marquette	5	3	2	2	2	2	1	3	5	0	0	5	7	2	1	100
Maryland College Park	60	10	5	5	5	1	0	5	15	0	0	10	20	1	0	90
Massachusetts Inst. of Tech.	4	10	10	10	15	0	0	10	15	0	0	20	30	0	0	50
McGill	15	8	4	2	5	2	0	10	10	0	0	12	15	2	0	70
Memorial, Newfoundland	10	8	1	1	2	2	1	17	13	2	0	18	15	4	1	90
Memphis	15	5	5	3	1	2	1	7	5	1	2	10	6	3	3	95
Miami	5	2	0	5	0	0	0	4	0	0	0	9	0	0	0	85
Michigan State	20	7	4	3	8	0	2	2	14	0	0	5	22	0	2	80
Michigan Tech.	42	20	2	2	1	16	4	95	15	7	0	97	16	23	4	88
Michigan, Ann Arbor	15	15	3	5	7	3	0	20	9	0	0	25	16	3	0	70
Michigan, Dearborn	30	10	3	20	0	20	0	40	5	10	5	60	5	30	5	70
Minnesota State, Mankato	5	4	0	5	0	0	0	35	0	5	0	40	0	5	0	75
Minnesota, Twin Cities	50	15	3	3	2	6	5	2	9	0	0	5	11	6	5	75
Mississippi State	10	8	6	3	3	3	3	8	13	0	0	11	16	3	3	100
Missouri of Science and Tech.	35	18	3	8	4	10	0	38	24	0	0	46	28	10	0	95
Missouri, Columbia	32	4	0	6	2	15	4	24	29	28	29	30	31	43	33	75
Missouri, Kansas City	16	13	0	1	0	2	0	28	3	0	0	29	3	2	0	90
Montana State, Bozeman	12	3	2	4	1	0	0	0	1	0	0	4	2	0	0	90
Nebraska, Lincoln	20	2	4	3	2	0	0	3	24	0	0	6	26	0	0	85
Nevada, Reno	10	3	1	2	0	0	0	2	5	0	0	4	5	0	0	85
New Haven	5	25	0	2	0	0	0	30	0	0	0	32	0	0	0	100
New Jersey Inst. of Tech.	20	28	5	7	1	3	1	18	3	0	0	25	4	3	1	90
New Mexico State	15	12	5	7	2	1	0	13	6	0	0	20	8	1	0	90
New York Polytechnic	15	40	6	5	2	10	3	60	20	0	0	65	22	10	3	80
North Carolina State, Raleigh	45	30	8	15	6	4	2	35	40	8	4	50	46	12	6	95
North Carolina, Charlotte	9	5	3	5	5	2	1	15	25	0	0	20	30	2	1	85
North Dakota	22	5	3	8	2	0	0	30	15	0	0	38	17	0	0	90
North Dakota State	25	1	0	0	0	0	0	2	7	0	0	2	7	0	0	98
Northeastern	10	15	2	3	1	3	0	30	10	0	0	33	11	3	0	80
Northern Arizona	2	2	0	0	0	0	0	1	0	0	0	1	0	0	0	50
Ohio Northern	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90
Ohio State	60	36	6	5	3	2	0	43	25	0	0	48	28	2	0	80
Oklahoma	20	8	5	3	1	0	1	7	3	0	0	10	4	0	1	100
Oklahoma State	15	3	3	0	0	2	0	10	8	4	0	10	8	6	0	70
Old Dominion	30	15	0	3	2	7	0	5	3	0	0	8	5	7	0	90
Oregon State	50	12	6	12	8	0	0	10	6	0	0	22	14	0	0	80
Pacific	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95
Pennsylvania State, Harrisburg	12	4	0	0	0	2	0	5	0	0	0	5	0	2	0	60
Pittsburgh	35	15	5	17	8	20	5	3	2	0	0	20	10	20	5	80
Portland State	20	12	0	10	1	20	3	4	0	0	0	14	1	20	3	80
Purdue Northwest	10	3	0	0	0	2	0	0	0	4	0	0	0	6	0	30
Purdue, West Lafayette	30	5	5	4	3	0	0	15	7	0	0	19	10	0	0	65

University	Est. Degrees Granted			Domestic Graduate Student Enrollment				International Graduate Student Enrollment				Total Graduate Student Enrollment				Est. Domestic Undergraduate Enrollment
				FT		PT		FT		PT		FT		PT		
	U	M	D	M	D	M	D	M	D	M	D	M	D	M	D	%
Rensselaer Polytechnic Inst.	15	5	4	1	3	0	0	2	15	0	0	3	18	0	0	90
Ryerson	80	5	5	10	10	0	0	2	2	0	0	12	12	0	0	98
San Jose State	10	5	0	10	0	5	0	15	0	0	0	25	0	5	0	90
Santa Clara	5	7	1	15	0	6	0	10	0	7	0	25	0	13	0	100
Saskatchewan	30	15	3	4	4	4	0	35	6	5	0	39	10	9	0	90
Seattle	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
South Carolina	15	4	3	5	4	4	3	0	12	0	0	5	16	4	3	90
South Dakota State	15	5	1	0	0	0	0	5	1	0	0	5	1	0	0	99
South Dakota, Mines and Tech.	9	0	0	0	0	0	0	2	0	0	0	2	0	0	0	90
South Florida	50	60	5	10	0	10	2	50	12	0	0	60	12	10	2	90
Southern Maine	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
St. Thomas	25	10	0	10	0	50	0	17	0	0	0	27	0	50	0	80
Suffolk	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
Syracuse	6	5	1	2	0	2	1	8	4	2	0	10	4	4	1	90
Temple	15	3	0	4	0	2	1	8	2	4	0	12	2	6	1	90
Tennessee State	3	1	1	0	0	2	1	2	2	5	3	2	2	7	4	66
Tennessee, Chattanooga	30	5	0	0	0	5	0	15	0	0	0	15	0	5	0	95
Tennessee, Knoxville	21	4	13	11	11	0	0	8	61	0	0	19	72	0	0	90
Texas A&M	60	30	10	5	5	0	0	30	35	0	0	35	40	0	0	80
Texas at Arlington	86	2	10	4	9	0	0	2	11	0	1	6	20	0	1	84
Texas at Austin	40	10	4	10	20	0	0	10	2	0	0	20	22	0	0	95
Texas at El Paso	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	95
Texas at San Antonio	15	5	1	2	0	0	0	6	5	0	0	8	5	0	0	85
Texas Tech	10	5	3	25	10	0	2	25	15	0	0	50	25	0	2	80
Toronto	50	10	5	20	10	10	0	10	5	5	0	30	15	15	0	75
Tufts	4	3	1	2	0	2	0	3	3	3	0	5	3	5	0	75
US Military Academy	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95
Utah	20	12	0	8	0	0	0	12	10	0	1	20	10	0	1	90
Valparaiso	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85
Vermont	10	2	2	2	8	0	0	1	1	0	0	3	9	0	0	80
Virginia Polytechnic	22	7	5	18	12	5	2	13	4	0	2	31	16	5	4	80
Washington	30	3	3	3	4	20	0	0	15	0	0	3	19	20	0	65
Washington State	40	1	7	1	0	1	0	8	39	0	0	9	39	1	0	85
Waterloo	30	20	30	40	5	100	0	10	25	0	0	50	30	100	0	90
Wayne State	10	6	2	0	0	0	0	1	7	0	2	1	7	0	2	90
West Florida	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95
West Virginia	12	4	2	1	0	0	0	6	8	0	0	7	8	0	0	90
West Virginia Inst. of Tech.	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90
Western Carolina	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Western Ontario	20	5	5	1	1	0	0	8	9	0	0	9	10	0	0	90
Wichita State	30	15	5	5	2	5	1	20	10	0	0	25	12	5	1	75
Wisconsin, Madison	82	26	8	42	10	8	3	39	23	0	0	81	33	8	3	80
Wisconsin, Milwaukee	75	5	3	1	0	20	0	17	7	1	2	18	7	21	2	75
Wisconsin, Platteville	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
Worcester Polytechnic	10	20	0	2	0	30	0	4	1	0	0	6	1	30	0	90
Wyoming	8	4	2	1	2	0	0	4	4	0	0	5	6	0	0	90

Appendix Table 6. Course Offerings by University

Abbreviations used in Appendix Table 6

Level
U: Undergrad; G: Grad

Offered
A: Annually; ET: Every Two Years; T: Twice Annually; O: Occasionally; SP: Special

Requirement
M: Mandatory; E: Elective

Lab
Y – Yes; Empty – No

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Arizona State University								
Advanced Power Electronics	G	A	E	3		60	10	70
Computer Simulation of Power Systems	G	A	E	3		20	0	20
Cyber Security and Privacy in the Smart Grid	G	A	E	3		15	0	15
Electric Energy Markets	G	A	E	3		30	0	30
Electric Power Quality	G	A	E	3		60	8	68
High Power Converters and Drives	G	A	E	3		15	0	15
Operations Research Applied to Electric Power Systems	G	A	E	3		15	0	15
Power Plant Control and Monitoring	G	A	E	3		15	0	15
Power System Dynamics	G	A	E	3		30	8	38
Power System Operation and Control	G	A	E	3		120	10	130
Power System Stability and Control	G	A	E	3		30	8	38
Power System Transients	G	A	E	3		30	7	37
Renewable Electric Energy	G	A	E	3		30	5	35
Renewable Resources	G	A	E	3		30	0	30
Transmission and Distribution	G	A	E	3		60	8	68
Electric Machinery	U	A	E	3		35	0	35
Electric Power Plants	U	A	E	3		35	5	40
Electric Power System Analysis	U	A	E	3		30	0	30
Electronic Power Devices	U	A	E	3		35	0	35
Energy Systems and Power Electronics	U	T	M	4	Y	160	0	160
Power Systems and Power Management	U	A	E	3		30	0	30
Senior Design Project in Power I	U	T	M	2	Y	10	0	10
Senior Design Project in Power II	U	T	M	2	Y	10	0	10
Auburn University								
Electric Machines	G	ET	E	3		12	0	12
Power Electronics	G	ET	E	3		20	0	20
Power System Analysis	G	ET	E	3		15	3	18
Power System Dynamics and Stability	G	ET	E	3		7	0	7
Power System Operation	G	ET	E	3		7	2	9
Power System Protection	G	ET	E	3		15	2	17
Electric Machines	U	ET	E	3		18	0	18
Electric Power Engineering	U	T	M	3		35	0	35
Power Electronics	U	ET	E	3		20	0	20
Power System Analysis	U	ET	E	3		25	0	25
Power System Protection	U	ET	E	3		20	0	20
Baylor University								
Power System Control	G	SP	E	3		5	0	5
Power System Operation	G	SP	E	3		5	0	5
Smart Grid Integration	G	SP	E	3		5	0	5
Power Electronics	U	A	E	3	Y	15	0	15
Power Quality	U	A	E	3		15	0	15
Power Systems	U	A	E	3		15	0	15
Renewable Energy	U	A	E	3		14	0	14
Smart Grid Interface	U	A	E	3		15	0	15
Boise State University								
Electric Machines	G	A	E	3		1	0	1
Power Electronics	G	A	E	3		7	0	7
Power System Analysis I	G	A	E	3		5	0	5
Power System Analysis II	G	A	E	3	Y	0	0	0
Electrical Machines	U	A	E	3		21	0	21
Power Electronics	U	A	E	3		32	0	32
Power System Analysis I	U	A	E	3		24	0	24
Power System Analysis II	U	A	E	3		17	0	17
Buffalo State University								
Operation and Management of Modern Grid	G	A	E	3		12	0	12
Power Systems Analysis I	G	A	E	3	Y	1	0	1
Power Systems Analysis II	G	A	E	3	Y	13	0	13
Renewable Distributed Generation and Storage	G	A	E	3	Y	0	0	0
Smart Grid from System Perspective	G	SP	E	3		0	0	0
Electric Machines	U	A	M	3	Y	24	0	24
Operation and Management of Modern Grid	U	A	E	3		8	0	8
Power Electronics	U	A	M	3	Y	17	0	17
Power Systems I	U	A	M	3	Y	17	0	17
Power Systems II	U	A	M	3	Y	20	0	20
Renewable Distributed Generation and Storage	U	A	E	3	Y	8	0	8
Smart Grid from Systems Perspective	U	SP	E	3		3	0	3
California Polytechnic State University, San Luis Obispo								
Advanced Analysis of Power Systems (EE 519)	G	ET	E	4		18	0	18
Advanced Topics in Power Electronics (EE 527)	G	ET	E	4		32	0	32
Electric Machines Theory (EE 511)	G	ET	E	4		12	0	12
Power System Protection (EE 518)	G	ET	E	4		24	0	24
Solar-Photovoltaic Systems Design (EE 520)	G	A	E	4		32	0	32
Alternating Current Machines (EE 417)	U	A	E	3		36	0	36
Alternating Current Machines Lab (EE 417)	U	A	E	1	Y	36	0	36
Automotive Engineering for a Sustainable Future (EE 434)	U	A	E	3		24	0	24
Automotive Engineering for a Sustainable Future Lab (EE 434)	U	A	E	1	Y	24	0	24
Energy Conversion Electromagnetics (EE 255)	U	T	M	3		72	0	72
Energy Conversion Electromagnetics Laboratory (EE 295)	U	T	M	1	Y	72	0	72
Introduction to Magnetic Design (EE 433)	U	ET	E	3		36	0	36
Introduction to Magnetic Design Lab (EE 433)	U	ET	E	1	Y	36	0	36
Power Electronics I (EE 410)	U	A	E	3		54	0	54
Power Electronics I Lab (EE 410)	U	A	E	1	Y	54	0	54
Power Electronics II (EE 411)	U	A	E	3		36	0	36
Power Electronics II Lab (EE 411)	U	A	E	1	Y	36	0	36

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Power Systems Analysis I (EE 406)	U	A	E	3		36	0	36
Power Systems Analysis II (EE 407)	U	A	E	3		36	0	36
Power Systems Laboratory (EE 444)	U	T	E	1	Y	16	0	16
Sustainable Electric Energy Conversion (EE 420)	U	A	E	3		36	0	36
Sustainable Electric Energy Conversion Lab (EE 420)	U	A	E	1	Y	36	0	36
California State University, Fresno								
Advanced Power Electronics	G	SP	E	3		20	0	20
Renewable Energy	G	SP	E	3		20	0	20
Advanced Power Electronics	U	SP	E	3		5	0	5
Electric Machines	U	A	M	3	Y	35	0	35
Power Electronics	U	ET	E	3		35	0	35
Power Systems	U	ET	E	3		35	0	35
Relays and Protection	U	ET	E	3		16	0	16
Renewable Energy	U	SP	E	3		10	0	10
California State University, Northridge								
Power Distribution	G	A	E	3		15	0	15
Power Electronics	G	A	E	3	Y	33	0	33
Power Transmission Lines	G	A	E	3		33	0	33
Protective Relaying	G	A	E	3		15	0	15
Renewable Energy	G	A	E	3		30	0	30
Short Circuit Analysis	G	A	E	3		15	0	15
Electrical Machines and Energy Conversion	U	A	E	4	Y	33	0	33
Power Electronics	U	A	E	3	Y	33	0	33
Power Transmission Lines	U	A	E	3		33	0	33
California State University, Sacramento								
Advanced Analysis of Faulted Power Systems	G	A	M	3		15	0	15
Advanced Power Systems Protection	G	SP	E	3		15	0	15
Advanced Topics in Power Systems	G	SP	E	3		15	0	15
Control and Stability of Power Systems	G	A	E	3		15	0	15
Future Power Systems and Smart Grids	G	A	E	3		15	0	15
Large Interconnected Power Systems	G	A	E	3		15	0	15
Power System Economics and Dispatch	G	A	E	3		15	0	15
Power System Reliability and Planning	G	SP	E	3		15	0	15
Wind Energy Electrical Conversion Systems	G	A	E	3		15	0	15
Electric Power Distribution	U	T	E	3		35	0	35
Electrical Power Design Project I	U	T	M	2		35	0	35
Electrical Power Design Project II	U	T	M	2		35	0	35
Electromechanical Conversion	U	T	M	3		35	0	35
Electromechanics Laboratory	U	T	E	1	Y	15	0	15
Energy Systems Control and Optimization	U	T	M	3		35	0	35
Power Electronics Controlled Drives	U	A	E	3		35	0	35
Power Electronics Laboratory	U	A	E	1	Y	15	0	15
Power System Analysis	U	T	M	3		35	0	35
Power System Laboratory	U	T	M	1	Y	15	0	15
Power System Operation and Control Laboratory	U	SP	E	1	Y	15	0	15
Power System Relay Protection and Laboratory	U	A	E	4	Y	35	0	35
Renewable Electrical Energy Sources and Grid Integration	U	A	E	3		35	0	35
Smart Electric Power Grid	U	A	E	3		35	0	35
Carnegie Mellon University								
Introduction to Solar Arrays: Modeling, Analysis and Design	G	ET	E	12	Y	5	0	5
Large Scale Dynamic Systems	G	ET	E	12		20	0	20
Optimization in Electric Energy Systems	G	A	E	12		20	0	20
Power Electronics for Electric Power Systems	G	ET	E	12		10	0	10

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
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Smart Grids and Future Electric Energy Systems	G	A	E	12		20	0	20
Computational Methods in Smart Grids	U	A	E	12		18	0	18
Electric Energy Processing: Fundamentals and Applications	U	ET	E	12		20	0	20
Electrical Energy Conversion, Control and Management (capstone course)	U	A	E	12	Y	10	0	10
Fundamentals in Electric Power Systems	U	A	E	12		20	0	20
Case Western Reserve University								
Distribution System Analysis	G	ET	E	3		5	0	5
Power System Analysis I	G	A	E	3		17	0	17
Power System Analysis II	G	A	E	3		7	0	7
Relay Protection	G	ET	E	3		5	0	5
Smart Grid	G	ET	E	3		10	0	10
Distribution System Analysis	U	ET	E	3		5	0	5
Power System Analysis I	U	A	E	3		17	0	17
Power System Analysis II	U	A	E	3		7	0	7
Relay Protection	U	ET	E	3		5	0	5
Smart Grid	U	ET	E	3		10	0	10
Clarkson University								
Advanced Electric Machines and Drives	G	ET	E	3		5	1	6
Alternate Energy Systems	G	A	E	3		2	1	3
Deregulated Power Systems	G	ET	E	3		9	0	9
Dielectrics	G	ET	E	3		7	0	7
High Voltage Techniques and Measurements	G	ET	E	3		5	2	7
Power System Planning	G	ET	E	3		6	2	8
Power System Protection	G	ET	E	3		5	5	10
Alternate Energy Systems	U	A	E	3		33	0	33
Dielectrics	U	ET	E	3		28	0	28
Energy Conversion	U	A	M	3		60	0	60
High Voltage Techniques and Measurements	U	ET	E	3		21	0	21
Power Systems Engineering	U	A	E	3		33	0	33
Power Transmission and Distribution	U	A	E	3		23	0	23
Clemson University								
Electric Machines and Drives	G	A	E	3		42	5	47
Electric Motor Control	G	ET	E	3		10	0	10
Electric Machines and Drives	U	A	E	3		1	0	1
Electric Power Engineering	U	T	M	3		50	0	50
Power System Analysis	U	A	E	3		25	0	25
Cleveland State University								
Power Electronics and Electric Machines	G	A	E	4		25	0	25
Power Electronics II	G	A	M	4		50	0	50
Power Systems	G	A	M	4		50	0	50
Power Systems Control	G	ET	E	4		25	0	25
Power Systems Operations	G	A	E	4		25	0	25
Electro-Mechanical Energy Conversion	U	A	M	3		55	0	55
Power Electronics	U	A	M	3	Y	55	0	55
Colorado School of Mines								
Advanced Electrical Machine Dynamics	G	ET	E	3		20	0	20
Advanced High Power Electronics	G	ET	E	3		20	0	20
Communication Networks for Power Systems	G	ET	E	3		10	0	10
Design and Control of Wind Energy System	G	ET	E	3		20	0	20
Power Distribution Systems Engineering	G	ET	E	3		20	0	20
Power Quality	G	ET	E	3		10	0	10
Power System Operation and Management	G	ET	E	3		10	0	10
Power System Risk Management	G	ET	E	3		10	0	10
Renewable Energy and Distributed Generation	G	ET	E	3		10	0	10

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Analysis & Design of Advanced Energy Systems	U	ET	E	3	Y	10	0	10
Computational Methods in Energy Systems and Power	U	A	E	3	Y	10	0	10
Fundamentals of Electric Machinery	U	T	M	4	Y	30	0	30
Introduction to High Power Electronics	U	A	E	3		20	0	20
Power System Analysis	U	A	E	3		20	0	20
Colorado State University								
Electric Power Engineering	G	A	E	3		20	10	30
Electric Power Quality	G	ET	E	3		10	5	15
Grid Integration of Wind Energy Systems	G	ET	E	3		10	5	15
Introduction to Electric Power Markets	G	ET	E	3		20	5	25
Power Electronics I	G	SP	E	3		15	0	15
Signal Processing for Power Systems -1	G	A	E	3		10	0	10
Signal Processing for Power Systems -2	G	ET	E	3		5	2	7
Electrical Energy Generation Technologies	U	A	E	3		20	0	20
Power Systems I	U	A	E	3	Y	25	0	25
Concordia University								
Controlled Electric Drives	G	A	E	4	Y	47	0	47
Power Electronics I	G	A	M	4	Y	65	0	65
Power Electronics II	G	A	E	4	Y	40	0	40
Control of Electrical Power Conversion Systems	U	A	M	4	Y	15	0	15
Electrical Engineering Project	U	T	M	4	Y	25	0	25
Electrical Power Equipment	U	A	E	4	Y	10	0	10
Electrical Power Systems	U	A	M	4	Y	15	0	15
Fundamentals of Electrical Power Engineering	U	A	M	4	Y	20	0	20
Power Electronics	U	A	E	4	Y	25	0	25
Cornell University								
Advanced Power Systems	G	ET	E	4		20	0	20
Advanced Power Systems	U	A	E	4		40	0	40
Power Systems I	U	A	E	4		40	0	40
Drexel University								
AC-DC/DC-AC Power Electrical Conversion	G	A	E	3	Y	12	0	12
Computer Analysis of Power Systems	G	A	E	3		15	0	15
Economic Operation of Power Systems	G	A	E	3		0	13	13
Modeling & Analysis of Power Distribution Systems	G	ET	E	3	Y	20	0	20
Power Distribution Automation and Control	G	ET	E	3	Y	20	0	20
Power Electronic Applications	G	ET	E	3	Y	4	0	4
Power Electronic Experiments	G	A	E	3	Y	9	0	9
Power System Analysis	G	A	E	3		17	8	25
Power System Dynamic Security	G	A	E	3		0	2	2
Power System Dynamics	G	A	E	3		0	13	13
Protective Relaying	G	A	E	3	Y	8	0	8
Protective Relaying Laboratory	G	A	E	3	Y	8	0	8
Service and Power Quality in Distribution Systems	G	ET	E	3	Y	16	0	16
Solid State Protective Relaying	G	A	E	3	Y	13	0	13
Synchronous Machine Modeling	G	A	E	3		13	0	13
Applications of Power Electronic Converters	U	ET	E	3	Y	0	0	0
Electric Motor Control Principles	U	T	M	4	Y	71	0	71
Energy Management Principles	U	T	E	4	Y	39	0	39
Experimental Study of Power Electronic Converters	U	ET	E	3	Y	6	0	6
Introduction to Renewable Energy	U	T	E	3		0	64	64
Modeling and Analysis of Electric Power Distribution Systems	U	ET	E	3	Y	15	0	15
Power Distribution Automation and Control	U	ET	E	3	Y	15	0	15
Power Electronic Converter Fundamentals	U	ET	E	3	Y	11	0	11

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Power Systems I	U	A	M	3		45	0	45
Power Systems II	U	A	M	4	Y	38	0	38
Power Systems III	U	A	M	3		18	0	18
Protective Relay Laboratory	U	A	E	3	Y	5	0	5
Protective Relaying	U	A	E	3	Y	5	0	5
Service and Power Quality Distribution Systems	U	A	E	3	Y	14	0	14
Solar Energy Engineering	U	A	E	3		0	32	32
Solid State Protective Relaying	U	A	E	3	Y	4	0	4
FAMU-FSU College of Engineering								
Electrical Machine Design	G	SP	E	3		8	0	8
Electromechanical Dynamics	G	ET	E	3		30	0	30
Integration of Distributed Generation	G	ET	E	3		12	0	12
Introduction to Energy Storage	G	A	E	3		25	3	28
Power Conversion and Control	G	ET	E	3		15	0	15
Power Electronics	G	A	E	3		20	0	20
Power Systems Analysis	G	A	E	3		15	0	15
Power Systems Transients	G	ET	E	3		10	0	10
Protective Relaying	G	SP	E	3		8	0	8
Renewable Energy I	G	ET	E	3		15	0	15
Superconducting Power Apparatus	G	SP	E	3		5	0	5
Converter Modeling and Control	U	A	E	3		20	0	20
Electrical Machine Design	U	ET	E	3		8	0	8
Electromechanical Dynamics	U	A	E	3		30	0	30
Fundamentals of Power Systems	U	A	E	3		50	0	50
Integration of Distributed Generation	U	ET	E	3		12	0	12
Introduction to Energy Storage	U	A	E	3		30	5	35
Power Conversion and Control	U	ET	E	3		30	0	30
Power Electronics	U	A	E	3		50	0	50
Power Systems Analysis	U	A	E	3		30	0	30
Power Systems I	U	A	E	3		15	0	15
Power Systems Lab	U	A	E	1	Y	30	0	30
Power Systems Transients	U	SP	E	3		10	0	10
Renewable Energy I	U	ET	E	3		15	0	15
Superconducting Power Devices	U	ET	E	3		6	0	6
Florida International University								
Electric Drives	G	ET	E	3		20	5	25
Electric Transients in Power Systems	G	ET	E	3		15	5	20
Intelligent Systems Application	G	ET	E	3		20	5	25
Power Quality	G	ET	E	3		20	5	25
Power System Engineering	G	ET	E	3		20	5	25
Power System Protection	G	ET	E	3		20	5	25
Power System Stability and Control	G	ET	E	3		20	5	25
Power Systems Reliability	G	ET	E	3		20	5	25
Renewable Energy Utilization	G	A	E	3	Y	25	5	30
Power Electronics (EEL4241)	U	ET	E	3	Y	25	5	30
Power Systems I (EEL4213)	U	T	M	3	Y	70	15	85
Power Systems II (EEL4214)	U	A	E	3		45	5	50
Power Systems III (EEL4215)	U	A	E	3		45	5	50
Gannon University								
Electric Machine Design	G	A	E	3		7	0	7
Integrating Renewable Energy Into Electrical Power Systems	G	A	E	3		20	0	20
Modelling and Analysis of Electric Drives	G	A	E	3		7	0	7
Integrating Renewable Energy Into Electrical Power Systems	U	A	E	3		0	0	0
Intro to Electric Drives	U	A	M	3	Y	17	0	17
Power System Analysis	U	A	E	3		5	0	5

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Georgia Institute of Technology								
Dynamics and Control of Electric Machine Drives	G	ET	E	3		25	10	35
Electric Machinery Analysis	G	ET	E	3		25	10	35
Electric Power Quality	G	ET	E	3		25	0	25
Power Electronic Circuits	G	ET	E	3		25	10	35
Power Electronics CAD Laboratory	G	ET	E	1		25	0	25
Power System Planning and Reliability	G	ET	E	3		25	10	35
Power System Stability	G	ET	E	3		25	10	35
Power Systems Control and Operation	G	A	E	3		25	10	35
Electric Energy Systems	U	T	M	3	Y	250	0	250
Electric Machinery Analysis	U	ET	E	3		10	0	10
Electric Power Quality	U	ET	E	3		25	0	25
Electromechanical and Electromagnetic Energy Conversion	U	T	E	3		35	0	35
Power Electronics	U	A	E	3		30	0	30
Power System Analysis & Control	U	A	E	3		25	0	25
Power System Engineering	U	A	E	3		30	0	30
Gonzaga University								
Electrical Distribution System Design	G	A	M	3		0	11	11
Electrical Grid Operations	G	A	M	3		0	12	12
Engineering Leadership	G	A	M	3	Y	0	11	11
Power System Analysis	G	A	M	3		0	13	13
Project Development and Construction Methods	G	A	M	3		0	9	9
Substation Design	G	T	M	3		0	9	9
System Automation	G	A	M	3		0	11	11
System Protection	G	A	M	3		0	9	9
Transmission Line Design - Advanced	G	A	E	3		0	9	9
Transmission Line Design - Electrical Aspects	G	A	M	3		0	9	9
Transmission Line Design - Introduction	G	A	M	3		0	6	6
Transmission Line Design - Structures	G	SP	E	3		0	11	11
Underground System Design	G	A	M	3		0	11	11
Utility Communications	G	A	E	3		0	9	9
Electric Power Distribution System Engineering	U	A	E	3		6	0	6
Introduction to Electric Power Engineering	U	A	M	4	Y	28	0	28
Power Systems Analysis	U	A	E	3		10	0	10
Special Topics - Protective Relaying	U	SP	E	3		6	0	6
Howard University								
Computer and Safety Critical System	G	A	M	3	Y	8	0	8
Energy Processing and Smart Grid	G	A	M	3	Y	4	0	4
Optimization Theory and Application	G	A	M	3		4	0	4
Power Communication and Control	G	A	M	3	Y	5	0	5
Energy Conversion	U	A	M	5	Y	14	0	14
Energy Processing and Smart Grid	U	A	E	3	Y	4	0	4
Power Communication and Control	U	A	E	3	Y	5	0	5
Power Electronics	U	A	E	3	Y	5	0	5
Power System Analysis	U	A	E	3	Y	5	0	5
Illinois Institute of Technology								
Control and Operation of Electric Power Systems	G	ET	E	3		38	18	56
Deregulated Power Systems	G	ET	E	3		27	18	45
Elements of Sustainable Energy	G	ET	E	3		28	9	37
Fault-Tolerant Power Systems	G	ET	E	3		18	13	31
Microgrid Design and Operation	G	ET	E	3		29	0	29
Power Market Economics and Security	G	ET	E	3		29	4	33
Power Market Operations	G	ET	E	3		41	12	53
Power System Planning	G	ET	E	3		36	18	54

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
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Power System Reliability	G	ET	E	3		23	6	29
Power System Transaction Management	G	ET	E	3		21	9	30
Analytical Methods in Power Systems	U	A	E	3		20	7	27
Fundamentals of Power Engineering	U	T	M	4	Y	29	0	29
Power System Analysis	U	A	E	4	Y	32	7	39
Indiana University - Purdue University Indianapolis								
Advanced Power Electronics Converters	G	A	E	3		20	0	20
Computational Methods for Power System Analysis	G	A	E	3		17	0	17
Energy Conversion	G	A	E	3		20	0	20
Smart Grid	G	A	E	3		24	0	24
Electromechanical Motion Devices	U	A	E	3		25	0	25
Elements of Power System Engineering	U	A	E	3		22	0	22
Power Electronics	U	A	E	3		30	0	30
Iowa State University								
Electromechanical Wind Energy Conversion and Grid Integration	G	ET	E	3		20	13	33
Energy System Planning	G	SP	E	3		18	12	30
Power System Dynamics	G	ET	M	3		11	0	11
Seminar in Electric Power	G	T	M	1		30	0	30
Steady State Analysis	G	ET	M	3		17	0	17
Wind Energy Resources	G	SP	E	3		15	0	15
Wind Energy Systems Seminar	G	SP	E	3		25	0	25
Economic Systems for Electric Power Planning	U	ET	E	3		25	0	25
Electrical Machines and Power Electronic Drives	U	A	E	3	Y	31	0	31
Electromechanical Wind Energy Conversion and Grid Integration	U	ET	E	3		20	13	33
Energy Systems and Power Electronics	U	T	M	3		77	0	77
Introduction to Energy Distribution Systems	U	A	E	3		33	0	33
Power System Analysis I	U	A	E	3		48	0	48
Power System Analysis II	U	A	E	3		45	0	45
John Brown University								
Power Electronics	U	ET	E	3	Y	25	0	25
Power Systems	U	ET	E	3		28	0	28
Kansas State University								
Advanced Power Electronics	G	SP	E	3		12	12	24
Distribution System Engineering	G	SP	E	3		11	16	27
Power Quality	G	SP	E	3		9	0	9
Power System Stability	G	SP	E	3		9	27	36
Energy Conversion	U	T	M	3		18	0	18
Power Electronics	U	A	E	3		28	15	43
Power Lab	U	A	M	3	Y	28	0	28
Power System Design	U	A	M	3		33	0	33
Power System Protection	U	A	E	3		25	0	25
Wind and Solar Energy	U	A	E	3	Y	17	11	28
Kennesaw State University								
Electric Drives	U	A	E	3	Y	16	0	16
Electric Machines	U	T	M	4	Y	36	0	36
Electric Power Systems	U	ET	E	3		18	0	18
Power Electronics	U	A	E	3	Y	20	0	20
Lake Superior State University								
Electro-Mechanical Systems	U	ET	M	4	Y	8	0	8
Energy Systems & Sustainability	U	ET	E	4	Y	10	0	10
Power Distribution/Transmission	U	ET	E	3		6	0	6
Power Electronics	U	A	M	4	Y	6	0	6
Vehicle Energy Systems	U	ET	E	3	Y	8	0	8

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Lamar University								
Electric Machines and Power Electronic Drives	G	A	E	3	Y	20	15	35
Electric System Modeling	G	A	E	3		0	20	20
Power Electronics	G	A	E	3		20	10	30
Power System Monitoring and Protection	G	A	E	3		10	15	25
Power System Stability and Control	G	A	E	3		15	15	30
Renewable Energy Generation	G	A	E	3		10	20	30
Electric Machines and Power Electronic Drives	U	A	E	3	Y	20	15	35
Electric System Modeling	U	A	E	3		0	20	20
Fundamentals of Power Engineering	U	A	M	4	Y	20	20	40
Power Electronics	U	A	E	3		15	10	25
Power System Monitoring and Protection	U	A	E	3		10	10	20
Power System Stability and Control	U	A	E	3		20	10	30
Lawrence Technological University								
Power Electronics	G	A	E	4	Y	5	0	5
Power Systems Analysis	G	A	E	4		8	0	8
Electrical Machinery	U	A	M	3		6	0	6
Electrical Machinery Lab	U	A	M	1	Y	6	0	6
Introduction to Electrical Systems	U	A	M	3		6	0	6
Introduction to Electrical Systems Lab	U	A	M	1	Y	6	0	6
Power Electronics	U	A	E	3	Y	10	0	10
Louisiana State University and A&M College								
Advanced Compensator Design	G	A	E	3		7	0	7
Advanced Electric Drives	G	A	E	3		12	0	12
Advanced Electric Machines	G	A	E	3		3	0	3
Advanced Power System Protection	G	A	E	3		9	0	9
Dynamics of Microgrids	G	ET	E	3		8	0	8
Harmonics in Power Systems	G	A	E	3		10	0	10
Power System Intelligent Control	G	ET	E	3		5	0	5
Power Systems Operation and Optimization	G	SP	E	3		7	0	7
Sensorless Drives	G	SP	E	3		15	0	15
Adjustable Speed Drives	U	A	E	3	Y	14	0	14
Electric Machine Design	U	A	E	3	Y	22	0	22
Harmonic Filter Design With Lab	U	A	E	3	Y	20	0	20
Introduction to Electric Power	U	T	E	3		33	0	33
Modeling & Analysis of Smart Power System	U	ET	E	3		12	0	12
Power Electronics	U	A	E	3	Y	26	0	26
Power System Modeling and Analysis With Lab	U	ET	E	3	Y	33	0	33
Power System Operations & Control	U	A	E	3	Y	33	0	33
Power System Protection With Lab	U	A	E	3	Y	24	0	24
Power System Reliability	U	A	E	3		40	0	40
Marquette University								
Design and Analysis of Electric Motor Drive Systems	G	A	E	3		25	0	25
Developments in Energy and Power	G	SP	E	3		3	0	3
Electric Energy Systems Analysis	G	ET	E	3		15	0	15
Power Electronics	G	A	E	3	Y	25	0	25
Protection and Monitoring of Electric Energy Systems	G	ET	E	3		15	0	15
Transients in Electric Energy Systems	G	ET	E	3		15	0	15
Electric Drives	U	A	M	3		60	0	60
Massachusetts Institute of Technology								
Advanced Topics in Power Electronics	G	SP	E	12	Y	30	0	30
Electric Machines	G	ET	E	12		15	0	15
Engineering Economics and Regulation of the Electric Power Sector	G	SP	E	12		10	0	10
Intro to Electric Power Systems	G	A	E	12		10	0	10
Power Electronics	G	A	E	12		65	0	65
Introduction to Electric Power Systems	U	A	E	12		10	0	10
Power Electronics Laboratory	U	A	E	12	Y	30	0	30
McGill University								
Flexible AC Transmission Systems	G	ET	E	3		15	0	15
Introduction to Power Electronics	G	A	E	3		15	0	15
Power System Operation and Planning	G	A	E	3		20	0	20
Distribution Networks	U	A	E	3	Y	5	0	5
Electric Power Generation	U	A	E	3	Y	15	0	15
Electromechanical Energy Conversion	U	A	E	3		15	0	15
Industrial Power Systems	U	A	E	3	Y	5	0	5
Power Electronic Systems	U	A	E	3		10	0	10
Power Engineering	U	T	M	3		150	0	150
Power Laboratory	U	A	E	2	Y	30	0	30
Power System Analysis	U	A	E	3		25	0	25
Power System Apparatus	U	A	E	3	Y	5	0	5
Power System Protection	U	A	E	3	Y	5	0	5
Power System Transients	U	A	E	3	Y	5	0	5
Memorial University of Newfoundland								
Advanced Electric Machines	G	ET	E	3		5	0	5
Advanced Power Electronics	G	A	E	3	Y	5	0	5
Renewable Energy Systems	G	A	E	3	Y	15	0	15
Electro Mechanical Devices	U	A	M	3	Y	26	0	26
Power Electronics	U	A	E	3	Y	10	0	10
Power System Analysis	U	A	E	3	Y	20	0	20
Power System Operation	U	A	E	3	Y	8	0	8
Renewable Energy	U	A	E	3	Y	20	0	20
Rotating Machines	U	A	M	3	Y	26	0	26
Miami University								
Electric Machinery and Drives	G	A	E	3	Y	2	0	2
Power Electronics	G	A	E	3		6	0	6
Power Systems Engineering	G	A	E	3		8	0	8
Electric Machinery and Drives	U	ET	E	3		20	0	20
Energy Systems Engineering	U	A	E	3		20	0	20
Power Electronics	U	A	E	3	Y	30	0	30
Power Systems Engineering	U	ET	E	3		33	0	33
Michigan State University								
AC Machines Design	G	ET	E	3		6	0	6
Advanced Power Electronics	G	A	M	3		16	0	16
Control of AC Machines	G	ET	E	3		7	0	7
Power System Reliability	G	ET	E	3		10	0	10
Power System Stability and Control	G	ET	E	3		10	0	10
Energy Conversion / Power Electronics	U	T	M	3		40	0	40
Power Laboratory	U	A	E	1	Y	14	0	14
Power Systems Analysis	U	A	E	3		40	0	40
Solid State Power Conversion	U	A	E	3		15	0	15
Michigan Technological University								
Advanced Electric Machines	G	ET	E	3		18	12	30
Advanced Methods in Power System Analysis	G	A	E	3		40	5	45
Advanced Power Electronics	G	ET	E	3		16	9	25
Advanced Propulsion Sys for Hybrid Electric Vehicles	G	A	E	3		37	0	37
Advanced Propulsion Systems for Hybrid Electric Vehicles Lab	G	A	E	1	Y	15	0	15
Computer Modeling of Power Systems	G	ET	E	3		42	0	42
Distribution Engineering	G	A	E	3		41	11	52
Introduction to Energy Storage Systems	G	A	E	3		47	0	47

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
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Power System Dynamics	G	SP	E	3		24	0	24
Power System Operations	G	A	E	3		48	6	54
Power System Optimization	G	ET	E	3		9	0	9
Power System Protection	G	ET	E	3		76	18	94
Power System Protection Lab	G	ET	E	1	Y	55	0	55
Solar Photovoltaic Technology	G	A	E	3		21	0	21
Transient Analysis Methods	G	ET	E	3		45	13	58
Wind Power	G	SP	E	3		56	21	77
Electric Energy Systems	U	T	M	3		100	7	107
Intro to Propulsion Systems for Hybrid Electric Vehicles	U	A	E	3		45	0	45
Intro to Propulsion Systems for Hybrid Electric Vehicles Lab	U	A	E	1	Y	12	0	12
Introduction to Electric Machines & Drives	U	A	E	3		50	10	60
Introduction to Electric Machines & Drives Lab	U	A	E	1	Y	26	0	26
Power Electronics	U	A	E	3		50	6	56
Power Electronics Lab	U	A	E	1	Y	19	0	19
Power Engineering Laboratory	U	T	E	1	Y	20	0	20
Power System Analysis 1	U	A	E	3		48	12	60
Power System Analysis 2	U	A	E	3		23	10	33
Minnesota State University, Mankato								
Electrical Power Systems Analysis and Design	G	SP	E	3		10	0	10
Power Electronics	G	SP	E	4	Y	10	0	10
Electrical Power Systems	U	A	M	3	Y	15	0	15
Electrical Power Systems Analysis and Design	U	SP	E	3		20	0	20
Power Electronics	U	SP	E	4	Y	15	0	15
Power Electronics	U	A	E	3	Y	10	0	10
Mississippi State University								
Feedback Control Systems I	G	A	E	3		6	0	6
Fundamentals of High Voltage Engineering	G	A	E	3	Y	5	0	5
Insulation Coordination in Electrical Power Systems	G	A	E	3	Y	0	0	0
Introduction to Power Electronics	G	A	E	3		0	0	0
Power Distribution Systems	G	A	E	3		7	2	9
Power System Stability and Control	G	ET	E	3		16	0	16
Power Systems Operation and Control	G	ET	E	3		0	0	0
Power Transmission Systems	G	A	E	3		6	0	6
Smart Grid	G	SP	E	3		0	0	0
Advanced Electronic Circuits	U	A	E	3		29	0	29
Feedback in Control Systems I	U	A	E	3		4	0	4
Fundamentals of Energy Systems	U	A	M	4	Y	20	0	20
Fundaments of High Voltage Engineering	U	A	E	3	Y	17	0	17
Insulation Coordination in Electric Power Systems	U	A	E	3	Y	0	0	0
Intro to Power Electronics	U	A	E	3		7	0	7
Power Distribution Systems	U	A	E	3		26	2	28
Power Transmission Systems	U	A	E	3		28	0	28
Missouri University of Science and Technology								
Advanced Electric Drive Vehicles	G	ET	E	3		18	3	21
Advanced Power Electronics	G	T	E	3		25	0	25
Advanced Theory of Electric Machines	G	ET	E	3		10	4	14
Computer Methods in Power System Analysis	G	ET	E	3		14	0	14
Power Converter Modeling and Design	G	T	E	3		21	0	21
Power System Operations	G	ET	E	3		16	5	21
Power System Protection	G	ET	E	3		12	5	17
Power System Reliability	G	ET	E	3		15	6	21
Power System Stability	G	ET	E	3		14	0	14
Surge Phenomena in Power Systems	G	ET	E	3		10	4	14
Electric Drive Systems	U	A	E	3		35	0	35
Electric Drive Vehicles	U	A	E	3		35	0	35
Electric Power Quality	U	A	E	3		50	3	53
Electromechanics	U	T	M	3	Y	50	0	50
Power Electronics	U	A	E	3		50	0	50
Power Electronics Laboratory	U	A	E	2	Y	15	0	15
Power System Design and Analysis	U	T	M	3	Y	50	0	50
Montana State University, Bozeman								
Advance Power Electronics	G	ET	E	3		5	0	5
Alternative Energy Distributed Power Generation	G	ET	E	3		3	0	3
Power System Dynamics	G	SP	E	3		4	0	4
Alternative Energy Power Generation	U	ET	E	3		8	0	8
Electromechanical Energy Conversion and Drives	U	A	M	4	Y	35	0	35
Power Electronics	U	ET	E	3	Y	5	0	5
Power System Analysis	U	A	E	3	Y	14	0	14
New Jersey Institute of Technology								
Economic Control of Interconnected Power Systems	G	A	M	3		39	0	39
Power Electronics	G	A	E	3		27	0	27
Power System Steady State Analysis	G	A	M	3		37	0	37
Protection of Power Systems	G	A	E	3		16	0	16
Renewable Energy Systems	G	A	E	3		35	0	35
Transients in Power Systems	G	A	M	3		41	21	62
Electrical Engineering Lab III	U	T	M	3	Y	30	0	30
Energy Conversion	U	T	M	3		50	0	50
Power Systems E	U	A	E	3		15	0	15
Power Systems Lab	U	A	E	2	Y	15	0	15
Renewable Energy Systems	U	A	E	3		15	0	15
New Mexico State University								
Dynamics of Power System	G	ET	E	3		5	2	7
Introduction to Smart Grid	G	A	E	3		7	0	7
Power Distribution Systems	G	A	E	3		10	8	18
Power Electronics	G	ET	E	3		10	0	10
Power System Modeling and Computational Methods	G	ET	E	3		5	2	7
Power System Relaying	G	A	E	3	Y	6	3	9
Power Systems II	G	A	M	3		10	15	25
Power Systems III	G	A	M	3		10	8	18
Introduction to Electric Power System	U	T	M	4	Y	35	0	35
Power Distribution Systems	U	A	E	3		5	0	5
Power Electronics	U	ET	E	3	Y	5	0	5
Power Systems II	U	A	E	3		28	0	28
Power Systems III	U	A	E	3		25	0	25
New York University Polytechnic School of Engineering								
Adjustable Speed Drives	G	ET	E	3		40	0	40
Distributed Generation Systems	G	ET	E	3		30	10	40
Electric Transmission and Distribution Systems	G	ET	E	3		20	0	20
Electronic Power Supplies	G	A	E	3		30	10	40
Finite Elements for Electrical Engineering	G	ET	E	3		15	0	15
Introduction to Electric Power Systems	G	A	E	3		30	10	40
Physics of Alternative Energy	G	ET	E	3		10	0	10
Power Electronics	G	ET	E	3		20	10	30
Power System Stability	G	ET	E	3		20	0	20
Power Systems Economics and Planning	G	A	E	3		20	10	30
Resonant Power Converters	G	ET	E	3		20	0	20

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students: On-Campus	Enrolled Students: Distance Ed.	Enrolled Students: Total
Transients, Surges and Faults in Power Systems	G	ET	E	3		20	0	20
Electric and Hybrid Vehicles	U	A	E	3		15	0	15
Electric Energy Conversion Systems	U	T	E	4	Y	30	0	30
Electrical Engineering Design Project in Power	U	T	E	3		15	0	15
Electrical Power and Machinery	U	A	E	3	Y	15	0	15
Introduction to Electric Power Systems	U	A	E	3		30	10	40
North Carolina State University at Raleigh								
Business of Electric Power Utility	G	A	E	3		35	0	35
Capstone Project	G	A	E	3		30	2	32
Communication and SCADA Systems for Smart Grid	G	A	E	3	Y	35	8	43
Computational Methods for Power Engineering	G	A	E	3		25	0	25
Dynamics and Control of Electric Machines	G	A	E	3		15	5	20
Electric Power Generation: Conventional and Renewable	G	A	E	3	Y	30	10	40
Power Electronics	G	A	E	3	Y	60	15	75
Power Electronics and Utility Applications	G	A	E	3		25	0	25
Power Electronics Design & Packaging	G	A	E	3		25	0	25
Power Engineering Practicum	G	A	E	3		30	3	33
Power System Dynamics	G	A	E	3		35	15	50
Power System Operation and Control	G	A	E	3		50	10	60
Power System Protection	G	A	E	3	Y	30	7	37
Smart Power Distribution Systems	G	A	E	3	Y	45	5	50
Electric Motor Drives	U	A	E	3		35	0	35
Electric Power Systems	U	T	E	3		65	0	65
Power Electronics	U	A	E	3	Y	50	0	50
Power System Analysis	U	A	E	3		45	0	45
Renewable Electric Energy Systems	U	A	E	3	Y	45	0	45
North Dakota State University								
Power Systems Dynamics Stability and Control	G	ET	E	3		7	0	7
Energy Conversion	U	T	M	4	Y	40	0	40
Power Systems Analysis	U	A	E	3		25	0	25
Power Systems Design	U	A	E	3		25	0	25
Northeastern University								
Power Electronics	G	A	E	4	Y	50	0	50
Power System Analysis	G	A	E	4	Y	35	5	40
State Estimation	G	SP	E	4		9	0	9
Sustainable Energy	G	A	E	4	Y	50	0	50
Unbalanced Power Systems	G	A	E	4		35	5	40
Northern Arizona University								
Electric Drives	G	A	E	3	Y	3	0	3
Power Systems	G	ET	E	3	Y	1	0	1
Renewable Energy Systems	G	A	E	4	Y	1	0	1
Electric Drives	U	A	E	3	Y	42	0	42
Power Systems	U	ET	E	3	Y	46	0	46
Renewable Energy Systems	U	A	E	4	Y	44	0	44
Ohio Northern University								
Energy Systems 1	U	A	M	4	Y	15	0	15
Energy Systems 2	U	A	M	3		15	0	15
Photovoltaic and Power Devices	U	A	E	3		9	0	9
Smart Grid	U	A	E	3		11	0	11
Ohio State University								
Advanced Topics of Electric Machines	G	ET	E	3		25	0	25
Advanced Topics of Power Electronics	G	ET	E	3		24	0	24
Advanced Topics of Power Systems	G	ET	E	3		23	0	23
Electric Machines	U	A	E	3		55	0	55

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students: On-Campus	Enrolled Students: Distance Ed.	Enrolled Students: Total
High Voltage Engineering	U	A	E	3	Y	45	0	45
Power Electronics	U	A	E	3		92	0	92
Power Electronics Lab	U	A	E	1	Y	48	0	48
Power System	U	A	E	3		75	0	75
Power System Analysis and Operation	U	A	E	3		43	0	43
Sustainable Energy and Power Systems I	U	T	M	3		180	0	180
Sustainable Energy and Power Systems II	U	A	E	3		45	0	45
Sustainable Energy Lab	U	T	E	1	Y	32	0	32
Oklahoma State University								
Advanced Power Electronics	G	ET	E	3		6	1	7
Direct Energy Conversion	G	A	E	3		8	2	10
Engineering Systems Reliability Evaluation	G	A	E	3		39	5	44
Introduction to Smart Grid	G	A	E	3		3	0	3
Energy, Environment and Economics	U	A	E	3		13	4	17
Power Electronics	U	A	E	3		19	8	27
Power System Analysis	U	A	E	3		21	7	28
Old Dominion University								
Electric Drives	G	A	E	3		30	0	30
Marine Power & Energy Systems	G	A	E	3		30	0	30
Power Electronics	G	A	E	3		30	0	30
Power System Design & Analysis	G	A	E	3		30	0	30
Electrical Power & Machinery	U	A	M	3		50	0	50
Introduction to Electrical Power	U	A	M	3		50	0	50
Marine Power & Energy Systems	U	A	E	3		30	0	30
Motor Drives	U	A	E	3		30	0	30
Power Electronics	U	A	E	3		30	0	30
Power System Design & Analysis	U	A	E	3		30	0	30
Oregon State University								
Contemporary Energy Applications	G	A	M	4		90	0	90
Power Electronics	G	A	E	4	Y	25	0	25
Power System Protection	G	A	E	3		50	0	50
Power Systems Analysis	G	A	E	4		20	0	20
Dynamics of Electromechanical Energy Conversion	U	A	E	4	Y	40	0	40
Electromechanical Energy Conversion	U	A	M	4	Y	60	0	60
Hybrid Electric Vehicles	U	A	E	3		40	0	40
Power Electronics	U	A	E	4	Y	100	0	100
Power Systems Analysis	U	A	E	4		75	0	75
Smart Grid	U	A	E	3		50	0	50
Pennsylvania State University, Harrisburg								
Power Systems Analysis I	G	A	E	3		20	0	20
Power Systems Analysis II	G	ET	E	3		1	0	1
Power Systems Control and Operation	G	ET	E	3		1	0	1
Smart Grid System Evaluation and Modeling	G	ET	E	3		10	0	10
Energy Systems and Conversion	U	A	M	3		35	0	35
Power Electronics	U	A	E	3		20	0	20
Power Systems Analysis I	U	A	E	3	Y	20	0	20
Power Systems Analysis II	U	ET	E	3	Y	1	0	1
Portland State University								
Advanced Power Systems Protection	G	A	M	4		20	0	20
Advanced Topics in Power Systems	G	SP	E	4		20	0	20
Power Operations Fundamentals I	G	SP	E	4		20	0	20
Power Operations Fundamentals II	G	SP	E	4		20	0	20
Power Systems Analysis	G	A	M	4		20	0	20
Power Systems Control	G	SP	E	4		20	0	20
Power Systems Design	G	A	M	4		20	0	20
Power Systems Protection	G	A	M	4	Y	20	0	20

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Analytical Methods for Power Systems	U	A	M	4		30	0	30
Power Systems Design	U	A	M	4		30	0	30
Power Systems I	U	A	M	4	Y	35	0	35
Power Systems II	U	A	M	4	Y	35	0	35
Power Systems Protection	U	A	M	4	Y	30	0	30
Purdue University Northwest								
Advanced Electric Drives	G	ET	E	3	Y	15	0	15
Power Electronics	G	ET	E	3	Y	5	0	5
Power Systems	G	ET	E	3		10	0	10
Electric Machines and Drives	U	A	E	3	Y	16	0	16
Energy Systems	U	A	E	3		15	0	15
Power Electronics	U	A	E	3	Y	13	0	13
Power Systems	U	A	E	3		20	0	20
Renewable Energy Systems	U	ET	E	3		20	0	20
Purdue University, West Lafayette								
Advanced Analysis of Electromechanical Systems	G	ET	E	3		10	0	10
Energy Conversion	G	A	M	3		25	10	35
Magnetic Component Design	G	ET	E	3		15	10	25
Modeling and Simulation of Power System Components	G	ET	E	3		15	10	25
Operation of Modern Power Systems	G	ET	E	3		30	0	30
Electric Drives	U	A	E	3		30	0	30
Electric Vehicles	U	A	E	3		40	0	40
Electromechanics	U	T	E	3	Y	200	50	250
Power Electronics	U	A	E	3	Y	50	0	50
Power Engineering	U	A	E	3		30	0	30
Rensselaer Polytechnic Institute								
Advanced Electrical Drive Systems	G	ET	E	3		2	0	2
Advanced Power Electronics	G	ET	E	3	Y	7	0	7
Advanced Power System Modeling and Control	G	ET	E	3		5	0	5
Computer Methods in EPE	G	ET	E	3		7	0	7
Electric and Magnetic Field in EPE	G	ET	E	3		9	0	9
Power Generation, Operation, and Control	G	ET	E	3		5	0	5
Power Quality	G	ET	E	3		5	0	5
Power System Analysis	G	A	E	3		5	0	5
Surge Phenomenon in EPE	G	ET	E	3		8	0	8
Ultra-Wide-Area Resilient Electric Energy Transmission Systems	G	ET	E	3		7	0	7
Electric Power Laboratory	U	A	E	4	Y	9	0	9
Electrical Energy Systems	U	A	M	3		104	0	104
Electromechanics	U	A	E	3		10	0	10
Fields and Waves II	U	A	E	3		3	0	3
Power Engineering Analysis	U	A	E	3		10	0	10
Semiconductor Power Electronics	U	A	E	3		15	0	15
Ryerson University								
Advanced AC Drives Systems	G	A	E	3		20	0	20
Modelling and Control of Power-Electronic Converters	G	A	E	3		20	0	20
Power Converter Systems	G	A	E	3		20	0	20
Power Systems Stability and Control	G	A	E	3		20	0	20
Switch-Mode Power Supplies	G	A	E	3		20	0	20
Vector Control of Rotating Machines	G	A	E	3		20	0	20
Advanced Electric Drives	U	A	E	3	Y	80	0	80
Alternative Energy Systems	U	A	E	3	Y	80	0	80
Electric Vehicles	U	A	E	3	Y	80	0	80
Energy Conversion	U	A	M	3	Y	80	0	80
Power Systems Analysis	U	A	E	3	Y	80	0	80

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Power Systems Protection and Control	U	A	E	3	Y	80	0	80
San Jose State University								
Advanced Power Electronics	G	A	E	3		15	0	15
Vector Control of AC Machine	G	A	E	3		15	0	15
Electrical Machines	U	A	E	3		20	0	20
Power Electronics	U	A	E	3	Y	25	0	25
Power Systems	U	A	E	3		20	0	20
Santa Clara University								
Characterization of Photovoltaic Devices	G	A	E	2		20	0	20
Design and Fabrication of Photovoltaic Cells	G	A	M	2	Y	24	0	24
Energy Management Systems	G	A	E	2		25	0	25
Energy Storage Systems	G	A	M	2		28	0	28
Introduction to Alternative Energy Systems	G	T	M	2		40	0	40
Introduction to Smart Grid	G	A	M	2		23	0	23
Introduction to Wind Energy Engineering	G	A	M	2		25	0	25
Photovoltaic Devices and Systems	G	A	E	2	Y	15	0	15
Power System Generation	G	T	M	3		25	0	25
Sustainable Energy, Engineering and Ethics	G	A	M	2		10	0	10
Topics in Energy Systems	G	ET	E	2		10	0	10
Energy System Design	U	A	E	4	Y	8	0	8
Power System Analysis	U	A	E	4	Y	10	0	10
Power System Stability and Control	U	A	E	4		8	0	8
Seattle University								
Electric Energy Systems	U	A	M	4		30	0	30
Electromechanical Energy Conversion	U	ET	E	4		40	0	40
Energy Conversion Lab	U	ET	E	2	Y	24	0	24
Power Electronics	U	ET	E	4		20	0	20
Power System Analysis	U	ET	E	4		35	0	35
Power Systems in Developing Countries	U	SP	E	4		15	0	15
Renewable Energy Systems	U	ET	E	4		35	0	35
South Dakota School of Mines and Technology								
Energy Systems	U	A	M	3	Y	30	0	30
Grid Connected Power Electronics	U	SP	E	3	Y	10	0	10
Power Distribution & Transmission	U	SP	E	3		12	0	12
Power Electronics	U	A	E	4	Y	15	0	15
Power Generation	U	SP	E	3		16	0	16
Power Systems I	U	A	E	4	Y	15	0	15
Power Systems II	U	A	E	3		13	0	13
South Dakota State University								
Advanced Power Electronics	G	A	M	4	Y	12	0	12
Advanced Power System	G	A	M	3		15	0	15
Linear Systems Theory	G	A	M	3		5	0	5
Model and Control of Power Electronics Systems	G	A	E	4	Y	10	0	10
Photovoltaic Systems Engineering	G	A	M	4	Y	18	0	18
Power Seminar	G	T	E	1		15	0	15
Wind Energy Systems	G	A	E	3		6	0	6
Applied Photovoltaics and Lab	U	A	E	4	Y	10	0	10
Electromagnetics	U	A	M	4	Y	20	0	20
Electromechanical Systems and Lab	U	A	E	4	Y	20	0	20
Electronics I and Lab	U	A	M	4	Y	20	0	20
Electronics II and Lab	U	A	M	4	Y	20	0	20
Engineering Economics and Management	U	A	E	3		15	0	15
Linear Control Systems	U	A	M	3		20	0	20
Power Systems Analysis and Lab	U	A	E	4	Y	15	0	15
Power Technology Tour	U	ET	E	1		10	0	10

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students On-Campus	Enrolled Students Distance Ed.	Enrolled Students Total
Suffolk University								
Control Systems	U	A	M	4	Y	15	0	15
Labview and Electric Machinery	U	A	E	4	Y	8	0	8
Power Devices and Circuits	U	A	M	4	Y	15	0	15
Power Systems	U	A	M	4		15	0	15
Syracuse University								
Advanced Measurement in Power Engineering	G	SP	E	3	Y	11	0	11
Control of Distributed Generation	G	SP	E	3		6	0	6
Distributed Generation Integration in Smart Grid	G	SP	E	3		7	0	7
Eletromechanical Devices	G	A	E	3	Y	4	0	4
Introduction to Smart Grid	G	SP	E	3		5	0	5
Power Electronics	G	SP	E	3	Y	8	0	8
Power Systems Protection	G	SP	E	3	Y	7	1	8
Sensors and Measurements	G	SP	E	3		4	2	6
Smart Grid Security Seminar	G	SP	E	3		8	0	8
Smart Grid: Security, Privacy and Economics	G	SP	E	3		14	0	14
Distributed Generation Integration in Smart Grid	U	SP	E	3		5	0	5
Eletromechanical Devices	U	A	E	3	Y	23	0	23
Introduction to Power Engineering	U	A	M	3	Y	27	0	27
Introduction to Smart Grid	U	SP	E	3		14	0	14
Power Electronics	U	SP	E	3	Y	11	0	11
Power System	U	A	E	3		15	0	15
Sensors and Measurements	U	SP	E	3		11	0	11
Temple University								
Electric Machines and Drives	G	A	E	3		3	0	3
Power Electronics Devices and Systems	G	A	E	3		7	0	7
Power Systems Engineering	G	A	E	3		11	0	11
Electromagnetic Energy Systems	U	A	E	3	Y	15	0	15
Modern Power Engineering and Electronics	U	A	E	3		12	0	12
Power Electronics Devices and Systems	U	A	E	3		8	0	8
Tennessee State University								
Modern Control Systems	G	ET	E	3		5	0	5
Probability, Statics and Risk Analysis	G	ET	M	3		7	0	7
Control Systems and Lab	U	A	M	3	Y	10	0	10
Electric Power Distribution	U	ET	E	3		7	0	7
Electrical Systems Design Lab	U	A	M	1	Y	14	0	14
Energy Conversion	U	A	M	3		10	0	10
Power Systems	U	A	M	3		9	0	9
Texas A&M University								
Advanced Power Electronics	G	ET	E	3		40	0	40
Computer Aided Design of Electrical Motion Devices	G	ET	E	3	Y	25	0	25
Computer Relays for Electric Power Systems	G	ET	E	3	Y	20	0	20
DC-DC Power Supplies	G	A	E	3		15	5	20
Electric and Hybrid Vehicle Engineering	G	ET	E	3		40	0	40
Electric Machines & Drives	G	A	E	3		15	5	20
Electric Power System Reliability	G	ET	E	3		15	0	15
General Theory of Electromechanical Motion Devices	G	ET	E	3		25	0	25
High Voltage DC Power Transmission	G	ET	E	3		35	0	35
Methods of Electric Power Systems Analysis	G	SP	E	3		25	0	25
Motor Drive Dynamics	G	ET	E	3		20	0	20
Physical and Economical Operations of Sustainable Energy Systems	G	A	E	3		20	0	20
Power Electronics	G	A	E	3		15	5	20
Power Electronics for Renewable Energy	G	ET	E	3	Y	20	0	20
Power System Faults and Protective Relaying	G	ET	E	3	Y	20	0	20
Power System Stability	G	ET	E	3		15	0	15
Power Systems Engineering	G	A	E	3		15	5	20
Power Systems State Estimation	G	ET	E	3		30	1	31
Sustainable Energy and Transportation Engineering	G	ET	E	3		49	0	49
DC-DC Power Supplies	U	A	E	3		25	10	35
DSP-Based Electromechanical Motion Control	U	A	E	3	Y	100	0	100
Electric Machines & Drives	U	A	E	3		20	10	30
Electric Power Systems I	U	A	E	4	Y	70	0	70
Electric Power Systems II	U	A	E	4	Y	80	0	80
Electronic Motor Drives	U	A	E	4	Y	100	0	100
Physical and Economical Operations of Sustainable Energy Systems	U	A	E	3	Y	30	0	30
Power Electronics	U	A	E	4	Y	100	0	100
Power Electronics	U	A	E	3		20	5	25
Power Systems Engineering	U	A	E	3		25	10	35
Texas Tech University								
DC-DC Power Supplies	G	A	E	3		15	5	20
Electric Machines & Drives	G	A	E	3		15	5	20
Power Electronics	G	A	E	3		15	5	20
Power Systems Engineering	G	A	E	3		15	5	20
DC-DC Power Supplies	U	A	E	3		25	10	35
Electric Machines & Drives	U	A	E	3		20	10	30
Power Electronics	U	A	E	3		20	5	25
Power Systems Engineering	U	A	E	3		25	10	35
Tufts University								
Power Electronics	G	A	E	4		10	0	10
Power Systems	G	A	E	4		5	0	5
Power Electronics	U	A	E	4		25	0	25
Power Systems	U	A	E	4		15	0	15
United States Military Academy								
Alternative Energy Engineering	U	A	E	3	Y	12	0	12
Electric Power Engineering	U	T	M	3	Y	29	0	29
Ind. Study in Power Engineering	U	SP	E	3		2	0	2
University of Alabama at Birmingham								
Advanced Induction Machines	G	ET	E	3		5	0	5
Computer Applications in Power Systems	G	ET	E	3		8	0	8
Control of Synchronous Machines	G	ET	E	3		8	0	8
Industrial Control	G	A	E	3	Y	3	0	3
Machinery II	G	A	E	3		3	0	3
Power Line Communications	G	SP	E	3		1	0	1
Power System Overvoltages	G	ET	E	3		3	0	3
Power Systems I	G	A	E	3		2	0	2
Powr Semiconductor Electronics	G	SP	E	3		6	0	6
Protection Relay Power Systems	G	A	E	3		1	0	1
Industrial Controls	U	A	E	3	Y	3	0	3
Machinery I	U	A	M	4	Y	49	0	49
Machinery II	U	ET	E	3		5	0	5
Power Semiconductor Electronics	U	SP	E	3		5	0	5
Power Systems I	U	A	E	3		8	0	8
Protective Relaying Power Systems	U	A	E	3		6	0	6
University of Alaska Fairbanks								
Power Electronics Design	G	A	E	4	Y	1	0	1
Renewable and Sustainable Energy Systems	G	SP	E	3		4	0	4
Electric Machinery	U	A	M	4	Y	14	0	14
Electrical Power Engineering	U	A	M	4	Y	8	0	8
Electrical Power Systems	U	A	M	4	Y	9	0	9

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
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Power Electronics Design	U	A	M	4	Y	8	0	8
Renewable and Sustainable Energy Systems	U	SP	E	3		2	0	2
University of Alberta								
Dynamics and Controls of Voltage-Source Converters (ECE 636)	G	A	E	3		20	0	20
Industrial Drive Systems (ECE 531)	G	A	E	4	Y	20	0	20
Modeling and Simulation of Electromagnetic Transients (ECE 633)	G	A	E	3		20	0	20
Power Converters and Renewable Energy Systems (ECE 635)	G	A	E	3		20	0	20
Power Electronics Applications in AC and DC Transmission Systems (ECE 730)	G	A	E	3		20	0	20
Power Electronics Systems Design (ECE 730)	G	A	E	3		20	0	20
Power Quality and Power Disturbance Analysis (ECE 530)	G	A	E	3		10	0	10
Smart Grid Communications (ECE 730)	G	A	E	3		20	0	20
Electric Machines (ECE 332)	U	A	M	4	Y	80	0	80
Introduction of Power Engineering (ECE 330)	U	A	M	3		120	0	120
Power Electronics (ECE 401)	U	T	E	4	Y	60	0	60
Power System Analysis (ECE 430)	U	A	E	3		70	0	70
Power System Stability and Transients (ECE 433)	U	A	E	4	Y	60	0	60
Variable Speed Drives (ECE 432)	U	A	E	4	Y	70	0	70
University of Arkansas								
Design of Advanced Power Distribution Systems	G	A	E	3		15	5	20
Electric Power Quality	G	ET	E	3		15	5	20
Electronic Packaging	G	SP	E	3		15	0	15
Intro to Power Electronics	G	A	E	3		25	3	28
Power Electronics and Motor Drives	G	ET	E	3		15	5	20
Power Systems Analysis	G	ET	E	3		5	3	8
Power Systems Operation and Control	G	ET	E	3		5	3	8
Design and Fabrication of Solar Cells	U	A	E	3		10	0	10
Electric Circuits and Machines	U	T	E	3		223	0	223
Electric Power Distribution Systems	U	A	E	3		20	5	25
Energy Systems	U	A	M	4	Y	50	0	50
Intro to Power Electronics	U	A	E	3		3	5	8
Power Electronics and Motor Drives	U	SP	E	3		5	0	5
Power Systems Analysis	U	ET	E	3		25	5	30
Quality of Electric Power	U	SP	E	3		0	5	5
Switch Mode Power Conversion	U	A	E	3		15	0	15
University of Calgary								
Grid-Connected Inverters for Alternative Energy Systems	G	A	E	3		15	0	15
Power Systems Operation (ENEL 601)	G	A	E	3		15	0	15
Restructured Electricity Markets (ENEL 693)	G	A	E	3		15	0	15
Electric Machines (ENEL 489)	U	A	E	3	Y	52	0	52
Energy Systems (ENEL 487)	U	A	M	3	Y	170	0	170
Power Electronics (ENEL 585)	U	A	E	3	Y	48	0	48
Power Systems (ENEL 587)	U	A	E	3	Y	50	0	50
Power Systems Operation (ENEL 597)	U	A	E	3		50	0	50
Power Systems Protection	U	A	E	3	Y	75	0	75
University of California, Berkeley								
Advanced Topics in Circuit Design (EE290C)	G	A	E	3		15	0	15
Electric Power Systems (ER 254)	G	A	E	3		25	0	25
Energy and Society (ER C200)	G	A	E	4		170	0	170
Photovoltaic Materials; Modern Technologies in the Context of a Growing Renewable Energy Market (ER C226/Mat Sci226)	G	ET	E	4		25	0	25
Energy and Society (ER C100)	U	A	E	4		180	0	180
Fundamentals of Photovoltaic Devices (EE134)	U	A	E	4		25	0	25
Introduction to Electric Power Systems (EE137A)	U	A	E	4		42	0	42
Introduction to Electric Power Systems (EE137B)	U	A	E	4		15	0	15
University of California, Los Angeles								
Design and Analysis of Smart Grid	G	A	M	4		5	0	5
Dynamics and Control of Power Systems	G	A	M	4		5	0	5
Power Systems Fundamentals	U	A	M	4		5	0	5
University of Central Florida								
Advanced Electric Machinery	G	ET	E	3		10	0	10
Advanced Power Systems Analysis	G	ET	E	3		10	0	10
Advanced Topics in Power Engineering	G	ET	E	3		10	0	10
Distributed Control and Optimization for Smart Grid	G	ET	E	3		10	0	10
Electric Machinery	U	A	E	3	Y	65	0	65
Fundamentals of Electric Power Systems	U	A	E	3	Y	65	0	65
Intro to Smart Grid	U	ET	E	3	Y	25	0	25
Power Electronics I	U	A	E	3	Y	30	0	30
University of Denver								
Electric Power Economy	G	A	E	4		10	0	10
Electric Power Systems	G	A	E	4		6	0	6
Introduction to Power and Energy	G	A	E	4		8	0	8
Power Generation, Operation, and Control	G	ET	E	4		8	0	8
Power System Protection	G	ET	E	7		7	0	7
Renewable and Efficient Power and Energy	G	A	E	4		8	0	8
SCADA Systems	G	A	E	4		4	0	4
Electric Power Economy	U	A	E	3		6	0	6
Electric Power Systems	U	A	E	4		6	0	6
Intro to Power and Energy Sys	U	A	M	3	Y	16	0	16
Renewable & Efficient Power System	U	A	M	4		6	0	6
University of Houston								
Advanced Power System Analysis	G	A	E	3		18	0	18
Electrical Power Regulations and Standards	G	T	E	3		20	0	20
Industrial Power Monitoring and Control	G	ET	M	3		28	0	28
Industrial Power System Analysis	G	A	M	3		20	0	20
Industrial Power System Management	G	ET	M	3		25	0	25
Industrial Power System Protection	G	ET	M	3		30	0	30
Industrial Substations and Switching Equipment	G	T	M	3		30	0	30
Power Electronics and Electric Drives	G	T	E	3		20	0	20
Power System Analysis	G	A	M	3		20	0	20
Power System Control and Stability	G	ET	E	3		10	0	10
Power System Transients, Harmonics and Grounding	G	T	E	3		10	0	10
Smart Grid Technology	G	A	E	3		30	0	30
Electromechanical Energy Conversion	U	A	M	3		40	0	40
Energy Conversion Laboratory	U	A	M	1	Y	40	0	40
Power Electronics and Electric Drives	U	A	E	3		25	0	25
Power Transmission and Distribution	U	A	M	3		25	0	25
Power Transmission and Distribution Laboratory	U	A	M	1	Y	25	0	25
Renewable Energy Technology	U	A	E	3		15	0	15
Smart Grid Technology	U	A	E	3		15	0	15
University of Idaho								
Advanced Electrical Machinery	G	SP	E	3		6	29	35
Dynamics and Control of AC Drives	G	SP	E	3		9	14	23
Induction Machines	G	ET	E	3		9	17	26
Power Systems Protection and Relaying	G	ET	E	3		12	45	57
Protection of Power Systems II	G	ET	E	3		13	34	47
Resilient Control of Power Grid	G	A	E	3		15	0	15

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Supervisory Control and Critical Infrastructures	G	ET	E	3		12	19	31
Symmetrical Components	G	ET	E	3		16	27	43
Transients in Power Systems	G	ET	E	3		14	16	30
Understanding Power Quality	G	ET	E	3		13	18	31
Utility Applications of Power Electronics	G	ET	E	3		10	23	33
Energy Systems I	U	A	M	3		38	3	41
Energy Systems I Lab	U	A	M	1	Y	37	0	37
Energy Systems II	U	A	E	3		40	9	49
Introduction to Power Systems	U	A	E	3		30	9	39
Power Electronics	U	A	E	3		33	5	38
Power Systems Analysis	U	A	E	3		20	9	29
Supervisory Control and Critical Infrastructure Systems	U	ET	E	3		14	5	19
University of Illinois at Urbana-Champaign								
Advanced Power Electronics	G	ET	E	4		26	0	26
Analysis Techniques for Large-Scale Electrical Systems	G	A	E	4		16	0	16
Dynamic System Reliability	G	ET	E	4		19	0	19
Electrical Machine Design	G	ET	E	4		22	0	22
Electricity Resource Planning	G	ET	E	4		20	0	20
Modeling and Control of Electromechanical Systems	G	ET	E	4		18	0	18
Power System Dynamics and Stability	G	ET	E	4		14	0	14
Power Systems Operations and Control	G	ET	E	4		17	0	17
Electric Machinery	U	A	E	4	Y	62	0	62
Green Electric Energy	U	T	E	3		181	0	181
Power Circuits and Electromechanics	U	T	E	3		334	0	334
Power Distribution Systems Analysis	U	ET	E	3		30	0	30
Power Electronics	U	A	E	3		99	0	99
Power Electronics Lab	U	A	E	2	Y	46	0	46
Power System Analysis	U	A	E	3		48	0	48
Techniques for Engineering Decision Making	U	A	E	3		27	0	27
University of Kentucky								
Advanced Electromechanics	G	A	E	3		0	0	0
Advanced Power System Protection	G	A	E	3		1	0	1
Alternative and Renewable Energy Systems	G	ET	E	3		8	0	8
Electric Power Economics and Public Policy	G	A	E	3		2	0	2
Power and Energy Experiences	G	A	E	3		6	0	6
Power Distribution Systems	G	ET	E	3		5	0	5
Power System Fault Analysis and Protection	G	A	E	3		1	0	1
Power System Fundamentals	G	A	E	3		1	0	1
Power Systems: Generation, Operation and Control	G	ET	E	3		3	0	3
Smart Grid-Automation and Control of Power Systems	G	A	E	3		2	0	2
Sustainable and Renewable Energy Systems	G	A	E	3		0	0	0
Advanced Electromechanics	U	A	E	3		5	0	5
Advanced Power System Protection	U	A	E	3		16	0	16
Alternative and Renewable Energy Systems	U	ET	E	3		36	0	36
Electric Power Economics and Public Policy	U	A	E	3		21	0	21
Electric Power Systems I	U	A	E	3		27	0	27
Electric Power Systems II	U	SP	E	3		20	0	20
Electromechanics	U	T	M	3		57	0	57
Energy Conversion Laboratory	U	T	M	2	Y	69	0	69
Power Distribution Systems	U	ET	E	3		29	0	29
Power System Fault Analysis and Protection	U	A	E	3		7	0	7
Power System Fundamentals	U	A	E	3		30	0	30
Power Systems: Generation, Operation and Control	U	ET	E	3		22	0	22
Smart Grid-Automation and Control of Power Systems	U	A	E	3		39	0	39
Sustainable and Renewable Energy Systems	U	A	E	3		21	0	21
University of Maine								
Electric Machinery	U	A	M	4	Y	25	2	27
Power Systems Analysis	U	A	M	4	Y	25	2	27
Protective Relaying	U	A	E	3	Y	16	1	17
Relay Communications	U	A	E	4	Y	20	5	25
University of Maryland College Park								
Advanced Power Electronics (ENEE 719B)	G	ET	E	3		15	0	15
Advanced Power Mechanics (ENME808A)	G	SP	E	3		15	0	15
Energy Systems Analysis (ENME635)	G	ET	E	3		12	0	12
Mechanical Design of Extreme Temperature and High Power Electronics (ENME 780)	G	ET	E	3		21	0	21
Electric Machines Laboratory (ENEE 473)	U	A	E	2	Y	15	0	15
Power Electronics (ENEE 475)	U	A	E	3		45	0	45
Power Systems (ENEE 474)	U	A	E	3		45	0	45
Renewable Energy (ENEE 419R)	U	A	E	3		60	0	60
University of Memphis								
Electrical Power Quality	G	A	E	3		25	0	25
Electrical Power Systems	G	SP	E	3		25	0	25
Introduction to Smart Grid	G	SP	E	3		25	0	25
Power Distribution System	G	SP	E	3		25	0	25
Power Electronics	G	SP	E	3		25	0	25
Power System Stability/Control	G	SP	E	3		25	0	25
Wind Energy Conversion Systems	G	SP	E	3		25	0	25
Electrical Power Quality	U	A	E	3		25	0	25
Electrical Power Systems	U	SP	E	3		25	0	25
Energy Conversion	U	A	M	4	Y	30	0	30
Power Distribution System	U	SP	E	3		25	0	25
University of Michigan - Dearborn								
Introduction to Energy Systems	G	A	E	3		34	26	60
Introduction to Power Management and Reliability	G	A	E	3		17	0	17
Introduction to Electrical Power Systems	U	A	E	3		34	0	34
Power Electronics	U	A	E	3	Y	30	0	30
University of Michigan, Ann Arbor								
Advanced Topics in Power System Analysis	G	ET	E	3		20	0	20
Analysis of Electric Power Distribution Systems and Loads	G	ET	E	3		20	0	20
Electric Drives	G	ET	E	4	Y	15	0	15
Electricity Markets and Optimization	G	ET	E	3		25	0	25
Infrastructure for Vehicle Electrifications	G	SP	E	3		15	0	15
Power Electronic Design	G	A	E	4	Y	20	0	20
Power System Dynamics and Control	G	ET	E	3		25	0	25
Electric Machinery and Drives	U	A	E	4	Y	30	0	30
Grid Integration of Alternative Energy Sources	U	ET	E	4		40	0	40
Power Electronics	U	A	E	4	Y	40	0	40
Power System Design and Operation	U	A	E	4		30	0	30
University of Minnesota -Twin Cities								
Advanced Electric Drives	G	ET	E	3		20	2	22
Advanced Power Electronics	G	ET	E	3		25	5	30
Modeling Analysis and Control of Renewable Energy Systems	G	A	E	3		20	2	22
Power Generation Operation and Control	G	ET	E	3		20	2	22
Electric Drives (EE 4701)	U	A	E	3	Y	70	0	70
Power Electronics (EE4741)	U	A	E	3	Y	70	0	70
Power Systems (EE 4721)	U	A	E	3	Y	70	0	70
Sustainable Electricity Supply (EE2701)	U	A	E	3		37	0	37

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
University of Missouri - Columbia								
Energy and Machines	G	A	E	3		2	0	2
Power Electronics	G	A	E	3	Y	2	0	2
Power Systems Analysis	G	A	E	3		5	0	5
Sustainable Electrical Energy Resources	G	A	E	3		5	0	5
Electromagnetic Fields	U	T	M	#		8	0	8
Energy and Machines	U	A	E	#		20	0	20
Energy and Machines Lab	U	A	E	0	Y	0	0	0
Power Electronics 1	U	A	E	#	Y	10	0	10
Power Systems Analysis	U	A	E	#		40	0	40
Sustainable Electrical Energy Resources	U	A	E	#		43	0	43
Topics: Test and Evaluation of Electrochemical Devices	U	SP	E	3		3	0	3
U Problems in ECE/Power	U	T	E	5		5	0	5
University of Missouri - Kansas City								
Automatic Control Systems Design	G	A	E	3		46	0	46
Auxiliary Electric Systems Design	G	A	E	3		25	0	25
Direct Current Power Systems	G	ET	E	3		26	0	26
Economics of Power Systems	G	A	E	3		35	0	35
Electric Power Distribution Systems	G	T	E	3		36	0	36
Electric Power Lab	G	A	E	3	Y	15	0	15
Energy Systems for Engineering	G	A	E	3		63	0	63
Fundamental Solar Cell-Photovoltaic	G	A	E	3		127	0	127
Instrumentation and Control	G	T	E	3		66	0	66
Lightning and Switching Surges in Power Systems	G	SP	E	3		24	0	24
Power Quality	G	A	E	3		14	0	14
Power System Transmission Planning	G	SP	E	3		17	0	17
Power Systems II	G	T	M	3		31	0	31
Power Systems Relaying	G	ET	E	3		40	0	40
Reliability of Electric Power Systems	G	T	E	3		30	0	30
Solar Photovoltaic Systems Engineering	G	A	E	3		88	0	88
Sustainable Energy Systems in Engineering	G	SP	E	3		34	0	34
Wind Energy	G	SP	E	3		63	0	63
Advanced Sustainable Energy System Engineering	U	A	E	3		7	0	7
Automatic Control Systems Design	U	A	E	3		18	0	18
Electric Machines	U	SP	E	3		3	0	3
Electric Power Distribution Systems	U	T	E	3		6	0	6
Electric Power Lab	U	A	E	3	Y	12	0	12
Energy Systems for Engineering	U	SP	E	3		9	0	9
Fundamentals of Solar Cell-Photovoltaic	U	A	E	3		2	0	2
Introduction to Control Systems	U	A	E	3		41	0	41
Power Electronics I	U	A	E	3		18	0	18
Power Quality	U	A	E	3		1	0	1
Power Systems I	U	A	M	3		54	0	54
Power Systems II	U	T	E	3		11	0	11
Reliability of Electric Power Systems	U	T	E	3		2	0	2
Solar Photovoltaic Systems Engineering	U	A	E	3		7	0	7
Substation Design	U	SP	E	3		16	0	16
Symmetrical Components and Power Systems	U	T	E	3		4	0	4
University of Nebraska - Lincoln								
Advanced Power Electronics & Applications	G	ET	E	3		7	0	7
Computational Intelligence	G	A	E	3		10	0	10
Electricity Markets	G	ET	E	3		5	0	5
Reliability and Maintainability Engineering	G	SP	E	3		6	0	6
Decision Analysis	U	ET	E	3		10	0	10
Electric Machines	U	A	E	3		20	0	20
Introduction to Electric Power and Energy Systems	U	A	E	3		24	6	30
Power Electronics	U	A	E	3	Y	37	0	37
Power System Analysis	U	A	E	3		8	0	8
Power System Planning	U	ET	E	3		7	0	7
Solar Energy	U	A	E	3		18	0	18
Wind Energy	U	A	E	3		35	12	47
University of Nevada, Reno								
Microgrid Operation and Control	G	ET	E	3		9	0	9
Power System Operation with Renewable Energy Sources	G	ET	E	3		7	0	7
Power Systems Planning	G	ET	E	3		10	0	10
Power Systems State Estimation	G	ET	E	3		10	0	10
Electric Power Distribution	U	ET	E	3		20	0	20
Electrical Machines	U	A	E	3		15	0	15
Power Electronics	U	A	E	3		15	0	15
Power System Fundamentals	U	A	M	3		45	0	45
Power System Protection	U	ET	E	3		18	0	18
Power Systems Analysis	U	A	E	3		17	0	17
University of New Haven								
Electric Drives	G	T	M	3		16	0	16
Electric Drives Laboratory	G	T	M	1	Y	12	0	12
Electric Power Distribution	G	A	E	3		16	0	16
Introduction to Smart Grid	G	A	E	3		18	0	18
Power Electronics	G	T	M	3		15	0	15
Power Electronics Laboratory	G	T	M	1	Y	12	0	12
Power System Engineering	G	T	M	3		18	0	18
Power Systems Laboratory	G	T	M	1	Y	12	0	12
Electric Drives	U	T	E	3		12	0	12
Electric Drives Laboratory	U	T	E	1	Y	10	0	10
Power Electronics	U	T	E	3		15	0	15
Power Electronics Laboratory	U	T	E	1	Y	12	0	12
Power System Engineering	U	T	E	3		15	0	15
Power Systems Laboratory	U	T	E	1	Y	15	0	15
University of North Carolina at Charlotte								
Distribution Systems I	G	ET	E	3		26	0	26
Distribution Systems II	G	ET	E	3		15	0	15
Electric Machines	G	A	E	3		4	0	4
Energy Markets	G	A	E	3		4	0	4
Energy Systems	G	A	E	3		5	0	5
Power Sys Stability & Control	G	A	E	3		9	0	9
Power System Relaying	G	ET	E	3		16	0	16
Power System Stability & Control	G	ET	E	3		9	0	9
Smart Grid	G	ET	E	3		17	0	17
Utility Applications of Power Electronics	G	A	E	3		17	0	17
Electric Machines	U	A	E	3		5	0	5
Electromagnetic Devices	U	A	E	3	Y	35	0	35
Energy Markets	U	A	E	3		5	0	5
Energy Systems	U	A	E	3		9	0	9
Power Electronics	U	A	E	3		21	0	21
Power Generation, Operation and Control	U	A	E	3		4	0	4
Power Systems I	U	A	E	3		15	0	15
Power Systems II	U	A	E	3		3	0	3
Utility Applications of Power Electronics	U	A	E	3		3	0	3

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students On-Campus	Enrolled Students Distance Ed.	Enrolled Students Total
University of North Dakota								
Linear Programming Models for Smart Grid	G	ET	E	3	Y	9	0	9
Power Electronics	G	ET	E	3	Y	12	5	17
Power Systems I	G	ET	E	3		10	2	12
Renewable Energy Systems	G	ET	E	3		20	15	35
Smart Grid Architectures and Models	G	ET	E	3	Y	4	2	6
Smart Grid Data Security	G	ET	E	3	Y	5	4	9
Electric Drives	U	A	M	3	Y	37	42	79
Electric Power Systems I	U	ET	E	3		30	21	51
Linear Programming Models for Smart Grid	U	ET	E	3	Y	4	22	26
Power Electronics	U	ET	E	3	Y	34	23	57
Renewable Energy Systems	U	ET	E	3	Y	39	30	69
Smart Grid Architectures and Models	U	ET	E	3	Y	5	0	5
Smart Grid Data Security	U	T	E	3		10	12	22
University of Oklahoma								
Energy Conversion	U	T	M	9		26	0	26
Power System Dynamics	U	A	E	9		6	1	7
Power System Operation	U	A	E	9		10	0	10
Transmission System Analysis	U	A	E	9		18	0	18
University of Pittsburgh								
Electrical Distribution Engineering & Analysis II	G	ET	E	3	Y	15	2	17
Embedded Systems	G	A	E	3		15	0	15
FACTS and HVDC Technologies and Applications	G	ET	E	3		25	7	32
Linear System Theory	G	A	E	3		25	7	32
Microgrid Concepts and Distributed Generation	G	ET	E	3		20	7	27
Optimization Methods	G	A	E	3		15	0	15
Power & Energy Industry Practices	G	ET	E	3		20	7	27
Power Electronics Circuits and Applications	G	A	E	3		25	7	32
Power System Engineering & Analysis 2	G	A	E	3		25	7	32
Power System Stability	G	ET	E	3		15	0	15
Power System Steady-State Control	G	ET	E	3		15	0	15
Power System Transients 1	G	ET	E	3		15	7	22
Protective Relaying and Substation Automation	G	ET	E	3	Y	15	7	22
Renewable and Alternative Energy Systems	G	ET	E	3		20	7	27
Smart Grid Technologies and Applications	G	ET	E	3	Y	25	7	32
Stochastic Processes	G	A	E	3		15	0	15
Sustainable Power System Modeling	G	ET	E	3		20	0	20
Cost and Construction of Electrical Supply	U	ET	E	3		15	0	15
Electric Distribution Engineering and Smart Grids	U	A	E	3	Y	25	0	25
Electric Machinery	U	A	E	3	Y	25	0	25
Electrical Power Transmission, Distribution & Grid Technologies	U	ET	E	3		25	0	25
Linear Control Systems	U	A	E	3		50	0	50
Power Electronics Circuits and Applications	U	A	E	3		25	0	25
Power Electronics Conversion Theory	U	ET	E	3		20	0	20
Power Generation, Operation, and Control	U	A	E	3		20	0	20
Power System Engineering and Analysis 1	U	A	M	3		50	0	50
Thermodynamics	U	A	E	3		10	0	10
University of Saskatchewan								
Economic System Operation	G	A	E	3		10	0	10
Power System Reliability	G	A	E	3		11	0	11
Power Systems Analysis	G	A	E	3		10	0	10
Power Systems Modeling & Control	G	A	E	3		5	0	5
Power Systems Protection & Relaying	G	A	E	3		10	0	10
Reliability Engineering	G	A	E	3		11	0	11

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students On-Campus	Enrolled Students Distance Ed.	Enrolled Students Total
Advanced Analysis of Electric Machines & Drive Systems	U	A	M	3	Y	26	0	26
Basic Electronics & Electric Power	U	A	M	3	Y	211	0	211
Electric Machines Fundamentals	U	A	M	3	Y	26	0	26
Introduction to Electric Power Systems	U	A	M	3	Y	43	0	43
Power Electronics	U	A	M	3	Y	33	0	33
Power Systems Analysis	U	A	M	3	Y	27	0	27
Power Systems Operation & Control	U	A	M	3	Y	24	0	24
Transmission of Electrical Energy	U	A	M	3	Y	22	0	22
University of South Carolina								
Advanced Power Electronics	G	ET	E	3		3	4	7
Digital Control Systems	G	A	E	3		2	0	2
Industrial Controls	G	A	E	3		3	0	3
Integration of PV in Modern Power Systems	G	A	E	3		2	0	2
Power Electronics	G	A	E	3		9	2	11
Power System Grounding & Transients	G	ET	E	3		6	5	11
Power Systems Design and Analysis	G	A	E	3		8	2	10
Digital Control Systems	U	A	E	3		23	0	23
Electromechanical Energy Conversion	U	A	E	3		13	0	13
Industrial Controls	U	A	E	3		20	0	20
Integration of PV in Modern Power Systems	U	A	E	3		3	0	3
Power Electronics	U	A	E	3		21	0	21
Power Systems Design & Analysis	U	A	E	3		17	0	17
University of South Florida								
Electric Distribution Systems	G	A	E	3		11	5	16
Electric Machines & Drives	G	A	E	3		13	2	15
Power Electronics	G	A	E	3		38	3	41
Power Quality	G	ET	E	3		6	0	6
Power System Analysis	G	A	E	3		19	4	23
Power System Market: Operation & Analysis	G	ET	E	3		4	0	4
Power System Protection	G	A	E	3		2	5	7
Power Systems II	G	A	E	3		27	1	28
Electric Distribution Systems	U	A	E	3		1	0	1
Electromechanical Systems	U	T	M	3	Y	46	0	46
Power Electronics	U	A	E	3		3	1	4
Power Quality	U	ET	E	3		2	2	4
Power System Analysis	U	A	E	3		10	0	10
Power System Protection	U	A	E	3		1	0	1
Power Systems II	U	A	E	3		0	0	0
University of Southern Maine								
Electric Machinery and Controls Laboratory (EGN 329)	U	A	M	1	Y	36	0	36
Electromechanical Energy Conversion (ELE 323)	U	A	M	3		36	0	36
Energy and Power Systems (ELE 327)	U	ET	E	3	Y	36	0	36
University of St. Thomas								
Advanced Controls	G	A	M	3		30	0	30
Digital Signal Processing 1	G	A	E	3		20	0	20
Digital Signal Processing 2	G	A	E	3		20	0	20
Electric Machines	G	A	E	3		30	0	30
Electromagnetic Fields and Waves	G	A	E	3		15	0	15
Power Electronics	G	A	E	3		25	0	25
Power Systems	G	A	M	3		40	0	40
Power Systems Operations/Controls	G	A	E	3		15	0	15
Protection and Relaying	G	A	E	3	Y	15	0	15
Renewable Energy Generation	G	A	E	3		25	0	25
Thesis/Projects 1	G	T	E	3	Y	30	0	30
Thesis/Projects 2	G	T	E	3	Y	30	0	30

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students: On-Campus	Distance Ed.	Total
University of Tennessee, Chattanooga								
Advance Fuzzy and AI Controls Application	G	A	E	3		2	0	2
Digital Communications	G	A	E	3		3	0	3
Digital Signal Processing	G	A	E	3		2	1	3
Fuzzy Logic and Intelligent Control Application	G	A	E	3		5	0	5
Linear Systems	G	A	E	3		8	1	9
Power Electronics and Drives	G	A	E	3		7	0	7
Power System Analysis and Design	G	A	E	3		6	0	6
Power System Operations	G	A	E	3		3	3	6
Power System Protection	G	A	E	3		6	3	9
Power System Stability and Control	G	A	E	3		7	0	7
Setting and Testing Digital Relays	G	A	E	3		7	0	7
Smart Distribution Systems	G	A	E	3		8	5	13
Sustainable Electric Energy Systems	G	A	E	3		13	4	17
Transients in Power Systems	G	A	E	3		9	8	17
Linear Controls and Drives Laboratory	U	A	E	1	Y	27	0	27
Power Electronics	U	A	E	3		33	0	33
Power Electronics Laboratory	U	A	E	1	Y	19	0	19
Power Simulation Laboratory	U	A	M	1	Y	36	0	36
Power System Analysis and Design	U	A	M	3		40	0	40
Power System in Transient	U	A	E	3		1	0	1
Protective Relaying	U	A	E	3		38	0	38
Setting and Testing Digital Relays	U	A	E	3		2	0	2
Smart Power Distribution	U	A	E	3		12	9	21
University of Tennessee, Knoxville								
Advanced Power Electronics and Drives	G	A	E	3		12	0	12
Advanced Power Grid Protection	G	A	E	3		20	0	20
Advanced Power Grid Simulations	G	ET	E	3		4	0	4
Alternative Energy Sources	G	ET	E	3		30	0	30
Independent Study: Power Systems Stability	G	SP	E	3		2	0	2
Power Electronics and Drives	G	A	E	3		10	0	10
Power Electronics Technologies	G	A	E	3	Y	10	0	10
Power System Economics	G	ET	E	3		8	0	8
Power Systems Analysis I	G	A	E	3		7	0	7
Power Systems Analysis II	G	A	E	3		12	0	12
Special Topics: Exploratory Research in Grid Dynamics	G	SP	E	3		6	0	6
Special Topics: Power Electronic Circuits	G	SP	E	3		8	0	8
Special Topics: Power Electronics	G	SP	E	3		3	0	3
Special Topics: Power Systems State Estimation	G	SP	E	3		10	0	10
Ultra-Wide-Area Resilient Electrical Energy Transmission Networks	G	T	E	3		20	10	30
Utility Applications of Power Electronics	G	ET	E	3		14	0	14
Electric Energy Systems	U	A	E	3		9	0	9
Electric Energy Systems Components	U	T	M	3		65	0	65
Power Electronic Circuits	U	A	E	3	Y	4	0	4
Power Electronics	U	A	E	3		17	0	17
Power System Operations and Planning	U	A	E	3		10	0	10
Power/Energy Systems Seminar	U	A	E	3		3	0	3
University of Texas at Arlington								
Power Electronics	G	ET	E	3		42	0	42
Power System Distribution Analysis	G	A	E	3		13	0	13
Power Systems Modeling and Analysis	G	A	E	3		39	3	42
Power Systems Protective Relaying	G	ET	E	3		30	4	34
Programmable Logic Controller in Industrial Automation	G	ET	E	3		56	0	56
Fundamentals of Power Systems	U	T	E	3	Y	25	0	25
Introduction to Power Electronics	U	A	E	3	Y	61	0	61
University of Texas at Austin								
Energy Systems	G	A	E	3		20	0	20
Power Systems Apparatus and Laboratory	G	A	E	3	Y	20	0	20
Restructured Electricity Markets	G	ET	E	3		20	0	20
Topics in Power System Engineering	G	A	E	3		20	0	20
Electric Drives and Machines	U	A	E	3		35	0	35
Power Electronics Laboratory	U	T	E	4	Y	75	0	75
Power Systems Apparatus and Laboratory	U	A	E	3	Y	25	0	25
Power Systems Engineering	U	A	E	3		70	0	70
University of Texas at El Paso								
Control of Electric Power	G	A	E	3		5	0	5
High Frequency Power Conversion	G	A	E	3		7	0	7
Power System Operations	G	A	E	3		16	0	16
Control of Electric Power	U	A	E	3		10	0	10
Electric Power Systems	U	A	E	3		12	0	12
Energy Conversion	U	A	E	3		15	0	15
Power Electronics	U	A	E	3		15	0	15
Power System Operations	U	A	E	3		16	0	16
University of Texas at San Antonio								
Modeling of Three-Phase PWM Converters	G	ET	E	3		5	0	5
Power Converters for Distributed Generation	G	ET	E	3		20	0	20
Analysis of Power Systems	U	A	E	3		28	0	28
Electric Drives	U	A	E	3		28	0	28
Power Electronics	U	A	E	3		34	0	34
Power Engineering Lab	U	ET	E	3		12	0	12
University of the Pacific								
Topics in Renewable Energy	G	ET	E	3		8	0	8
Energy Conversion	U	ET	E	4	Y	11	0	11
Power Electronics	U	ET	E	4	Y	10	0	10
Power System Analysis	U	ET	E	3		15	0	15
University of Toronto								
Design of High-Frequency Switch-Mode Power Supplies I	G	A	E	1		20	0	20
Dynamics of HVDC-AC Transmission Systems	G	ET	E	1		20	0	20
HVDC Transmission Systems	G	ET	E	1		20	0	20
Power Management for Photovoltaic Systems	G	A	E	1		20	0	20
Power System Optimization	G	A	E	1		20	0	20
Smart Grid Case Studies	G	A	E	1		20	0	20
Space Vector Theory and Control	G	A	E	1	Y	15	0	15
Electric Drives	U	A	E	3	Y	60	0	60
Energy Systems and Distributed Generation	U	A	E	3	Y	100	0	100
Fundamentals of Electrical Energy Systems	U	A	E	3	Y	150	0	150
Introduction to Energy Systems	U	A	M	3	Y	60	0	60
Introduction to Lighting Systems	U	A	E	3		20	0	20
Power Electronics: Converter Topologies	U	A	E	3	Y	50	0	50
Power Electronics: Switch-Mode Power Supplies	U	A	E	3	Y	50	0	50
University of Utah								
Control of Electric Motors	G	A	E	3	Y	8	0	8
Electrical Forensics and Failure Analysis	G	ET	E	3		10	0	10
Power System Economics	G	A	E	3		12	0	12
Power System Protection	G	ET	E	3		11	0	11
Power System Security Analysis	G	A	E	3		6	0	6
Sustainable Energy Sources	G	SP	E	3		13	0	13
Utility Applications of Power Electronics	G	SP	E	3		5	0	5
Control of Electric Motors	U	A	E	3	Y	10	0	10

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Electrical Forensics and Failure Analysis	U	ET	E	3		12	0	12
Introduction to Electric Power Engineering	U	A	E	3	Y	48	0	48
Power Electronics Fundamentals	U	A	E	4	Y	10	0	10
Power System Planning and Design	U	A	E	3		10	0	10
Power System Protection	U	ET	E	3		10	0	10
Power Systems Analysis	U	A	E	3		12	0	12
University of Vermont								
Electric Energy Systems Analysis	G	A	E	3		15	0	15
Low Carbon Energy	G	ET	E	3		15	0	15
Optimization with Energy Applications	G	ET	E	3		7	0	7
Smart Grid	G	ET	E	3		15	0	15
Electric Energy Systems	U	A	E	4	Y	15	0	15
Electric Energy Systems Analysis	U	A	E	3		15	0	15
University of Washington								
Distribution Networks	G	A	E	4		5	0	5
Large Electric Energy Systems Analysis	G	ET	E	4		12	0	12
Power System Dynamics and Control	G	ET	E	4		8	0	8
Power System Economics	G	ET	E	4		12	0	12
Special Topics in Energy Systems	G	ET	E	4		10	0	10
Wind Energy	G	ET	E	4		24	0	24
Computer-aided Design in Power Systems	U	A	E	4		35	0	35
Electric Drives	U	A	E	5	Y	49	0	49
Electric Energy Distribution Systems	U	A	E	4		17	0	17
Introduction to Electric Energy Devices & Systems	U	T	E	5	Y	98	0	98
Power Electronics Design	U	A	E	5	Y	51	0	51
Power System Analysis	U	A	E	4		45	0	45
Power System Dynamics and Protection	U	A	E	4		40	0	40
Wind Energy	U	ET	E	4		30	0	30
University of Waterloo								
Asset Management and Risk Assessment of Power Systems	G	A	E	3		0	30	30
Design and Application of DC/DC Converters	G	ET	E	3		0	20	20
Dielectric Materials	G	ET	E	3	Y	10	0	10
Dielectrics and Electrical Insulation	G	ET	E	3		0	20	20
Distributed Generation	G	A	E	3		0	30	30
Distribution Systems Engineering	G	A	E	3		30	30	60
Electric Machines and Motor Drives	G	ET	E	3		0	20	20
Electric Safety and Grounding System Design	G	ET	E	3		0	20	20
Electromagnetic Compatibility and Power Quality	G	ET	E	3		0	20	20
Energy Processing	G	A	E	3		30	0	30
FACTS: Models, Controls and Applications	G	ET	E	3		0	20	20
High Voltage Engineering Applications	G	ET	E	3	Y	10	20	30
Industrial Utilization of Electrical Energy	G	A	E	3		0	30	30
Medium and HV Power Cables	G	ET	E	3		0	20	20
Operation of Restructured Power Systems	G	ET	E	3		0	20	20
Power Electronics Converters: Design and Applications	G	ET	E	3		0	20	20
Power System Analysis and Control	G	A	E	3		30	30	60
Power System Components and Modeling	G	ET	E	3		20	20	40
Power System Management and Electricity Markets	G	ET	E	3		0	20	20
Power System Protection	G	A	E	3		0	30	30
Power System Quality	G	ET	E	3		20	0	20
Power Systems Operation	G	A	E	3		30	0	30
Sustainable Distributed Generation	G	ET	E	3		30	0	30
Design and Applications of Power Electronic Converters	U	A	E	3	Y	50	0	50

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Electrical Distribution Systems	U	A	E	3		50	0	50
High Voltage Engineering and Power System Protection	U	A	E	3	Y	50	0	50
Power System Analysis, Operations and Markets	U	A	E	3		50	0	50
Power Systems and Components	U	T	M	3	Y	120	0	120
University of West Florida								
Basic Electric Energy Engineering	U	T	M	3	Y	40	15	55
Electric Energy Systems-1	U	A	E	3		15	5	20
Future Energy Systems	U	ET	E	3		60	0	60
Power Electronics	U	A	E	3		50	0	50
Renewable Energy Systems	U	A	E	3		60	0	60
Sustainable Power Systems	U	ET	E	3		60	0	60
University of Western Ontario								
Computer-based Power Systems Protection	G	A	E	3		20	0	20
Flexible AC Transmission Systems FACTS	G	A	E	3		19	0	19
High Frequency Power Electronic Converters	G	A	E	3		14	0	14
Modeling Power Systems for Protection, Control, and Transient Studies	G	A	E	3	Y	17	0	17
Theory and Application of Protective Relays	G	A	E	3		20	0	20
Conventional, Renewable and Nuclear Energy	U	A	M	3		20	0	20
Electric Power Systems I	U	A	M	3	Y	37	0	37
Electric Power Systems II	U	A	M	3	Y	33	0	33
Power Electronics	U	A	M	3	Y	48	0	48
Power System Protection	U	A	M	3	Y	20	0	20
University of Wisconsin - Madison								
Advanced Power System Analysis	G	ET	E	3		14	0	14
Dynamics and Controls of AC Drives	G	ET	E	3	Y	2	2	4
Electric Machines Laboratory	G	A	E	3	Y	8	9	17
On-Line Control of Power Systems	G	ET	E	3		12	0	12
Power Electronics Laboratory	G	A	E	3	Y	12	0	12
Solid State Power Conversion	G	A	E	3	Y	15	3	18
Utility Application of Power Electronics	G	ET	E	3	Y	6	2	8
Electric Power Processing for Alternative Energy Systems	U	A	E	3		42	0	42
Electric Power Systems	U	A	E	3		41	4	45
Electromechanical Energy Conversion	U	A	E	3		31	4	35
Fundamentals of Electrical and Electro-mechanical Power Conversion	U	A	E	4		38	2	40
Introduction to Electric Drive Systems	U	A	E	3	Y	33	12	45
Power Electronic Circuits	U	A	E	3	Y	52	6	58
Transmission Lines and Networks Laboratory	U	A	E	1	Y	20	0	20
University of Wisconsin - Milwaukee								
Advanced Power Electronics	G	ET	M	3		30	0	30
Advanced Synchronous Machines	G	ET	E	3		25	0	25
Analysis of Electric Machines and Drives	G	A	M	3		30	0	30
Cyber Physical Systems	G	ET	E	3		25	0	25
Introduction to Smart Grid Technology	G	ET	E	3		25	0	25
Nonlinear Systems Analysis	G	ET	E	3		30	0	30
Power Electronics	G	A	M	3		39	0	39
Power System Reliability and Cybersecurity	G	A	E	3		25	0	25
Renewable Energy Systems	G	ET	M	3		30	0	30
Robust Controls	G	ET	E	3		30	0	30
Electric Power Systems	U	T	E	3		30	0	30
Electromechanical Energy Conversion	U	T	M	3	Y	30	0	30
University of Wyoming								
Electrical Power Quality (EE5885)	G	ET	E	3		18	0	18
Power Engineering (EE5700)	G	ET	E	3		18	0	18

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Signal Processing for Power Systems Analysis (EE5885)	G	ET	E	3		18	0	18
Wide Area Monitoring for Power Systems (EE5885)	G	ET	E	3		18	0	18
Electric Power Quality (EE 4800)	U	SP	E	3		24	0	24
Electrodynamics (EE4550)	U	SP	E	3		18	0	18
Electromechanics (EE3510)	U	A	M	4	Y	24	0	24
Power System Analysis (EE4510)	U	ET	E	3		18	0	18
Valparaiso University								
Power Electronics	U	ET	E	3		20	0	20
Virginia Polytechnic Institute and State University								
Advanced Alternative Energy Systems	G	A	E	3		14	0	14
Advanced Instrumentation in Power Systems	G	ET	E	3		10	0	10
Advanced Topics in Power	G	A	E	3		12	2	14
Computational Methods in Power Engineering	G	ET	E	3		12	1	13
Electric Machines and Transients	G	ET	E	3		18	4	22
Power System Operation and Control	G	A	E	3		12	0	12
Power Systems Planning	G	ET	E	3		20	0	20
Alternative Energy	U	A	E	3		36	0	36
Design in Power Engineering	U	T	E	3		22	0	22
Introduction to Power Engineering	U	T	M	3		100	0	100
Power Electronics	U	A	E	3		35	0	35
Power Laboratory	U	T	M	1	Y	100	0	100
Power System Analysis and Control	U	A	E	3		25	0	25
Power System Protection	U	A	E	3		18	0	18
Protection Lab	U	A	E	1	Y	7	0	7
Washington State University								
Advanced Topics	G	SP	E	3		8	0	8
Analysis of Power System	G	A	E	3		15	10	25
High Voltage Engineering	G	SP	E	3		0	2	2
High Voltage Overhead Transmission Lines	G	ET	E	3		0	1	1
Power System Applications of Power Electronics	G	ET	E	3		5	0	5
Power System Economics and Electricity Markets	G	ET	E	3		0	9	9
Power Systems Stability and Control	G	A	E	3		12	0	12
Protection of Power Systems II	G	ET	E	3		8	0	8
Critical Infrastructure Security	U	A	E	3		7	0	7
Electrical Power Systems	U	T	M	3		68	0	68
Internship in Electrical Industry	U	A	E	1		5	0	5
Introduction to Control Systems	U	A	E	3		54	0	54
Performance of Power Systems	U	A	E	3		42	2	44
Power Electronics	U	A	E	3		17	0	17
Power Systems Lab	U	A	E	3	Y	48	0	48
Protection of Power Systems I	U	A	E	3		20	8	28
Protective Relay Lab	U	A	E	2	Y	10	0	10
Renewable Energy	U	A	E	3		34	0	34
Topics	U	SP	E	3		6	0	6
Wayne State University								
Advanced Energy Storage System	G	T	E	4		67	0	67
Alternative Energy Sources and Energy Conversions	G	A	E	4		24	0	24
Energy Systems Engineering	G	A	E	4		33	0	33
Modeling and Control of Electric Vehicle Powertrain	G	A	M	4		56	0	56
Power Electronics and Control	G	A	E	4		45	0	45
Advanced Energy Storage System	U	T	E	4		67	0	67
Alternative Energy Sources and Energy Conversions	U	A	E	4		24	0	24
Energy Systems Engineering	U	A	E	4		33	0	33

Course Title	Level	Offered	Requirement	Credit Hours	Lab	Enrolled Students		
						On-Campus	Distance Ed.	Total
Modeling and Control of Electric Vehicle Powertrain	U	A	M	4		56	0	56
Power Electronics and Control	U	A	E	4		45	0	45
Special Topic-Smart Grid	U	A	E	4		10	0	10
West Virginia University								
Advanced Distribution Power System	G	ET	E	3		5	0	5
Advanced Electrical Machinery	G	A	E	3		14	0	14
Computer Applications in Power System Analysis	G	A	E	3		9	0	9
HVDC Transmission	G	SP	E	3		3	0	3
Protection of Power Systems	G	ET	E	3		6	0	6
Real Time Control of Power System	G	ET	E	3		5	0	5
Electric Power Distribution System	U	A	E	3		10	0	10
Electromechanical Energy Conversion and Energy Systems	U	A	M	3	Y	56	0	56
Power Electronics	U	A	E	3		29	0	29
Power Systems Analysis	U	A	E	3		12	0	12
West Virginia University Institute of Technology								
Alternative Energy Resources	U	A	E	3		15	0	15
Electromagnetic Energy Conversion Systems	U	A	M	4	Y	15	0	15
Introduction to Power Electronics	U	A	E	3		10	0	10
Power System Analysis	U	A	M	3		15	0	15
Protective Relaying	U	A	E	3		5	0	5
Western Carolina University								
Advanced Power System Analysis	G	ET	M	3		7	0	7
Electric Power Systems	U	SP	M	3		14	0	14
Power Electronics	U	A	M	3		10	0	10
Wichita State University								
Electric Power Distribution	G	ET	E	3		25	0	25
Electric Power Quality	G	ET	E	3		15	0	15
Integration of Renewables	G	ET	E	3		25	0	25
Markets	G	ET	E	3		20	0	20
Motors and Drives	G	ET	E	3	Y	18	0	18
Operation & Control	G	ET	E	3		20	0	20
Protection	G	ET	E	3		20	0	20
Reliability	G	ET	E	3		20	0	20
Smart Grid	G	ET	E	3		30	0	30
Electric Machinery and Power Systems	U	A	M	4	Y	84	0	84
Electric Power Systems Analysis I	U	A	E	3		35	0	35
Electric Power Systems Analysis II	U	A	E	3		25	0	25
Power Electronics	U	A	E	4	Y	60	0	60
Smart Grids	U	ET	E	3		30	0	30
Worcester Polytechnic Institute								
Advanced Applications in Protective Relaying	G	A	E	3		0	17	17
Capstone Project in Power Systems	G	A	E	3		23	0	23
Electromechanical Energy Conversion	G	T	E	3		16	25	41
Power Distribution	G	SP	E	3		27	24	51
Power System Analysis	G	SP	M	3		19	48	67
Power System Dynamics	G	T	E	3		18	18	36
Power System Operation and Planning	G	A	E	3		0	24	24
Power System Protection and Control	G	A	E	3		0	10	10
Power Transmission	G	A	E	3		0	10	10
Protective Relaying	G	T	E	3		28	18	46
Transients in Power Systems	G	SP	E	3		32	33	65
Electrical Energy Conversion	U	A	E	3		35	0	35
Introduction to Contemporary Electric Power Systems	U	A	E	3		45	0	45
Power Electronics	U	A	E	3	Y	35	0	35

ATTACHMENT: 2015-2016 PEEC ONLINE SURVEY TEXT

Text of the 2015-2016 IEEE PES Power Engineering Education Committee (PEEC) Survey (with links removed)

This document has been prepared to help respondents to the 2015-2016 PEEC Survey compile the information needed to complete the online survey. This document cannot be used to submit a response to the survey.

Objectives: The objectives of this survey are to gather information about curriculum and faculty from electrical engineering, four year institutions in the U.S. and Canada (1) to promote power engineering education through an easy-to-access web location with information on power engineering education opportunities, (2) to facilitate advancement in power engineering education, and (3) to assess the state of power engineering education and research from a national perspective. The educational focus is on electrical engineering students. Information from the survey will be available on the PES website (see PES university programs web page with results from the 2013-2014 PEEC Survey), and in power engineering education publications.

Designated Representative: Only the designated respondent for your institution may submit survey data. You are the designated respondent if you are the first person to work on the survey for your institution or if you submitted data for your institution in the 2013-2014 PEEC Survey (click to see the list of designated respondents as of July 1). You can request to become the designated respondent for an institution that submitted data in the last PEEC survey by sending an email to peecsurvey@ieee.org. You are automatically the designated respondent if you begin the survey and your institution did not submit a response to the previous survey.

Adding a University: If you start the survey and find that your institution is not listed, send an email to peecsurvey@ieee.org requesting that it be added. You will be notified if your institution is eligible. Afterwards you will be able to start working on the survey.

Institution Eligibility: Four year institutions in the U.S. and Canada awarding accredited (i.e., ABET accreditation in the U.S.) degrees in electrical engineering. Institutions only offering degrees in electrical engineering technology will not be included in this survey. Institutions offering both types of degrees may be included, but responses in this survey should be limited to faculty, education, and research activities in the electrical engineering area.

Survey Text and Worksheets: Documents have been prepared to help respondents to the 2015-2016 PEEC Survey compile the information needed to respond to the online survey. These documents cannot be used to submit a response to the survey. The documents are: (1) Text of the entire survey [Survey text in PDF] and (2) Worksheets that can be given to colleagues to help the designated respondent collect the necessary data [Worksheets in PDF] [Worksheets in MS Word format].

What Data to Include: Instruction and research topics underlying this survey focus on electric power engineering associated with grid operations, planning and maintenance. Power electronics is included. Other engineering topics, such as communications and IT, are included to the extent they address power engineering challenges. Please remember that this survey is <u>not</u> looking for data on your entire engineering program.

Reporting Period: The data should be for the academic year of July 1, 2015 to June 30, 2016.

More Information: Send an email to peecsurvey@ieee.org

Log-in

- Email
- Password

If you do not have an account and intend to be the designated respondent for your university, please register now.

If you forgot your password and need to reset it, click here.

Need login assistance? Send an email to peecsurvey@ieee.org.

Respondents to 2013-2014 Survey

If your university responded to the 2013-2014 Survey, some data has been pre-populated to make it easier for you to complete this 2015-2016 Survey. Please check the data for accuracy and completeness. Not all data have been pre-populated and some of the data may be out-of-date. Also, delete data that are no longer relevant, such as for faculty who have moved or for courses that are no longer offered. The data you submit provide important insights into your power program so do make sure it is accurate.

Survey

Only the designated respondent for your institution may submit survey data. You are the designated respondent if you are starting the survey for your institution or if you submitted data for your institution in the 2013-2014 PEEC survey. You can request to become the designated respondent by sending an email to peecsurvey@ieee.org. You can also ask who the current designated respondent is by emailing peecsurvey@ieee.org.

If you are returning to continue work on your survey, please identify your country, state and institution again to proceed.

- Select your Institution's country
- Select your Institution's state/province
- Name of your Institution

Click here if your institution is not listed.

Survey Part 1: General Information

Required fields throughout this survey are marked with an asterisk (*)

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

Survey Contact

- *First Name
- *Last Name
- *Email
- *Work Phone (example: 999-999-9999)

Program Contact

- *First Name
- *Last Name
- *Email
- *Work Phone (example: 999-999-9999)

General Information About Your Power Program

*College/School Name:

For example, College of Engineering. Please do not insert your university's name. (No abbreviations or acronyms)

- Name:

*Lead Department's Name

For example, Department of Electrical and Computer Engineering. (No abbreviations or acronyms)

- Name:

Power Research Centers or Related Organizations in Power

Enter the full name of the organization. Do not use abbreviations or acronyms.

- Name:

University Calendar

- Semester
- Quarter
- Other

Survey Part 2A: Power Faculty and Staff Information

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

The objective of this information is to identify personnel resources used in higher education for power and energy engineering. The personnel includes faculty, adjunct professors, and other non-faculty instructors, but excludes TA's and RA's. Listed personnel must spend time delivering course instruction. Individuals who do not teach should not be included.

Faculty and Staff Information (for each individual)

- *First Name
- *Last Name
- *Email (for PES administrative use only)
- *Department (Use no abbreviations; for example, enter Department of Electrical Engineering):
- *Rank/Title
    - Professor
    - Associate Professor
    - Assistant Professor (tenure track)
    - Adjunct Professor
    - Emeritus Professor
    - Instructor/Lecturer (non-tenure track)
- *Highest Degree:
    - PhD
    - Master's
    - Bachelors
    - Other
- *IEEE PES Member
    - Select: Yes/No
- *IEEE Fellow
    - Select: Yes/No
- *Total Career Job Experience in Years
    - Academic: (enter number)
    - Power Industry: (enter number)
    - Other Industry: (enter number)
    - Total Career Years: (enter sum of above)
- *Academic Year Appointment
    - Full-time
    - Part-time
- Areas of Instruction in the Last Two Years (select all that apply - hold Ctrl/Cmd key to select multiple areas)
    - Distribution System Analysis
    - Electric Machinery
    - Energy Development & Power Generation
    - Energy Storage & Stationary Battery
    - Intelligent Grid
    - Other
    - Power Electronics
    - Power Engineering Education
    - Power System Communications & Cybersecurity
    - Power System Computation and Analysis
    - Power System Dynamic Performance

- Power System Economics
- Power System Instrumentation and Measurements
- Power System Operations
- Power System Planning and Implementation
- Power System Relaying
- Reliability, Risk and Probability Applications
- Renewable Generation
- Substation Automation
- Switchgear, Surge Protection Devices
- Transformers
- If other, please specify:

- Current Research Interests (select all that apply - hold Ctrl/Cmd key to select multiple areas)
  - Distribution System Analysis
  - Electric Machinery
  - Energy Development & Power Generation
  - Energy Storage & Stationary Battery
  - Intelligent Grid
  - Power Electronics
  - Power Engineering Education
  - Power System Communications & Cybersecurity
  - Power System Computation and Analysis
  - Power System Dynamic Performance
  - Power System Economics
  - Power System Instrumentation and Measurements
  - Power System Operations
  - Power System Planning and Implementation
  - Power System Relaying
  - Reliability, Risk and Probability Applications
  - Renewable Generation
  - Substation Automation
  - Switchgear, Surge Protection Devices
  - Transformers
  - If other, please specify:

Survey Part 2B: General Questions about Faculty and Staff

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

- *How many full-time personnel who taught in the power area left your institution, whether due to retirement or other reasons, during the reporting period (July 2015-June 2016?
    - Select: 0,1,2,3,4,5,6 or more
- *How many full-time personnel who teach in the power area were hired by your institution during the reporting period (July 2015 - July 2016)?
    - Select: 0,1,2,3,4,5,6 or more
- *Either assuming a typical retirement age of 65 or using the retirement criteria at your school, how many personnel listed in this survey are within the given number of years until being retirement eligible?
    - Retirement eligible now: (enter number),
    - 1-5 years: (enter number),
    - 6-10 years: (enter number)
- *Did power faculty participate in any power-related outreach events designed to attract K-12 students into the power engineering career field or to help K-12 teachers?
    - Select: Yes/No

Survey Part 3: Undergraduate and Graduate Programs

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

- *What are your institution's undergraduate power and energy engineering options? (select all that are relevant)
    - Mandatory courses for all students
    - Mandatory courses for students in a special track, minor, certificate, etc.
    - Elective courses
    - Special track (give title without any abbreviations
    - Minor (give title without any abbreviations)
    - Certificate offering (give title without any abbreviations)
    - Other (give title without any abbreviations)
- *Undergraduate Cooperative Program
    - Not available
    - Available (optional)
    - Available (mandatory)

Master's Power Degree Options

- *Does your university offer a Master's degree that would help students prepare for a career in electric power engineering?
    - Select: Yes/No
- *Does your university offer an online Master's degree that would help students prepare for a career in electric power engineering?
    - Select: Yes/No

Doctoral Power Degree Options

- *Does your university offer a Doctoral degree that would help students prepare for a career in electric power engineering whether in industry, government or academia?
    - Select: Yes/No
- *Does your university offer an online Doctoral degree that would help students prepare for a career in electric power engineering whether in industry, government or academia?
    - Select: Yes/No

Survey Part 4: Course Offerings

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

Undergraduate Power Course Offerings

List the courses that are in the curriculum to help students prepare for a career in power engineering. Including such specialties as nuclear engineering courses is not encouraged. For the course title, provide the complete title for the course with no abbreviations (for example, a course title could be Power Systems Analysis). If there are no students of a type (example: no Distance Education Students), please enter 0. Exclude courses that have not been taught since the 2011-2012 academic year.

Please do not just give the course numbers for the course titles. Course numbers are not requested.

Courses

- Course Title
- Offering Cycle
  - Twice per year
  - Annually
  - Every two years
  - Special
- Academic Year (AY) Last Offered
  - 2015-2016
  - 2014-2015
  - 2013-2014
  - 2012-2013
- Requirement
  - Select: Mandatory or Elective
- Course Credit Hours
- Lab (Select: Yes/No)
- Number of Classroom Students: (enter number)
- Number of Distance Education Students: (enter number)
- Total Number of Students (automatically calculated)

Graduate Power Course Offerings

List the courses that are in the curriculum to help students prepare for a career in power engineering. Including such specialties as nuclear engineering courses is not encouraged. For the course title, provide the complete title for the course with no abbreviations. If there are no students of a type (example: no Distance students), please enter 0.

Please do not just give the course numbers for the course titles. Course numbers are not requested.

Courses

- Course Title
- Offering Cycle
  - Twice per year
  - Annually
  - Every two years
  - Special
- Academic Year (AY) Last Offered
  - 2015-2016

    - 2014-2015
    - 2013-2014
    - 2012-2013
- Requirement
    - Select: Mandatory or Elective
- Course Credit Hours
- Lab (Select: Yes/No)
- Number of Classroom Students: (enter number)
- Number of Distance Education Students: (enter number)
- Total Number of Students (automatically calculated)

Survey Part 5: Student Estimates

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

The principal objective of this part of the survey is to assess the overall trends in the U.S. and Canada in student interest in power engineering and to estimate the number of graduating students who are entering the power engineering career field whether in industry, government or academia. Provide the best estimates that you can of the number of degrees conferred and enrollments for the indicated electrical engineering students.

To estimate the number of undergraduates likely to pursue entry-level positions in electric power and energy engineering, consider the undergraduate enrollment in your elective course on introduction to power systems analysis.

- *Estimated number of undergraduate electrical engineering students graduating during the reporting year (July 2015 - July 2016) who were likely to pursue positions in electric power engineering: (enter number)
- *Estimated number of Master's degrees conferred during reporting year (July 2015 - July 2016) for electrical engineering students who were likely to pursue positions in electric power engineering: (enter number)
- *Estimated number of Doctoral degrees conferred during reporting year (July 2015 - July 2016) for electrical engineering students who were likely to pursue positions in electric power engineering (industry, government or academia): (enter number)

Number of Enrolled Domestic and International Students

For the following questions, a “Domestic” student is a student who is a citizen of or permanent resident in your country.

- *Number of enrolled electrical engineering domestic students preparing for a career in power engineering: (enter numbers for Master’s Full Time, Master’s Part Time, Doctoral Full Time, and Doctoral Part Time)
- *Number of enrolled electrical engineering international students preparing for a career in power engineering: (enter numbers for Master’s Full Time, Master’s Part Time, Doctoral Full Time, and Doctoral Part Time)
- *Estimated % of enrolled undergraduate electrical engineering students who are Domestic: (enter number for %)

Survey Part 6: Research

REMINDER: Data has been pre-populated in multiple fields if your university responded to the 2013-2014 Survey. Please edit each entry with the latest information and check all data for accuracy and completeness!

*Total research expenditures during reporting period (July 2015 - July 2016)

Please enter the estimated expenditures (not awards) in dollars ($) by the tenured and untenured professional faculty entered in this survey. Include university overhead charges. (Example: Use numeric values such as $42000. Do not use commas or alpha values such as $1M.)

- Government
  - non-equipment (enter number in $)
  - equipment (enter number in $)

- Domestic Utility
  - non-equipment (enter number in $)
  - equipment (enter number in $)

- Other Industry
  - non-equipment (enter number in $)
  - equipment (enter number in $)

*Principal Areas of Current Research (select all that apply - hold Ctrl/Cmd key to select multiple areas):

- Distribution System Analysis
- Electric Machinery
- Energy Development & Power Generation
- Energy Storage & Stationary Battery
- Intelligent Grid
- Power Electronics
- Power Engineering Education
- Power System Communications & Cybersecurity
- Power System Computation and Analysis
- Power System Dynamic Performance
- Power System Economics
- Power System Instrumentation and Measurements
- Power System Operations
- Power System Planning and Implementation
- Power System Relaying
- Reliability, Risk and Probability Applications
- Renewable Generation
- Substation Automation
- Switchgear, Surge Protection Devices
- Transformers

- If other, please specify:

*What is the general consensus among the faculty at your institution about the outlook for new funding for university power systems research in your country over the next three years?

- Rising
- Stable
- Declining
- Unsure
- Not applicable

*What is the general consensus among the faculty at your institution about the outlook for new funding for university power systems research in your country over the next ten years?

- Rising
- Stable
- Declining
- Unsure
- Not applicable

Next Steps in Completing the PEEC Survey

You may now either return to the previous page, save your work and exit, or submit your survey for review. If you save your work and exit, you will be able to return to make additional edits after you login. If you submit your survey, you will be done. No additional editing will be possible. Click on your choice below.

- Previous page
- Save and Exist without Submitting
- Submit Survey for Review