Department of Engineering and Public Policy

Peter Adams, Department Head
Deanna H. Matthews, Associate Department Head for Undergraduate Affairs

Location: Baker Hall 129
www.cmu.edu/epp (http://www.cmu.edu/epp)
The Department of Engineering and Public Policy (EPP) is a unique department that works on problems at the interface between technology and society. Society is largely responsible for setting the goals and framing the problems that engineers and scientists work on. However, technologies designed by engineers and scientists profoundly change the societies in which they operate. Technology has enabled a healthier, richer, and more productive society. At the same time, technology has contributed to the creation of many of the more serious problems our society faces. In order to do their jobs responsibly and well in today's world, engineers and scientists must develop an understanding of the interface between technology and society and a command of the skills necessary to work at that intersection. Our undergraduate programs aim to educate young scholars to be interdisciplinary problem solvers.

The undergraduate degree programs of the Department of Engineering and Public Policy (EPP) have been designed to allow undergraduate students at Carnegie Mellon University to add this important interdisciplinary dimension to their traditional engineering or science education. EPP additional major graduates, for the most part, will enter traditional engineering or science careers, but will carry with them a set of insights and skills that will help them to better deal with issues in technology and policy, and better exercise their ethical and social obligations as practicing professionals. Our program has a long history of 50+ years producing graduates with these critical skills, with alumni serving in all areas of industry and government.

Overview of the Undergraduate Programs in EPP

The undergraduate additional major programs in EPP combine the strong foundation in mathematics and physical sciences, and the development of engineering or science skills with a rigorous preparation in the analysis of social and political problems. The curriculum includes subject matter which is not part of traditional technical or social science curricula, but which contains elements of each. Students complete courses in four core areas: economics, statistics, decision-making, and communication. Breadth is achieved through EPP Technology-Policy elective courses. Finally, students apply their skills in a project preparatory course and two interdisciplinary problem-solving projects. Problem areas for these projects are chosen from local, state, and national situations, and include such topics as climate change, energy systems, technological innovation, telecommunication issues, computer security and privacy, risk analysis and communication, among others. Students from several CMU colleges enroll in these projects courses exposing EPP additional majors to working in truly interdisciplinary situations. Examples of past project course topics (http://www.cmu.edu/epp/prospective/undergraduate/epp-project-courses/) and final reports are available.

Additional Major in Engineering and Public Policy

The EPP department offers an additional major in Engineering and Public Policy (EPP) with each of the five traditional engineering departments in the engineering college. The engineering additional major leads to a fully accredited engineering degree that prepares students for traditional technical careers. EPP additional major engineers are not educated to be a different kind of engineer. Rather, their education is intended to enable them to be better, more socially responsible engineers in the traditional technical fields.

Additional Major in Science, Technology, and Public Policy

The EPP department offers an additional major in Science, Technology and Public Policy (STPP) for students outside of the engineering college who are earning a B.S. degree. This includes students in the Mellon College of Science, the School of Computer Science, Tepper School of Business, and select majors in the Dietrich College and College of Fine Arts. Similar to the additional major in Engineering and Public Policy, the additional major in Science, Technology and Public Policy is meant to broaden the perspectives on a student’s primary major and provide additional skills for future careers.

Minor in Technology and Policy

The department also offers a minor in Technology and Policy for non-engineering majors. The Technology and Policy minor exposes students to issues at the interface of science, technology, and society, and how interdisciplinary approaches are needed to solve complex problems.

Minor in Information Security, Privacy and Policy

The department offers a minor in Information Security, Privacy and Policy for all majors in partnership with the School of Computer Science. The Information Security, Privacy and Policy minor offers students an understanding of how to identify potential security and privacy risks and relevant legal and policy issues, a working understanding of security topics as they pertain to design, development and management of new information technologies.

Career Options with EPP Additional Majors

Students who select one of the EPP additional majors graduate with an accredited engineering degree or complete science degree, and thus have all of the options for traditional technical careers as their single major classmates. A large portion of our additional major students pursue traditional technical careers after graduation in areas such as product development, consulting, project management, etc.

The advantage of the additional major is the added set of skills and perspectives, which allow a graduate of the program to improve the quality, sensitivity, and social responsiveness of their work, and the work of their colleagues. Employers recognize these skills and often view our graduates as more attractive for a traditional engineering or technical position. Firms contact the EPP department every year to recruit EPP graduates because of their satisfaction with the knowledge and skills acquired by EPP students. In addition, the additional major also opens up options for careers in policy analysis in federal, state, and local government or in public policy consulting firms. Alumni pursue careers in a range of companies to deal with issues like government regulation of technological systems, product liability and safety, environmental control, worker health and safety, telecommunications policy, energy systems, and the social impact of large technological systems.

Students also choose to continue their formal education, doing graduate work in engineering, the social sciences, law, or interdisciplinary programs.

Faculty Advisors

Faculty in several departments serve as advisors and information resources to students selecting the EPP undergraduate programs. Given the interdisciplinary perspective of EPP, students may find that a faculty member outside their traditional major can provide support and guidance with EPP-related courses and career paths. The EPP Associate Department Head for Undergraduate Affairs is Deanna Matthews. Dr. Matthews can provide general academic advice and guidance for all EPP undergraduates. Other faculty affiliated with the undergraduate programs in EPP are:

- Civil Engineering: Peter Adams, Jared Cohon, Desteinie Nock, Mitch Small
- Chemical Engineering: Peter Adams, Neil Donahue
- Computer Science: Lorrie Cranor, Nicolas Christin
- Economics/Business: Nicholas Muller, Marvin Sirbu
- Electrical and Computer Engineering: Jon Peha, Marvin Sirbu
- Engineering and Public Policy: Daniel Armanios, Alex Davis, Erica Fuchs, Paulina Jaramillo, Valerie Karplus, Deanna Matthews, Granger Morgan
- Institute for Politics and Strategy: Baruch Fischhoff
- Mechanical Engineering: Jeremy Michalek, Edward Rubin, Kate Whitefoot
- Material Science and Engineering: Jay Whitacre
- Social and Decision Sciences: Paul Fischbeck

EPP Program Educational Objectives

Students who earn an additional major in Engineering and Public Policy at the undergraduate level do so in conjunction with a traditional engineering major. The elements of the EPP undergraduate program broaden the traditional scope of technical analysis to encompass an engineering solution’s potential impact on society. Thus, our graduates have all of the skills as their peers in traditional engineering majors, but with a broader societal perspective and additional analysis skills. This enables our graduates to understand the interface between technology and society and...
to help solve the complex, interdisciplinary systems problems facing our world in their careers. Students will be able to work in a variety of career fields, including technical and non-technical, in industry, government or elsewhere where these broad skills are needed.

EPP Student Outcomes

By the end of the combined B.S. programs in a traditional engineering program and the EPP program, students should have attained the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The additional major in Engineering and Public Policy is accredited by the Department of Engineering and Public Policy. 

Course Requirements for the Additional Major in EPP

Minimum units for the additional major: 106

Students pursuing an additional major in EPP must complete three sets of requirements: courses for the EPP additional major, courses for their traditional disciplinary major, and general education courses. The student should refer to the relevant sections of this catalog for the required courses in the traditional disciplinary major. The EPP additional major is designed to be completed with a traditional disciplinary major in the standard four-year time frame. However, additional units or course work may be required. Some courses for the EPP additional major may also satisfy requirements for traditional disciplinary majors or for general education courses.

Overview

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-101 Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-201 EPP Sophomore Seminar</td>
<td>1</td>
</tr>
<tr>
<td>73-102 Principles of Microeconomics</td>
<td>9</td>
</tr>
<tr>
<td>19-250 Special Topics: Statistical Models for Engineering Analysis and Design</td>
<td>9</td>
</tr>
<tr>
<td>36-220 Engineering Statistics and Quality Control (or other approved statistics course)</td>
<td>9</td>
</tr>
<tr>
<td>19-301 Decision Making Methods for Engineers and Scientists (or other approved decision science course)</td>
<td>9</td>
</tr>
<tr>
<td>84-369 Decision Science for International Relations</td>
<td>9</td>
</tr>
<tr>
<td>88-223 Decision Analysis</td>
<td>12</td>
</tr>
<tr>
<td>19-325 Technology and Policy Writing for Lay Audiences (or other approved writing course)</td>
<td>9</td>
</tr>
<tr>
<td>76-270 Writing for the Professions</td>
<td>9</td>
</tr>
<tr>
<td>19-351 Applied Methods for Technology-Policy Analysis</td>
<td>9</td>
</tr>
<tr>
<td>19-451 EPP Projects I</td>
<td>12</td>
</tr>
<tr>
<td>19-452 EPP Projects II</td>
<td>12</td>
</tr>
<tr>
<td>Three EPP Technology-Policy Electives</td>
<td>min. 24</td>
</tr>
</tbody>
</table>

Introductory Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-101 Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-201 EPP Sophomore Seminar</td>
<td>1</td>
</tr>
<tr>
<td>19-211 Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-303 Cryptocurrencies, Blockchains and Applications</td>
<td>Var.</td>
</tr>
<tr>
<td>19-403 Policies of Wireless Systems</td>
<td>12</td>
</tr>
<tr>
<td>19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech</td>
<td>9</td>
</tr>
<tr>
<td>19-425 Sustainable Energy for the Developing World</td>
<td>9</td>
</tr>
<tr>
<td>19-433 Data Science for Technology, Innovation and Policy</td>
<td>9</td>
</tr>
<tr>
<td>19-443 Climate Change Science and Adaptation</td>
<td>9</td>
</tr>
</tbody>
</table>

The two introductory courses prepare students for the additional major experience through discussion and assessment of technology-policy interactions. 19-101 Introduction to Engineering and Public Policy may be taken as the second introductory engineering course during the first year for engineering students. 19-201 EPP Sophomore Seminar is required in addition to any corresponding seminar course in a student’s traditional degree program.

Core Area Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>73-102 Principles of Microeconomics</td>
<td>9</td>
</tr>
<tr>
<td>EPP Statistics elective - one of the following, or other approved course:</td>
<td>9</td>
</tr>
<tr>
<td>19-250 Special Topics: Statistical Models for Engineering Analysis and Design</td>
<td>9</td>
</tr>
<tr>
<td>36-220 Engineering Statistics and Quality Control</td>
<td>9</td>
</tr>
<tr>
<td>EPP Decision Science elective - one of the following, or other approved course (9 units minimum):</td>
<td>9</td>
</tr>
<tr>
<td>19-301 Decision Making Methods for Engineers and Scientists</td>
<td>9</td>
</tr>
<tr>
<td>88-223 Decision Analysis</td>
<td>12</td>
</tr>
<tr>
<td>88-302 Behavioral Decision Making</td>
<td>9</td>
</tr>
<tr>
<td>84-369 Decision Science for International Relations</td>
<td>9</td>
</tr>
<tr>
<td>EPP Writing and Communications elective - one of the following, or other approved course</td>
<td>9</td>
</tr>
<tr>
<td>19-325 Technology and Policy Writing for Lay Audiences</td>
<td>9</td>
</tr>
<tr>
<td>76-270 Writing for the Professions</td>
<td>9</td>
</tr>
</tbody>
</table>

The four core area courses provide the foundational skills in the social sciences that are needed for robust analysis of policy problems. 73-102 Principles of Microeconomics should be taken as a CIT General Education course.

CE, ME, and MSE students will complete the statistics elective as part of their traditional engineering majors (both courses listed meet traditional engineering requirements). CHE students will substitute the statistics elective for 03-232 Biochemistry I. ECE students, who take 36-217 Probability Theory and Random Processes for their traditional engineering major, may take either course listed above, or 36-226 Introduction to Statistical Inference. Students should complete the statistics requirement by the end of sophomore year. A statistics course is a prerequisite for the EPP Decision Science elective.

The EPP Decision Science elective fulfills either the CIT General Education Social Analysis and Decision Making requirement or a CIT General Education free elective. The EPP Writing and Communications course fulfills the CIT General Education Writing and Expressions requirement.

Technology-Policy Electives

- At least 3 courses of EPP Technology-Policy electives (24 units minimum)

EPP Technology-Policy Electives include courses that belong to three categories. First, EPP Technology-Policy Electives include courses that synthesize engineering analysis and social analysis perspectives and apply them to problems with substantial societal and technological components. Specific areas of interest for these courses are (1) energy, resources, and the environment, (2) risk assessment, (3) technology innovation, (4) urban engineering, (5) information and communication technology, and (6) product engineering and design, among others. Second, EPP Technology-Policy Electives include courses that teach methods or analysis skills necessary for solving complex problems. Examples include mathematical or statistical courses related to optimization or estimation, or economic courses related to economic analysis. Finally, EPP Technology-Policy Electives include courses that provide technical background for policy relevant issues. These courses are fundamental for understanding our current engineering systems and how proposed changes can be implemented. Examples include courses on electricity systems, engine design, or atmospheric systems. A sample of courses for EPP Technology-Policy Electives is below, a full list of approved courses is available from the department.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-211 Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-303 Cryptocurrencies, Blockchains and Applications</td>
<td>Var.</td>
</tr>
<tr>
<td>19-403 Policies of Wireless Systems</td>
<td>12</td>
</tr>
<tr>
<td>19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech</td>
<td>9</td>
</tr>
<tr>
<td>19-425 Sustainable Energy for the Developing World</td>
<td>9</td>
</tr>
<tr>
<td>19-433 Data Science for Technology, Innovation and Policy</td>
<td>9</td>
</tr>
<tr>
<td>19-443 Climate Change Science and Adaptation</td>
<td>9</td>
</tr>
</tbody>
</table>
The majority of 19-xxx EPP departmental courses are considered EPP Technology-Policy Electives. Exceptions will be identified when the courses are offered. Courses that are required or used for core area courses for the additional major can not be used as electives. Courses from other departments also are acceptable as electives with approval. Students should work with their advisors to define areas of concentration or a selection of breadth courses for the EPP Technology-Policy Electives.

Students are required to take at least three EPP Technology-Policy electives for a minimum of 24 units. Units may be added in any combination, but a maximum of one 3-unit course is permitted. Up to 9 units of research may be used with approval. Students may not use a required course from their traditional disciplinary major for these elective units. However, students may use an elective course from their traditional major requirements to meet the requirements of both their traditional engineering major and an EPP Technology-Policy elective, but the units for the course will not be double-counted toward units required for their degree. Some EPP Technology-Policy elective courses may fulfill requirements for CIT General Education categories (e.g., 19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech is an I&I course), otherwise students use Free Elective units to complete this requirement.

### Capstone Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>19-351</td>
<td>Applied Methods for Technology-Policy Analysis</td>
</tr>
<tr>
<td>12</td>
<td>19-451</td>
<td>EPP Projects I</td>
</tr>
<tr>
<td>12</td>
<td>19-452</td>
<td>EPP Projects II</td>
</tr>
</tbody>
</table>

The capstone courses synthesize the technical skills and knowledge from a student’s traditional major with the social science skills and broad perspective of the EPP major.

19-351 Applied Methods for Technology-Policy Analysis is a preparatory course for EPP Projects sequence. 19-351 may be completed as a co-requisite of 19-451 EPP Projects I. The course fulfills CIT General Education free elective units.

19-451 EPP Projects I and 19-452 EPP Projects II are technology/policy projects which deal with research and development of recommendations for solving actual and critical problems currently affecting society. The students, faculty, and graduate student managers for the project are drawn from EPP, Social and Decision Sciences, and the Heinz College, and other CMU departments, and hence bring different areas of expertise to the structuring and solution of the problem. The topics for EPP Projects are drawn from diverse areas such as environmental systems and resources, public transportation, urban engineering problems, energy and fuel utilization, the interaction of law and technology, strategic materials and vulnerability of supply, technical issues in national security, and problems in automation, robotics, and communication technology. Students use Free Elective units to complete this requirement. 19-452 EPP Projects II serves as the capstone engineering design course experience for additional majors.

### Notes on EPP additional major requirements

Students should follow the suggested curriculum timelines for completing the math, science, and engineering course requirements of the traditional major with the exception of the statistics elective which should be taken as early as possible and no later than the end of sophomore year.

Some courses as noted above may be used to fulfill requirements of general education courses. Acceptable courses for the CIT General Education requirements are maintained by the CIT Dean's Office. Students must submit an application during their first-semester as an EPP student (usually Fall sophomore year) for these general education courses demonstrating their relevance to EPP.

Students must complete the minimum number of units as required by their traditional major for graduation. In some cases, students completing the EPP additional major may need to complete additional units to meet all requirements for the traditional major and EPP additional major.

In addition to any other graduation requirements (e.g., regarding course work, minimum QPA, pass/fail course work, etc.) of the student's traditional disciplinary major, students must earn a minimum QPA of 2.0 in all courses required for the EPP major.

Side-by-side curriculum charts (http://www.cm.edu/epp/prospective/undergraduate/epp-additional-major/courriculum-charts/) of the curricula for the traditional engineering majors alone versus the traditional engineering majors with the EPP additional major can assist students in determining the course requirements and scheduling needed to complete the degree requirements.

### Course Requirements for the Additional Major in STPP

Minimum units required for additional major: 106

Students pursuing an additional major in STPP must complete three sets of requirements: courses for the STPP additional major, courses for their traditional disciplinary major, and general education courses. The student should refer to the relevant sections of this catalog for the required courses in the traditional disciplinary major. The STPP additional major is designed to be completed with a traditional disciplinary major in the standard four-year time frame. However, additional units or course work may be required. Some courses for the STPP additional major may also satisfy requirements for traditional disciplinary majors or for general education courses.

#### Introductory Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>19-101</td>
<td>Introduction to Engineering and Public Policy</td>
</tr>
<tr>
<td>1</td>
<td>19-201</td>
<td>EPP Sophomore Seminar</td>
</tr>
</tbody>
</table>

The two introductory courses prepare students for the additional major experience through discussion and assessment of technology-policy interactions. 19-101 Introduction to Engineering and Public Policy may qualify as a general education course in some traditional majors. 19-201 EPP Sophomore Seminar is required in addition to any corresponding seminar course in a student’s traditional degree program.

#### Core Area Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>73-102</td>
<td>Principles of Microeconomics</td>
</tr>
</tbody>
</table>

Statistics course — one of the following:

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>19-250</td>
<td>Special Topics: Statistical Models for Engineering Analysis and Design</td>
</tr>
<tr>
<td>9</td>
<td>36-220</td>
<td>Engineering Statistics and Quality Control</td>
</tr>
<tr>
<td>9</td>
<td>36-226</td>
<td>Introduction to Statistical Inference</td>
</tr>
<tr>
<td>or other approved statistics course</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STPP Decision Science course — one of the following:

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>19-301</td>
<td>Decision Making Methods for Engineers and Scientists</td>
</tr>
<tr>
<td>9</td>
<td>88-223</td>
<td>Decision Analysis</td>
</tr>
<tr>
<td>9</td>
<td>88-302</td>
<td>Behavioral Decision Making</td>
</tr>
<tr>
<td>9</td>
<td>84-369</td>
<td>Decision Science for International Relations</td>
</tr>
<tr>
<td>or other approved decision science course</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STPP Writing and Communications course — one of the following:

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>19-325</td>
<td>Technology and Policy Writing for Lay Audiences</td>
</tr>
<tr>
<td>9</td>
<td>76-270</td>
<td>Writing for the Professions</td>
</tr>
<tr>
<td>9</td>
<td>76-271</td>
<td>Introduction to Professional and Technical Writing</td>
</tr>
<tr>
<td>or other approved writing and communications course</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The four core area courses provide the foundational skills in the social sciences that are needed for robust analysis of policy problems. For students in SCS and MCS, the economics, decision science, and writing
course selections may qualify as general education courses, and the statistics elective may qualify for a math/science requirement. For students in DC and CFA, some core area requirements may be fulfilled by traditional program requirements or general education courses. Students should consult with their advisors in both programs to assure that courses are meeting requirements and providing appropriate depth of content.

**Technology-Policy Electives**

- **3 courses, at least 24 units**
- **24 minimum units**

STPP Technology-Policy Electives include courses that belong to three categories. First, STPP Technology-Policy Electives include courses that synthesize technical analysis and social analysis perspectives and apply them to problems with substantial societal and technological components. Specific areas of interest for these courses are (1) energy, resources, and the environment, (2) risk assessment, (3) technology innovation, (4) urban engineering, (5) information and communication technology, and (6) product development and design, among others. Second, STPP Technology-Policy Electives include courses that teach methods or analysis skills necessary for solving complex problems. Examples include mathematical or statistical courses related to optimization or estimation, or economics courses related to economic analysis. Finally, STPP Technology-Policy Electives include courses that provide technical background for policy relevant issues. These courses are fundamental for understanding our current technical systems and how proposed changes can be implemented. Examples include courses on electricity systems, telecommunication systems, engine design, or atmospheric systems. A sample of courses for STPP Technology-Policy Electives is below, a full list of approved courses is available from the department.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-211</td>
<td>Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-303</td>
<td>Cryptocurrencies, Blockchains and Applications</td>
<td>Var.</td>
</tr>
<tr>
<td>19-403</td>
<td>Policies of Wireless Systems</td>
<td>12</td>
</tr>
<tr>
<td>19-411</td>
<td>Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech</td>
<td>9</td>
</tr>
<tr>
<td>19-421</td>
<td>Emerging Energy Policies</td>
<td>9</td>
</tr>
<tr>
<td>19-433</td>
<td>Data Science for Technology, Innovation and Policy</td>
<td>9</td>
</tr>
<tr>
<td>19-458</td>
<td>Special Topics: Organizational Theory for Engineers</td>
<td>9</td>
</tr>
<tr>
<td>19-626</td>
<td>Climate Science and Policy</td>
<td>12</td>
</tr>
</tbody>
</table>

The majority of 19-xxx EPP departmental courses are considered STPP Technology-Policy Electives. Exceptions will be identified when the courses are offered. Courses that are required or used for core area courses for the additional major can not be used as electives. Courses from other departments also are acceptable as electives with approval. Students should work with their advisors to define areas of concentration and a selection of breadth courses for the STPP Technology-Policy Electives.

Students are required to take at least three STPP Technology-Policy electives for a minimum of 24 units. Units may be added in any combination, but a maximum of one 3-unit course is permitted. Up to 9 units of research may be used with approval. Students may not use a required course from their traditional disciplinary major for these elective units. However, students may use an elective course from their traditional major requirements to meet the requirements of both their traditional engineering major and an STPP Technology-Policy elective, but the units for the course will not be double-counted toward units required for their degree. Some STPP Technology-Policy elective courses may fulfill general education requirements for traditional major programs.

**Capstone Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-351</td>
<td>Applied Methods for Technology-Policy Analysis</td>
<td>9</td>
</tr>
<tr>
<td>19-451</td>
<td>EPP Projects I</td>
<td>12</td>
</tr>
<tr>
<td>19-452</td>
<td>EPP Projects II</td>
<td>12</td>
</tr>
</tbody>
</table>

The capstone courses synthesize the technical skills and knowledge from a student’s traditional major with the social science skills and broad perspective of the STTP additional major.

19-351 Applied Methods for Technology-Policy Analysis is a preparatory course for the EPP Projects sequence. 19-351 may be completed as a prerequisite of 19-451 EPP Projects I.

19-451 EPP Projects I and 19-452 EPP Projects II are technology/policy projects which deal with research and development of recommendations for solving actual and critical problems currently affecting society. The students, faculty, and graduate student managers for the project are drawn from the EPP and STPP programs, the Heinz College, and other CMU departments, and hence bring different areas of expertise to the structuring and solution of the problem. The topics for EPP Projects are drawn from diverse areas such as environmental systems and resources, public transportation, urban engineering problems, energy and fuel utilization, the interaction of law and technology, strategic materials and vulnerability of supply, technical issues in national security, and problems in automation, robotics, and communication technology. These capstone courses may qualify as general education courses in some traditional major programs.

**Notes on STPP additional major requirements**

Students should follow the suggested curriculum timelines for completing the course requirements of their traditional major program where necessary and will work with both their traditional program advisor and the STPP advisor to assure that requirements for both degrees are met. Students must complete the minimum number of units as required by their traditional major for graduation. In some cases, students completing the STPP additional major may need to complete additional units to meet all requirements for the traditional major and STPP additional major.

In addition to any other graduation requirements (e.g., regarding course work, minimum GPA, pass/fail course work, etc.) of the student’s traditional disciplinary major, students must earn a minimum GPA of 2.0 in all courses required for the STPP additional major.

**Integrated B.S./M.S. Programs**

**B.S. integrated with M.S. in Engineering and Public Policy**

Students, regardless of whether they complete an undergraduate additional major or not, may plan a course of study that leads to completing both their undergraduate B.S. degree and an MS in Engineering and Public Policy. This course of study will ordinarily require two additional semesters of study beyond that required for the undergraduate degrees in the primary major and EPP/STPP additional major, although advanced placement or other study may reduce this time. Some coursework towards the MS may be completed during the student’s senior year; however, no courses taken may count for both a B.S. program and the MS in EPP. Students interested in the program should contact their advisor for details on the application process and course requirements. See the EPP website for more information about the MS in EPP program requirements (https://www.cmu.edu/epp/prospective/ms-in-eppp/) including curriculum.

**B.S. integrated with M.S. in Public Policy and Management**

Students may also combine their undergraduate degree program and EPP or STPP additional major program with a master’s degree in the H. John Heinz College of Public Policy and Management in a five-year course of study. During the third year of study, the student applies to the Heinz College for admission to the master’s program; an academic record of B average or better is normally a prerequisite for admittance. For general information on Heinz 3-1-1 programs please contact the Heinz College or refer to their website.

**Minors in Engineering and Public Policy**

**MINOR IN TECHNOLOGY AND POLICY**

The department offers a minor in Technology and Policy to non-CIT majors. This minor allows students outside of engineering to sample the EPP requirements and develop exposure and awareness to issues at the interface of science, technology, and society.

Pre-requisites: Students should have prerequisite knowledge in economics (73-102 Principles of Microeconomics or higher level economics course) and statistics (36-202 Methods for Statistics & Data Science or higher level statistics course) in order to pursue the Technology and Policy Minor.

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-101</td>
<td>12</td>
</tr>
<tr>
<td>19-301</td>
<td>9</td>
</tr>
<tr>
<td>19-351</td>
<td>9</td>
</tr>
<tr>
<td>19-451</td>
<td>12</td>
</tr>
<tr>
<td>xx-xxx</td>
<td>18</td>
</tr>
</tbody>
</table>

EPP Technical Electives include courses that address problems at the society-technology interface and the means of analyzing these issues.
A list of qualifying Technology-Policy electives is available from the EPP Department. Example Technology-Policy electives include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-211</td>
<td>Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-303</td>
<td>Cryptocurrencies, Blockchains and Applications</td>
<td>Var.</td>
</tr>
<tr>
<td>19-402</td>
<td>Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>19-424</td>
<td>Energy and the Environment</td>
<td>9</td>
</tr>
<tr>
<td>19-425</td>
<td>Sustainable Energy for the Developing World</td>
<td>9</td>
</tr>
<tr>
<td>19-433</td>
<td>Data Science for Technology, Innovation and Policy</td>
<td>9</td>
</tr>
<tr>
<td>19-626</td>
<td>Climate Science and Policy</td>
<td>12</td>
</tr>
</tbody>
</table>

Students must earn a cumulative GPA of 2.0 in all courses taken for the minor. Required courses taken for a student’s primary major may not be counted toward the Technology and Policy Minor. Elective courses for a student’s primary major or courses fulfilling general education requirements may be counted, however.

Details of this program are provided in the discussion of CIT minors; see Technology and Policy Minor Description (http:// courscatalog.web.cmu.edu/carnegieinstituteoftechnology/minorsformonengineeringstudents/technologyandpolicy/minor).

MINOR IN INFORMATION SECURITY, PRIVACY AND POLICY

Lujo Bauer, Director

Interdisciplinary minor offered by both CIT and SCS

There is a growing demand for security and privacy experts, and increasing interest among CMU undergraduates in taking security and privacy courses. Security and privacy expertise is an asset in a variety of careers outside, not just in computer science, but also in areas that include business, management, and law. In addition, the policy side of security and privacy is becoming increasingly important and employers are interested in hiring people with an understanding of relevant policy issues, especially in the privacy and security area.

This minor is for undergraduate students across the university who are interested in policy issues related to security and privacy, including those who are planning careers in security/privacy as well as those who plan to focus their careers in other areas. The curriculum has been designed to accommodate students from any major as long as they have taken at least one introductory-level college programming course (such as 15-110 or 15-112).

After completing this minor, students will have a good understanding of how to identify potential security and privacy risks and relevant legal and policy issues; a working understanding of security topics such as cryptography, authentication, and internet security protocols; as well as broad knowledge of several security- and privacy-related areas as they pertain to the design, development, deployment and management of technologies in a variety of practical contexts (e.g., Web, mobile, Internet of Things, social media, crypto currencies).

Admission

Students are not required to apply to enroll in this minor to start the required courses. However, they are encouraged to consult with the minor director on their elective course selection. In addition, students doing the independent study option must get approval from the minor director prior to enrolling in their independent study course. Finally, students must contact the minor director to certify their completion of the minor.

Curriculum

Students are required to take five courses to complete this minor with a minimum of 48 units.

INTRODUCTORY SECURITY COURSE

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-331</td>
<td>Information Security, Privacy, and Policy</td>
</tr>
</tbody>
</table>

Students who have taken 15-213 Introduction to Computer Systems may substitute 15-330 Introduction to Computer Security/18-330 Introduction to Computer Security

PRIVACY AND POLICY COURSE

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-333</td>
<td>Privacy Policy, Law, and Technology</td>
<td>9</td>
</tr>
</tbody>
</table>

Students may substitute 12-unit version of this course: 19-608, 17-733, or 95-818.

PRIVACY ELECTIVES

Complete a minimum of 9 units:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-534/17-334/Osborne</td>
<td>Privacy and Security</td>
<td>9</td>
</tr>
<tr>
<td>19-602/17-702 Current Topics in Privacy Seminar</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>17-731</td>
<td>Foundations of Privacy</td>
<td>12</td>
</tr>
</tbody>
</table>

TECHNOLOGY AND POLICY ELECTIVES

Complete a minimum of 9 units:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-211</td>
<td>Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>17-562</td>
<td>Law of Computer Technology</td>
<td>9</td>
</tr>
<tr>
<td>19-101</td>
<td>Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-402</td>
<td>Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>19-403</td>
<td>Policies of Wireless Systems</td>
<td>12</td>
</tr>
<tr>
<td>19-639</td>
<td>Policies of the Internet</td>
<td>12</td>
</tr>
<tr>
<td>84-387</td>
<td>Technology and Policy of Cyber War</td>
<td>9</td>
</tr>
</tbody>
</table>

Crosslisted courses are also allowed.

ADDITIONAL APPROVED ELECTIVE

Students must complete an additional elective of 9 units or more. Students may choose an additional privacy elective or technology policy elective from the list above, or the one of the following security electives:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-316</td>
<td>Software Foundations of Security and Privacy</td>
<td>9</td>
</tr>
<tr>
<td>15-356</td>
<td>Introduction to Cryptography</td>
<td>9</td>
</tr>
<tr>
<td>19-17-303</td>
<td>Cryptocurrencies, Blockchains and Applications</td>
<td>Var.</td>
</tr>
<tr>
<td>19-534/17-334 Usable Privacy and Security</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>18-335</td>
<td>Secure Software Systems</td>
<td>12</td>
</tr>
</tbody>
</table>

Students who have the necessary prerequisites may choose any approved elective from the SCS or ECE security and privacy undergraduate concentration. Check with the minor program director to determine which category of elective each course will fulfill.

Students should be careful to choose electives for which they have appropriate prerequisites. New elective options are expected as more courses are offered. Students may petition to count a course not on this list as an elective. Students should request permission before taking a course that is not on this list. Students may not count multiple electives that overlap substantially.

Optional Project: Subject to approval by the minor director, students may optionally count towards one of the elective requirements 9 units of an independent study or research project course in the security or privacy area, under the supervision of a faculty member in any department. In order to receive credit towards the minor, students must submit a brief project proposal to their project advisor and to the minor director and have it approved prior to conducting the project. Depending on the topic of the project, the minor director may approve credits counting towards privacy electives, technology policy electives, security electives, or some combination of these. Students may work individually, with other undergraduates, or as part of project teams with graduate students or research staff. Students involved in a group project must identify specific project components for which they are responsible. In addition, they must submit a final project report to their project advisor and the minor director that includes a literature review and describes the work they completed. Students working on a group project must each submit their own final report, which should also situate their contribution in the context of the larger project. Note, students are expected to work approximately 1 hour per week for each unit of project in which they are enrolled (e.g. 9 units = 9 hours/week of project work).

Double Counting: At most 2 of the courses used to fulfill the minor requirements may be counted towards any other undergraduate major or minor program. This rule does not apply to courses counted for general education requirements.

Notes on EPP Undergraduate/Graduate Level Courses

Many courses taught by the department (19-XXX courses) are offered to undergraduate and graduate students. These “dual level” courses are offered in two formats:

- Some courses are taught under both an undergraduate and graduate number. An example is Telecommunications Technology and Policy for the Internet Age (19-402) and (19-722). In these types of courses, students who sign up under the 700-level (graduate) course number may be expected to perform the same coursework at a higher level, and/or complete additional coursework, compared to 400-level courses.
students. Undergraduates who choose to take the course under the graduate number will be also be expected to work at the higher expectation/coursework level.

- Other courses are taught under a 600 level number. An example is 19-626 Climate Science and Policy. These courses may be taken by undergraduates as a senior level course, or by graduate students as a graduate level course. As with dual number courses, graduate level students or undergraduates taking the course for graduate credit may be required to perform coursework at a higher level and/or complete additional coursework. Undergraduates who are taking a 600 level course for graduate credit should identify this fact to both the course instructor and to their EPP department advisor.

Students who have questions about the requirements of a specific EPP 400/700, or 600 level course, should contact the course instructor. Some courses have pre-requisites which may be waived for students given prior background.

Other departments may have different policies regarding courses offered under both an undergraduate and graduate number, and courses offered under numbers other than the 100, 200, 300, 400, or 700 levels. Students who wish to take these courses should check with those departments for their specific policies.

Faculty

PETER ADAMS, Department Head, Engineering and Public Policy; Professor of Civil and Environmental Engineering / Engineering and Public Policy – Ph.D., Caltech; Carnegie Mellon, 2001–

JAY APT, Professor of Technology of The Tepper School of Business / Engineering and Public Policy – Ph.D., MIT; Carnegie Mellon, 2000–

DANIEL ARMANIOS, Assistant Professor of Engineering and Public Policy – Ph.D., Stanford University; Carnegie Mellon, 2015–

TIMOTHY BROWN, Professor of Engineering and Public Policy with assignment to CMU Africa – Ph.D., California Institute of Technology; Carnegie Mellon, 2013–

KATHLEEN M. CARLEY, Professor, Computer Science/ Tepper School of Business/ Social and Decision Sciences/ H. John Heinz III College / Engineering and Public Policy – Ph.D., Harvard University; Carnegie Mellon, 1984–

NICOLAS CHRISTIN, Associate Professor, Computer Science/ Engineering and Public Policy/ CyLab – Ph.D., University of Virginia; Carnegie Mellon, 2005–

JARED L. COHON, University Professor, Civil and Environmental Engineering / Engineering and Public Policy; President Emeritus – Ph.D., MIT; Carnegie Mellon, 1997–

LORRIE FAITH CRANOR, FORE Systems Professor, Computer Science / Engineering and Public Policy/ Director, CyLab Usable Privacy and Security Laboratory – D.Sc., Washington University, St. Louis; Carnegie Mellon, 2003–

ALEX DAVIS, Associate Professor of Engineering and Public Policy – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2012–

NEIL M. DONAHUE, Thomas Lord Professorship in Chemistry; Professor of Chemical Engineering / Chemistry / Engineering and Public Policy – Ph.D., MIT; Carnegie Mellon, 2000–


PAUL S. FISCHBECK, Professor of Social and Decision Sciences / Engineering and Public Policy – Ph.D., Stanford University; Carnegie Mellon, 1990–

BARUCH FISCHHOFF, Howard Heinz University Professor, Professor of Engineering and Public Policy / Institute for Politics and Strategy – Ph.D., Hebrew University; Carnegie Mellon, 1987–

ERICA R. H. FUCHS, Professor of Engineering and Public Policy – Ph.D., MIT; Carnegie Mellon, 1992–

ALEX HILLS, Distinguished Service Professor, Engineering and Public Policy – Ph.D., Carnegie Mellon; Carnegie Mellon, 2007–

PAULINA JARAMILLO, Professor of Engineering and Public Policy and CMU Africa – Ph.D., Carnegie Mellon University; Carnegie Mellon, 2007–

VALERIE KAPPLUS, Associate Professor Engineering and Public Policy – PhD, MIT; Carnegie Mellon, 2020–

RAMAYYA KRISHNAN, Dean of The H. John Heinz III College; William W. and Ruth F. Cooper Professor of Management Science and Information Systems; Professor of Engineering and Public Policy – Ph.D., University of Texas at Austin; Carnegie Mellon, 1987–

DEANNA MATTHEWS, Teaching Professor of Engineering and Public Policy; Associate Department Head for Undergraduate Affairs - Ph.D., Carnegie Mellon University; Carnegie Mellon, 2001–

JEREMY J. MICHALEK, Professor of Mechanical Engineering / Engineering and Public Policy – Ph.D., University of Michigan; Carnegie Mellon, 2005–

M. GRANGER MORGAN, Hammerschlag University Professor of Engineering; Professor of Engineering and Public Policy / Electrical and Computer Engineering / The H. John Heinz III College – Ph.D., University of California, San Diego; Carnegie Mellon, 1974–

NICHOLAS MULLER, Lester and Judith Lave Associate Professor of Economics, Engineering, and Public Policy, Tepper School of Business / Engineering and Public Policy; Associate Department Head for Graduate Affairs, Engineering and Public Policy – Ph.D., Yale University; Carnegie Mellon, 2017–

DESTENIE NOCK, Assistant Professor, Civil and Environmental Engineering/ Engineering and Public Policy – Ph.D., University of Massachusetts, Amherst; Carnegie Mellon, 2019–

SPIROS N. PANDIS, Research Professor of Chemical Engineering / Engineering and Public Policy – Ph.D., California Institute of Technology; Carnegie Mellon, 1993–

JON M. PEHA, Professor of Engineering and Public Policy – Ph.D., Stanford University; Carnegie Mellon, 1991–

ALLEN ROBINSON, David and Susan Coulter Head and Raymond J. Lane Distinguished University Professor; Mechanical Engineering Professor, Engineering and Public Policy – Ph.D., University of California, Berkeley; Carnegie Mellon, 1998–

EDWARD S. RUBIN, Alumni Chair Professor of Environmental Engineering and Science/ Engineering and Public Policy/ Mechanical Engineering – Ph.D., Stanford University; Carnegie Mellon, 1969–


MITCHELL J. SMALL, The H. John Heinz III Professor of Environmental Engineering; Professor of Civil and Environmental Engineering / Engineering and Public Policy – Ph.D., University of Michigan; Carnegie Mellon, 1982–


JOEL A. TARR, Richard S. Caliguiri Professor of Urban and Environmental History and Policy; Professor of History / Engineering and Public Policy / The H. John Heinz III College – Ph.D., Northwestern University; Carnegie Mellon, 1967–

JEANNE VANBRJENSEN, Vice Provost for Faculty, Carnegie Mellon University; Duquesne Light Company Professor, Professor of Civil and Environmental Engineering / Engineering and Public Policy – Ph.D., Northwestern University; Carnegie Mellon, 2001–

JAY WHITACRE, Trustee Professor in Energy, Materials Science and Engineering / Engineering and Public Policy – Ph.D., University of Michigan; Carnegie Mellon, 2007–

KATE WHITEFOOT, Assistant Professor of Mechanical Engineering / Engineering and Public Policy – Ph.D., University of Michigan; Carnegie Mellon, 2016–

JIMMY WILLIAMS, Distinguished Service Professor and Executive Director Engineering and Technology Innovation Management, Engineering and Public Policy – D.Sc., Washington University, St. Louis; Carnegie Mellon, 2015–

HAIBO ZHAI, Associate Research Professor of Engineering and Public Policy – Ph.D., North Carolina State University; Carnegie Mellon, 2008–

Emeriti Faculty

TUNG AU, University Professor of Civil and Environmental Engineering / Engineering and Public Policy, Emeritus – Ph.D., University of Illinois; Carnegie Mellon, 1957–

ALFRED BLUMSTEIN, J. Erik Jonsson University Professor of Urban Systems and Operations Research; Professor of The H. John Heinz III College / Engineering and Public Policy, Emeritus – Ph.D., Cornell University; Carnegie Mellon, 1969–

ELIZABETH CASMAN, Associate Research Professor of Engineering and Public Policy, Emeritus – PhD, Johns Hopkins University; Carnegie Mellon, 1997–
JAMES GOODBY, Distinguished Service Professor, Emeritus – A.B., Harvard; Carnegie Mellon, 1989–

MICHAEL GRIFFIN, Research Professor of Engineering and Public Policy, Emeritus – PhD, University of Rhode Island; Carnegie Mellon, 2000–

CHRISTOPHER T. HENDRICKSON, University Professor of Civil and Environmental Engineering / Engineering and Public Policy, Emeritus – PhD, MIT; Carnegie Mellon, 1978–

DAVID A. HOUNSHELL, David M Roderick Professor of Technology and Social Change; Professor of Social and Decision Sciences / Engineering and Public Policy, Emeritus – Ph.D., University of Delaware; Carnegie Mellon, 1991–

MARIJA ILIC, Professor of Electrical and Computer Engineering / Engineering and Public Policy, Emeritus – D.Sc., University of Washington, St. Louis; Carnegie Mellon, 2002–

INDIRA NAIR, Vice Provost for Education, Carnegie Mellon University; Professor of Engineering and Public Policy, Emeritus – Ph.D, Northwestern University; Carnegie Mellon, 1978–

SAROSH TALUKDAR, Professor of Electrical and Computer Engineering / Engineering and Public Policy, Emeritus – Ph.D., Purdue University; Carnegie Mellon, 1974–

ROBERT M. WHITE, University Professor of Electrical and Computer Engineering / Engineering and Public Policy, Emeritus – Ph.D., Stanford University; Carnegie Mellon, 1993–