Additional Major in Engineering and Public Policy

The EPP department offers an additional major in Engineering and Public Policy (EPP) for students completing an undergraduate degree in engineering from any 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 completing an undergraduate B.S. degree outside of the engineering college. 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 of 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, financial investment, 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, Destenie Nock, Mitch Small
- Chemical Engineering: Peter Adams, Neil Donahue
- Computer Science: Lorrie Cranor, Nicholas Christakis
- 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, environmental, and 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

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>or 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</td>
<td>9</td>
</tr>
<tr>
<td>or 84-369 Decision Science for International Relations</td>
<td>9</td>
</tr>
<tr>
<td>or 88-223 Decision Analysis</td>
<td></td>
</tr>
<tr>
<td>or 88-302 Behavioral Decision Making</td>
<td></td>
</tr>
<tr>
<td>(or other approved decision science course)</td>
<td></td>
</tr>
<tr>
<td>19-325 Technology and Policy Writing for Lay Audiences or 76-270 Writing for the Professions (or other approved writing course)</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 min. 24</td>
<td></td>
</tr>
</tbody>
</table>

Introductory Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>19-101 Introduction to Engineering and Public Policy</td>
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</tr>
<tr>
<td>19-201 EPP Sophomore Seminar</td>
<td>1</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>
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</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></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></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></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
economics 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>
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<tr>
<td>19-303 Cryptocurrencies, Blockchains and Applications Var.</td>
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</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>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>19-351</td>
<td>9</td>
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<tr>
<td>19-451</td>
<td>12</td>
</tr>
<tr>
<td>19-452</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 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 a plan 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.cmu.edu/epp/prospective/undergraduate/epp-additional-major/curriculum-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.

A proposed semester plan is below. Students work with their faculty advisors to determine the best sequence of courses given the varied requirements in the traditional majors.

### 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>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-101</td>
<td>12</td>
</tr>
<tr>
<td>19-201</td>
<td>1</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>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>73-102</td>
<td>9</td>
</tr>
</tbody>
</table>

Statistics course — one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-250</td>
<td>9</td>
</tr>
<tr>
<td>36-220</td>
<td>9</td>
</tr>
<tr>
<td>36-226</td>
<td>9</td>
</tr>
</tbody>
</table>

or other approved statistics course

STPP Decision Science course — one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>19-301</td>
<td>9</td>
</tr>
<tr>
<td>88-223</td>
<td>12</td>
</tr>
<tr>
<td>88-302</td>
<td>9</td>
</tr>
<tr>
<td>84-369</td>
<td>9</td>
</tr>
</tbody>
</table>

or other approved decision science course

STPP Writing and Communications course — one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-325</td>
<td>9</td>
</tr>
<tr>
<td>76-270</td>
<td>9</td>
</tr>
<tr>
<td>76-271</td>
<td>9</td>
</tr>
</tbody>
</table>

or other approved writing and communications course

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</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Century: Firms, Nations, and Tech</td>
<td></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</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Policy</td>
<td></td>
</tr>
<tr>
<td>19-458</td>
<td>Special Topics: Organizational Theory for</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Engineers</td>
<td></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 or 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 STPP 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 corequisite 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, 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. 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

CMU undergraduate students, regardless of whether they complete an undergraduate additional major in EPP or STPP or not, may plan a course of study that leads to completing both their undergraduate B.S. degree and an M.S 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 M.S may be completed during the student’s senior year, however no courses taken may count for both a B.S program and the M.S 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 M.S 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>
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<tbody>
<tr>
<td>19-101</td>
<td>12</td>
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<tr>
<td>19-301</td>
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<tr>
<td>19-451</td>
<td>12</td>
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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:

19-211 Ethics and Policy Issues in Computing 9
19-303 Cryptocurrencies, Blockchains and Applications 9
19-402 Telecommunications Technology and Policy for the Internet Age 12
19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech 9
19-424 Energy and the Environment 9
19-425 Sustainable Energy for the Developing World 9
19-433 Data Science for Technology, Innovation and Policy 9
19-626 Climate Science and Policy 12

Students must earn a cumulative QPA 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://coursecatalog.web.cmu.edu/carnegieinstituteoftechnology/minorsfornonengineeringstudents/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
17-331 Information Security, Privacy, and Policy 12
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
17-333 Privacy Policy, Law, and Technology 9
Students may substitute 12-unit version of this course: 19-608, 17-733, or 95-818.

PRIVACY ELECTIVES

Complete a minimum of 9 units:
19-534/17-334 Usable Privacy and Security 9
17-731 Foundations of Privacy 12

TECHNOLOGY AND POLICY ELECTIVES
Complete a minimum of 9 units:
19-211 Ethics and Policy Issues in Computing 9
17-562 Law of Computer Technology 9
19-101 Introduction to Engineering and Public Policy 12
19-402 Telecommunications Technology and Policy for the Internet Age 12
19-403 Policies of Wireless Systems 12
19-639 Policies of the Internet 12
84-387 Technology and Policy of Cyber War 12

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:
15-316 Software Foundations of Security and Privacy 9
15-356 Introduction to Cryptography 12
19/17-303 Cryptocurrencies, Blockchains and Applications Var.
19-534/17-334 Usable Privacy and Security 9
18-335 Secure Software Systems 12

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 (19-721). In these types of courses, students who sign up under the 700-level (graduate) course number may be expected to perform the same coursework as a higher level, and/or complete additional coursework, compared to 400-level students. Undergraduates who choose to take the course under the
graduate number will 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, Thomas Lord Professor of Civil and Environmental Engineering and Engineering and Public Policy / 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–

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

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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–

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