



Engineering & Public Policy – An Education Perspective

CREATING ENGINEERS WITH A DIFFERENCE

Deanna Matthews

Associate Department Head – Undergraduate Affairs

Teaching Professor

Engineering and Public Policy

Carnegie Mellon University

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Agenda

1. My perspectives and biases
2. Our EPP Programs at CMU
3. Curricula
4. Courses
5. Careers and pathways

Current status and challenges in each



My perspectives and biases

- Engineering program Professor and academic advisor at a
- Very high research activity, PhD granting institution
- highly selective undergraduate institution
- with large international student population
- and *generally* students from upper-class socioeconomic, suburban backgrounds
- [“Academic Wheel of Privilege” \(Flavio\)](#)



What am I missing?

- Non-engineers with technical backgrounds who can be brought to the table
- Less research, primarily undergraduate institutions
- HBCU, HSIs, Tribal colleges
- Broader political and economic spectrum of students



CMU Programs and Curricula

Carnegie Mellon University and Engineering and Public Policy

- Undergrad program established in 1970, PhD program a few years later, MS formally in 2020

| Programs | Cohort Size | Annual Total Program Size |
|---|--------------------|----------------------------------|
| Undergraduate – Engineering and Public Policy | 20-25 | 75-90 |
| Undergraduate – Science, Technology and Public Policy | 2-4 | |
| Masters in Engineering and Public Policy | 10-15 | 10-15 |
| Doctorate in Engineering and Public Policy | 10-15 | 75 |

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Less than 10% of the CMU College of Engineering population

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What is Engineering and Public Policy?

- Addressing the connections between engineering systems and society



Communicating vaccine effectiveness



Identify transit and COVID exposure inequities during the pandemic



Understanding air pollution and health impacts from food production

Need for transparent privacy policies for apps

| Security & Privacy Overview | | | | | |
|--|------------------------|---|-------------------------------|---------------|----------|
| Smart Device Co. | | | | | |
| Smart Video Doorbell NS200 | | | | | |
| Firmware version: 2.5.1 - updated on: 11/12/2020 | | | | | |
| The device was manufactured in: China | | | | | |
| Security Mechanisms | Security updates | Automatic - Available until at least 1/1/2022 | | | |
| | Access control | Password - Factory default - User changeable, Multi-factor authentication, Multiple user accounts are allowed | | | |
| Data Practices | Sensor data collection | Visual | Audio | Physiological | Location |
| | Sensor type | | Microphone | | |
| | Purpose | | | | |
| | Data stored on device | | | | |
| | Data stored on cloud | | Identified - Option to delete | | |
| Shared with | | Manufacturer | | | |
| Sold to | Not disclosed | Not sold | | | |



CMU EPP Research Focus Areas

- Climate and environment
- Energy systems
- Risk Analysis
- Technology Innovation Policy
- Information and Communication Technology

These faculty and doctoral research areas limit our reach on problems and students we might attract.

CMU Engineering and Public Policy Curricula

Policy + Analysis + Technical Understanding

Undergraduate

Core – policy basics,
interdisciplinary focus

Skill/Knowledge Areas –

- Economics
- Statistics/data analysis
- Decision making
- Communication

Capstone – Applied methods,
Projects courses (2)

Electives – technology and/or
policy/society focus

Masters

Core – theory and practice of
policy analysis, quantitative
policy analysis methods

Quantitative methods depth

Social science and policy depth

Electives – technology and/or
policy/society focus

Doctoral

Core – theory and practice of
policy analysis, quantitative
policy analysis methods, data
analysis

Quantitative methods depth

Economics

Social science and policy depth

Engineering/Science/Technology
knowledge

Research



Courses and Skills



Technology Policy Electives - examples

- Regulation of Internet Edge Platforms
- Patents, Licensing, and Innovation
- Science and Innovation Leadership
- Policies of Wireless Systems
- Climate Change Science and Solutions
- Sustainable Energy in the Development World
- Cryptocurrencies, Blockchains, and Applications
- Energy Innovation and Entrepreneurship
- Privacy Policy, Law, and Technology



EPP Projects Course

Durable Course Skills

Structuring complex problems

Completing analyses (qualitative and quantitative)

Working with students in other disciplines

Collaboration within and across teams

Project management

Oral/written communication

Course Design

Single project topic but with multiple issues

Students investigate topic, determine 4-5 areas of interest for further study

4-5 small groups with targeted focus

Advisory board for insight and feedback

Formal presentations and report to advisory board

EPP Projects Course – past topics

- Planning for Public Transit in a Post-Pandemic and Remote Work World
- Implications of Vehicle Electrification for Geopolitical Supply Chain Risks, Trade, Security, Economic Prosperity, and Social Welfare (Jobs, Environment, Equity)
- Cybersecurity Resilience
- Future of Automated Alerts and Warnings
- Decarbonizing Residential Energy Use
- Climate Change and Pittsburgh Urban Food System





Careers and Trajectories



...but I don't want to work in government

- Majority of our undergraduate alumni don't
- You might be interested in EPP if you...
 - Want to work in a highly regulated industry, in the public eye, or with public perception issues
 - Want training in quantitative decision-making tools that are useful in business contexts too
 - Are interested in how technology impacts individuals and society
 - Understand that engineering leaders work in an interdisciplinary context alongside public groups, economists, business-people, politicians, etc.
 - Realize that qualitative factors (e.g., stakeholders, organizational behavior) are as influential in making decisions as quantitative ones

What do EPP undergrad graduates and students do?

Alumni Destinations

- Graduate programs - MS, PhD, Law
- Consulting – business and industry focused (energy, transportation, computing)
- R&D, National Labs
- Finance – product manager, risk assessment
- Industry – all areas

Summer 2022

- Research across CMU
- Ascend Analytics – battery / renewable software
- EPA Office of Environmental Justice
- Idaho National Labs – foreign energy and climate policy analysis
- Argonne National Labs – wastewater reuse
- Jane Street
- Nexamp – solar design engineering
- SWE intern at Google
- Zero-G
- Dominion Energy
- PennDOT – transportation inspector
- Clear Path – clean energy policy
- Bosun and Mate on a schooner
- Camp counselor
- IT dept @ former HS

What do EPP graduate alumni do?

MS Program

Doctoral programs – CMU and elsewhere

Consulting – business, engineering

PHD Program

Academia (but fewer these days)

Consulting – BCG, Deloitte, West Monroe

National Labs

Industry

U.S. Federal Government Agencies

Return to home country government role



Challenges



Programs, curricula, courses

- Few programs exist and starting new programs difficult
- Breadth that program can reach is questionable (CMU is all engineering, not within one program)
- Need interdisciplinary support which not all schools have
- Faculty may not be comfortable teaching in this space
- BUT ABET outcomes “consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors” can push to include



Students

- Attracting students to programs difficult – STEM focus, don't want to write
- Difficult to explain to others – parents know what a minor in business is, not this EPP degree thing
- Not getting salary bump for this
- Need to capture students with varied experience and background needed for the array of problems we are facing
- BUT, politically active in some spaces where tech background is needed - Climate change, gender/sexual orientation, AI/social media



Careers and Trajectories

- Difficult to explain to others – recruiters don't know what this EPP degree thing is
- May need a technical job first to help understand the realities of the engineering and technology
- BUT, every professional I speak to says these professional skills are critical and having this additional non-engineering knowledge is important (Lavik, Ray)



Policy and Government Jobs (Service?)

- Lack of awareness of career pathways in policy and in government
 - see government as elected officials
- Levels of local, regional, state, federal government
- Perceived pay gap, security clearance time
- International students and visa status
- BUT, implementation of laws is policy (Molnar) and we can focus efforts there “The government does that.” Career versus “service”??

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