Integrating Energy Technology and Policy Course

## Integrating Energy Technology and Policy: A New Graduate-Level Course

Kristin L. Field\* Mark Alan Hughes Russell J. Composto As part of a five-year National Science Foundation Research Traineeship (NRT) program, called *Interdisciplinary Training in Data Driven Soft Materials Research and Science Policy*, at the University of Pennsylvania (Penn), we started a new, semesterlong (14-week) course. This course, EAS 5110/ENMG 5100, *Societal Grand Challenges at the Interface of Technology and Policy*, is a partnership between Penn's School of Engineering and Applied Science (SEAS) and the Penn Kleinman Center for Energy Policy (KCEP) and is cross-listed as Engineering & Applied Science (EAS) and Energy Management and Policy (ENMG), respectively.

Graduate students are recruited to build a class enrollment where half of the students are pursuing degrees in SEAS or one of the science, technology, engineering, or math (STEM) degrees and the other half are involved with KCEP-related programs (e.g., students pursuing business, law, city planning, design, or social science degrees and/or energy policy certificates in addition to their primary degrees).

This new course is structured around the basics of energy policy and energy technologies and incorporates case studies, pre-class assignments based on readings, small group activities, and student team projects. The class offers an opportunity for STEM students to work with policy students and vice versa. One goal of this course is to have students appreciate that both science and policy are needed to successfully advance climate initiatives.

This course was offered for the first time in Spring 2023 (with 16 students) and for a second time in Spring 2024 (with 15 students). Although having not been co-instructors previously, the teaching team from SEAS and KCEP designed the course with an intentional integration of technology and policy from perspectives across Penn's 12 schools as well as centers and institutes. At the time of the ASES SOLAR 2024 conference, this team was currently teaching the 2024 course and building on instructor and student experiences from 2023. Even after only one year, the instructors have observed the need to continually update the course content because of the rapidly evolving technology and policy landscapes of the energy transition.

## **Key Findings**

These findings are ongoing. For the course design, it became apparent how different courses from different schools tend to be taught in different ways (e.g., amount and types of course reading materials, types of questions asked of the students, expectations of synthesis of large amounts of material more superficially versus focused, specific understanding of incrementally built knowledge, and student engagement). Learning how to integrate and balance these norms was important for the instructors and for the students.

For the course content, the enormity of topics relevant to the energy transition, even when focusing on those that were rich sources for illustrating the overlap of technology and policy issues, provided opportunities (and challenges). Offering this course once a year around this pool of dynamic topics (e.g., renewable energy, energy storage, hydrogen economy) also requires a substantial amount of reviewing and updating of the content.

The last general observation is that *process* is a critical component of this type of course that brings together professional graduate students with research-based PhD students from a variety of disciplines. To help promote a collaborative, engaged cultural norm, as well as productive, final group projects that are rewarding for the students, the teaching team continues the intentional mixing of students for in-class small group activities, emphasizes the focus on group-level (rather than individual-level) outcomes as a grading metric, and has refined guidelines and guardrails for final projects. In summary, initial feedback from both STEM and policy students is that this type of interdisciplinary course has impacted how they think about current interests and future career paths.

Keywords: interdisciplinary graduate education, energy transition, energy technology, energy policy, STEM education, climate change

## **Conflict of Interest**

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