

Plan of Study for the Markets, Politics, and Societies Track of the Concentration in Energy, Climate, and the Environment

Name: _____

Class (FY, SO, JR): _____

Date: _____

Email: _____

Please summarize your plan of study or name your braid (see pp. 2-9 for requirements):

Please list your selected concentration courses in the schedule below:

Fall 1	Spring 1	Fall 2	Spring 2	Fall 3	Spring 3	Fall 4	Spring 4

Student's signature and date: _____

MPS Track ENCE approver's signature and date: _____

The increasingly visible impacts of climate change, pollution, and biodiversity loss are driven to a large degree by economic growth and the world's increasing demands for energy. Other developments, including the proliferation of microplastics and forever chemicals, also threaten planetary health. Solutions to these challenges will require reimagining technologies, economic incentives, political relations, and social constructs. Those solutions will be created through the development of new science and engineering designs, innovation in policies and markets for decarbonizing economies and preserving ecosystems, mitigation of climatic impacts on public health and the natural world, renewed attention to ethical principles, and consideration of alternative ways of negotiating relations between humanity and our planet.

The concentration on Energy, Climate, and the Environment (ENCE) is focused on such solutions. It prepares the next generation of leaders to address these complex and multifaceted problems in the private sector, government, civil society, the arts, and academia. Students will develop field expertise, with a deep grounding in the methods and tools of a specific area of specialization, while gaining literacy and collaborative capacity in other relevant fields. For example, leaders in the development of low-carbon technologies should understand markets, social impacts, and stakeholder concerns, and government and business leaders should understand the science and engineering of climate change and low-carbon technologies. The students will learn the value of and be well prepared for working effectively with experts outside their own field.

To reflect this philosophy, ENCE takes a truly cross-School and cross-Divisional approach, spanning the School of Engineering and Applied Sciences (SEAS) and the FAS Divisions of Arts & Humanities, Social Science, and Science, and drawing on expertise across Harvard's professional Schools. All students share a common core of coursework, fostering a community where peers learn with and from one another across disciplines. Students will begin and end their programs with a shared introductory course (ENCE 10) and a shared, team-based capstone class in their senior year (ENCE 100), while focusing the remainder of their program on one of four tracks that will provide field depth and will also incorporate a distribution requirement for students to take two courses from other tracks. Each track has a braided structure to ensure coherence, proper scaffolding, and disciplinary depth, and students follow one of the pre-approved braids listed under each track. Students can propose other braids that meet the same standards; however, alternative braids need approval by the faculty advisor.

The four tracks:

- ***Markets, Politics, and Societies (Social Sciences)***: This track provides rigorous social-science training in economics, political science, and sociology through the lenses of energy, climate, and environmental challenges. Students use quantitative and qualitative methods to understand the systemic forces – from

global markets to local governance to community life – that shape climate mitigation, sustainability finance, and social adaptation. Pre-approved Braids have emphasis in: Making Markets, Sustainable Business, or Justice & Law.

- ***Nature, Ethics, and the Human Imagination (Arts & Humanities)***: This track provides students with core competencies in understanding and addressing environmental challenges from historical, ethical, literary, artistic, and other value-sensitive perspectives. The curriculum covers diverse positions on the foundational causes and ultimate costs of human-caused climate change, biodiversity loss, and marine degradation, discussions of why we should care, and exploration of individual roles in the quality of all lives on the planet. It includes innovative design strategies, morally persuasive literary and art forms, values and practices of different cultures, and historical cases of environmental care. Pre-approved Braids have emphasis in: Historical Study, Religion and Ethics, or Art and Media.
- ***Science and Engineering for Sustainable Solutions (Engineering and Applied Sciences)***: This track prepares students to be future inventors and drivers of technical solutions to the world's converging problems of growing energy needs, climate change, and environmental pollution. The students will gain depth and expertise in sciences and engineering, with a focus on decarbonization and electrification of the energy, chemical manufacturing, and transport sectors, design of state-of-the-art computing systems optimized for both compute performance and environmental impacts, and mitigation of human impacts on natural environmental systems with outcomes ranging from climate to public health. Pre-approved Braids have emphasis in: Energy Systems, Sustainable Computing, or Climate and Environmental Systems and Modeling.
- ***Climate and Biodiversity (Sciences)***: This track focuses on the interface of Earth system science and biology. Climate governs how ecosystems function, and ecosystems influence how carbon, water, and energy move through the Earth system. Topics covered in this track include climate–ecosystem interactions and physical drivers of biodiversity change. Students develop the tools to analyze and address questions such as how climate change reshapes species distributions and ecosystem services, when and how nature-based strategies can contribute to climate mitigation, and how to evaluate tradeoffs among emissions goals, ecosystem integrity, and land use needs across coupled human–natural systems.

LEARNING OBJECTIVES

Graduates of the Energy, Climate, and the Environment program achieve the following objectives as part of their program completion, and they are trained to become solutions focused and informed leaders prepared to address real-world challenges in energy and climate.

- **Disciplinary Depth with Multidisciplinary Literacy & Collaborative Leadership:** The ability to operate effectively within "T-shaped" professional environments, leveraging deep expertise in a specific track while communicating and

collaborating fluently with experts across science and engineering, the social sciences, and the arts and humanities to address systemic societal challenges.

- **Integrated Problem-Solving & Design Thinking:** The capacity to translate complex, large-scale energy and environmental challenges into tractable problems through an iterative design process that incorporates stakeholder needs, real-world boundary conditions, and iterative experimentation.
- **Technical & Disciplinary Mastery for their Track:** A rigorous command of the quantitative and qualitative foundations, methods, and tools specific to their chosen track; ranging from energy systems and climate science to economic policy analysis and historical critique.
- **Synthesis of Theory and Real-World Application:** The proficiency to apply academic frameworks to real-world scenarios through experiential learning and team-based capstones, resulting in viable solutions that account for technical, social, and cultural dimensions of energy-climate issues.

REQUIREMENTS

Energy, Climate, and the Environment

Concentration Requirements: 12–15 courses (48–60 credits)

1. *Required courses, ENCE Common Core for all Tracks (2 courses):*

- a. Foundation (1 course): ENCE 10
- b. Senior Team Project (1 course): ENCE 100

2. *Track requirements:*

Students must fulfill the requirements for one ENCE Track

a. Markets, Politics, and Societies (MPS) Track (11 courses required, 12 for Honors)

i. Methods (3 courses)

1. MATH 1a
2. Empirical methods: Statistics and econometrics at the level of ECON 1123, GOV 50, or STAT 111.
3. One other course chosen to expand the methodological toolkit
 - a. Qualitative methods: SOCIOL 1107, SOCIOL 1157
 - b. Computational methods
 - c. Game Theory
 - d. Advanced probability or statistics

ii. Social Science Core (6 courses)

1. Disciplinary courses (2 courses), select 2 from:
 - a. Environmental and climate economics (example: ECON 1661)
 - b. Politics of the environment and climate change (example: GOV 1722)
 - c. Sociology of climate change (example: SOCIOL 1284)
2. Social Science Electives (3 courses). Select 3 from (e.g.):
 - a. ECON 1346, ECON 1661, ECON 2688, ECON 2689, FS42h

- b. ESPP 77, ESPP 78, ESPP 160
 - c. GOV 94EN, GOV 1722
 - d. HKS API-165
 - e. HIST 15E, HIST 187
 - f. SOC 1284, SOC 2278
- 3. Junior Tutorial (1 course)
 - a. ENCE 98
- iii. Track Distribution (2 courses)
 - a. Select 2 other ENCE courses from outside of the MPS track, chosen with advisor. May include relevant GENED courses (e.g., GENED 1094, GENED 1015)
- iv. Track Honors (0-1 courses)
 - a. Senior Tutorial (two semesters): Thesis and two-semester tutorial are required for Honors (including GOV 99, ECON 99R, SOCIOL 99A/B)
- v. Track Braids: With their advisor, student should select a coherent set of courses to match their interests in a Track Braid. Example Braids within the MPS Track may include: Making Markets, Sustainable Business, Justice & Law.
- b. Nature, Ethics, and the Human Imagination (NEHI) Track (10 courses, or 11 courses for Honors) [see website]**
- c. Science and Engineering for Sustainable Solutions (SESS) Track (13 courses) [see website]**
- d. Climate and Biodiversity (CB) Track (12 courses, 13 for Honors) [see website]**

To illustrate the depth of expertise available to students in the MPS track, we describe three provisional Braids within the MPS track:

- Making Markets
- Sustainable Business
- Justice & Law

Harvard has considerable social-science expertise in its professional schools (e.g., Business, Law, HKS, Public Health) and we will draw on the strengths of social science faculty outside FAS. We welcome faculty from these programs who wish to teach an undergraduate-level course and will find entry-points for Harvard College students to these courses.

Braid 1: Making Markets

Markets – fields of buyers and sellers, signals of costs and prices, and materialities of products and technologies – do not make themselves. Making, remaking, and unmaking markets challenge climate solutions, because the institutional arrangements – the rules of the game – that enable current markets often constrain new technologies in ways that slow their adoption. Electricity markets vividly and urgently illustrate this. The electric grid – really a network of regional grids – relies on price-setting mechanisms that simply do not work as well for the kind of power that AI data centers demand, or the kind of power that lower-energy-density renewables such as solar and on-shore wind supply. Moreover, the supply of abundant renewable energy is often located very far from the demand for that energy, crossing the jurisdictional lines of existing markets. Students following the Making Markets plan of study will learn about the theory and practice of market design, and apply these lessons to live cases of market design for climate solutions.

The Making Markets Braid within the Markets, Politics, & Societies Track could consist of:

1. ENCE 10 (gateway course)
2. ENCE 100 (senior team-project course)
3. Math 1a
4. Quantitative Methods
5. Qualitative Methods or other applied methods course to expand the methodological toolkit
6. Environmental and climate economics (example: Econ 1661)
7. Politics of the environment and climate change (example: Gov 1722)
8. New course by Anna Russo on environmental regulation and market design (SS)
9. Energy, Env Econ, Policy (HKS API-165)

10. Technology, Environment, and Society (ESPP 77) or Economic Sociology (Sociology 1144)
11. ENCE 98 Junior Tutorial
12. ENCE-51 Introduction to Nature, Environment, and Human Imagination
13. ENCE 50 or **ES 145**: Modern Electric Power Systems

Courses that would fit the Making Markets plan of study include:

1. SOCIOL 114: Economic Sociology
2. PSY 1525: Psychology for a Sustainable Future
3. GOV 94CP: Political Economy of the Environment
4. AFRAMER 193Y/ANTHRO 2695: Landscape Fieldwork: People, Politics, Practices
5. SOCIOL 1173: Sociology of Development
6. WOMGEN 1495: Feminist Ecologies and Economies
7. HISTSCI 1385: Water: The Politics and Uncertain Futures of Drought and Climate Change
8. HISTSCI 1480: Food, Science, and the Invention of Global Hunger
9. ES 145: Modern Electric Power Systems
10. ES 215: Physical and Economical Operations of Sustainable Energy Systems.
11. EPS 109: Earth Resources and the Environment

Braid 2: Sustainable Business

Sustainable business means making money, meeting present and future human needs, and enabling long-run planetary health – all at the same time. This simultaneity requires the capacity to understand how business practices in the present carry long-run implications for the wellbeing of people and our planet. The Sustainable Business braid and plan of study within the Markets, Politics, and Societies track prepares students for the sustainable businesses of the future, by providing multiple perspectives on what business is, who and what business is and can be for, and how organizational change is possible. The new and fast-growing climate-tech field illustrates the urgent demand for graduates with this kind of training: business leaders in sustainability need to understand deeply the scientific and engineering principles of sustainable technologies and practices, the social and economic realities of implementing innovation, and the cultural foundations of representing and imagining future generations and future planetary conditions.

The Sustainable Business Braid within the Markets, Politics, & Societies Track could consist of:

1. ENCE 10 (gateway course)
2. ENCE 100 (senior team-project course)
3. Math 1a
4. Quantitative Methods

5. Qualitative Methods or other applied methods course to expand the methodological toolkit
6. Sociology of climate change (example: Soc 1284)
7. Environmental and climate economics (example: Econ 1661)
8. PSY 1525: Psychology for a Sustainable Future
9. Technology, Environment, and Society (ESPP 77) or Economic Sociology (Sociology 1144)
10. ENCE 98 Junior Tutorial
11. ENCE-51 or PHIL 1661: Indigenous Philosophies for the Technological Age
12. ENCE 50 or AP 236: Physical Electrochemistry and its Applications to Sustainable Engineering

Courses that would fit the Sustainable Business plan of study include:

1. WOMGEN 1495: Feminist Ecologies and Economies
2. SOC-STD 98WM: Infrastructure and Sociality
3. AFRAMER 130Y: Mobility, Power and Politics
AFRAMER 193Y/ANTHRO 2695: Landscape Fieldwork: People, Politics, Practices
4. GOV 94CP: Political Economy of the Environment
5. GOV 1013: GIS Analysis of Hazard Vulnerability
6. GOV 94DN: Mapping Social and Environmental Space
7. PSY 1525: Psychology for a Sustainable Future
PSY 1017: Nature Can Nurture: Fostering an Ecological Worldview
8. SOCIOL 1173: Sociology of Development
9. ANTHRO 1255: Human Diet: From Neanderthals to the Future of Food
10. AP 236: Physical Electrochemistry and its Applications to Sustainable Engineering.

Braid 3: Justice & Law

Energy, climate, and environmental problems and solutions all raise questions of fairness in outcomes and processes. Who wins, who loses, and who bears responsibility in a changing climate? Are justice and legal rights just for people, or can we expand the frame to nature and the environment? What about the rights and responsibilities of people long dead, or yet to be born? How does and should law change as the climate changes? How should we think about and how can we apply ideas of climate justice and environmental justice? More specifically, the current concept of a “just energy transition” illustrates why climate solutions demand a new generation with combined insight into the engineering and scientific fundamentals of energy, the human foundations of justice, and the political and social realities of law. Within the Markets, Politics, & Societies Track, students will have opportunities to develop the depth of expertise and breadth of perspective required to take their next steps toward creating and implementing climate solutions through ethical, legal, and moral practice.

The Justice & Law Braid within the Markets, Politics, & Societies Track could consist of:

1. ENCE 10 (gateway course)
2. ENCE 100 (senior team-project course)
3. Math 1a
4. Quantitative Methods
5. Qualitative Methods or other applied methods course to expand the methodological toolkit
6. Sociology of climate change (example: Soc 1284)
7. Politics of the environment and climate change (example: Gov 1772)
8. GENED 1015: Ethics of Climate Change or API 170: Managing Climate Change Risks: Information, Incentives, and Institutions
9. HIST 1936: The Rights of Nature or API 101: Resources, Incentives, and Choices I: Markets and Market Failures
10. GENED 1167: Climate Crossroads or SES 5409: Climate Justice
11. ENCE 98 Junior Tutorial
12. ENCE-51 or PHIL 18: Human Ethics: A Brief History
13. ENCE 50 or EPS 109: Earth Resources and the Environment

FAS courses that would fit the Justice & Law plan of study include:

1. AFRAMER 130Y: Mobility, Power and Politics
2. AFRAMER 193Y/ANTHRO 2695: Landscape Fieldwork: People, Politics, Practices
3. GOV 40: International Conflict and Cooperation
4. GOV 1247: Geopolitics of Energy
5. PSY 1521: Political Polarization and Misinformation
6. SOCIOL 1175: Sociology of Immigration
7. SOCIOL 1184: Climate Change, Power, and Global Inequality
8. SOC-STD 98WH: Climate Justice: The Politics of Decarbonization
9. EH 213/ESPP 180: Climate Change, Health, and Environmental Justice-Focusing on Solutions
10. ANTHRO 1924: Catastrophes across Cultures: The Anthropology of Disaster
11. WOMGEN 1292: Indigenous Feminisms: Environmental Justice and Resistance