Academic
Experience in Prague

The Energy Transition in Europe

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Course Description:

Europe is attempting one of the most ambitious economic transformations in modern history: the transition from a fossil fuel-based energy system towards one that is cleaner, more secure, and more sustainable. This transition is often described as a simple shift from coal, oil, and gas to renewable energy. In practice, it is much more complex. Europe must reduce greenhouse gas emissions while maintaining affordability, energy security, industrial competitiveness, and social acceptance.

This course introduces students to the economics of the European energy transition. It combines energy economics, environmental economics, electricity market design, public policy, and basic energy system analysis. Students will learn how Europe uses energy, why electricity markets are different from other markets, how energy technologies can be compared, why renewable electricity creates new system challenges, and why technologies such as hydrogen, biomass, carbon capture, storage, and electrification may be complementary rather than competing solutions.

The course takes a systems perspective. Instead of asking whether one technology or policy can solve the transition, students will learn to ask what problem each technology solves, what constraints it faces, what it costs, and how it interacts with the wider energy system. Particular attention is paid to trade-offs between sustainability, affordability, and security of supply.

A central goal of the course is to develop critical thinking. Energy debates are full of confident but oversimplified claims. Students will learn to evaluate such claims using data, economic reasoning, and credible sources. By the end of the semester, students should be able to distinguish evidence-based arguments from slogans, misleading statistics, and one-sided narratives.

Course Prerequisites:

Introductory macroeconomics or microeconomics course

Course Objectives/Learning Outcomes:

By the end of the course, students should be able to explain the main economic and technical challenges of the European energy transition; interpret basic energy and emissions data; understand how European electricity markets operate; compare energy technologies using economic metrics; explain the limitations of simple cost comparisons such as LCOE; evaluate the role of electrification, hydrogen, biomass, carbon capture, and storage; understand the logic of carbon pricing, subsidies, and other climate policies; and critically assess controversial claims about Europe's pathway towards climate neutrality.

Course Format:

The course consists of two 90-minute sessions per week. One session is usually a lecture and the other is a seminar or exercise session. Lectures introduce the main concepts, while seminars apply these concepts through simple calculations, data interpretation, structured discussion, market simulations, debates, and group work.

Grading Policy:

Grades are based on the following components:

1. Class participation 10%
2. Quick quizzes 10%
3. Midterm exam 30%
4. Group project presentations 20%
5. Final exam 30%

Students may choose to replace up to 30% of their coursework grade with additional weight on the final exam. For example, a student who is not satisfied with their midterm exam grade may choose to drop the midterm grade and have the final exam count for 60% of the final course grade instead of 30%. Any such arrangement must be made before the final exam.

This option is intended to give students a chance to recover if, for any reason, they were not able to perform strongly earlier in the semester and later catch up with the material. It does not place students in a more favorable position, since the final exam is not intended to be easier than the midterm or other course requirements.

Student Project

Students will work in small groups on a controversial topic related to the European energy transition. Each topic will be framed as a strong public claim or common myth, such as “renewable electricity alone can solve the energy transition,” “nuclear power is too expensive,” “hydrogen will replace natural gas,” or “carbon taxes hurt ordinary people and do not reduce emissions.”

The task is not to repeat the instructor’s opinion. Students are not required to debunk every claim. They may conclude that a claim is wrong, partly wrong, partly true, strongly supported, or too complex for a simple answer. What matters is the quality of reasoning, the use of evidence, and the ability to recognize uncertainty and assumptions.

Only the presentation of the project will be graded. Students will present their work to the class, explain their evidence, defend their reasoning, and respond to questions. A good presentation should not simply summarize information. It should evaluate a claim.

This project is designed to strengthen critical thinking. Students should not use AI to generate their presentations. A presentation with some mistakes, imperfect wording, or weak points is preferable if it reflects the students’ own thinking. A polished AI-generated story that students do not understand and will not remember the next day defeats the purpose of the assignment. The goal is not perfection. The goal is to learn how to think carefully about difficult energy and climate questions.

Reading Policy

The course is designed so that all core knowledge is developed during lectures, seminars, discussions, and exercises. Students are not expected to master the material through textbook reading before class. Readings are provided mainly as optional background resources for students who want to explore a topic in more depth, clarify concepts after class, or use additional sources for their project presentations.

Because energy transition debates are often shaped by current data and policy developments, students are encouraged to consult accessible sources such as Eurostat, the International Energy Agency, Our World in Data, the European Commission, and selected policy reports. More technical textbooks and academic papers may be suggested for students who want a deeper theoretical treatment, but they are not required for successful participation in the course.

All reading materials will be provided in Moodle.

Letter Grade	Percentage	Description
A+	97-100	Excellent Work
A	93-97	Outstanding Work
A-	90-92	
B+	87-89	Good work
B	83-86	
B-	80-82	
C+	77-79	Acceptable Work
C	73-76	
C-	70-72	
D+	67-69	Work that is significantly below average
D	63-66	
D-	60-62	
F	0-59	Work that does not meet the minimum standards for passing the course

Mandatory Completion Policy

Note that all mandatory assignments and exams must be completed to the best of your ability in order for your final grade to be issued. Failure to complete a mandatory assignment or exam may result in a failing grade.

AEP Academic Integrity Policy

Plagiarism and other forms of academic dishonesty are not tolerated. The use of Artificial Intelligence (AI) for the development of knowledge and learning is encouraged at many stages of the learning process. While we value technology for educational purposes, we also value originality and the retainment of knowledge, and thus using AI for assignments and examinations, even if rephrased, is strictly prohibited and considered an academic integrity violation, unless the instructor explicitly allows for it in the context of evaluated work

AEP Non-Discrimination/Harassment Policy

The AEP program in Prague promotes a diverse learning environment where the dignity, worth, and differences of each individual are valued and respected. Discrimination and harassment, whether based on a person's race, gender, sexual orientation, color, religion, national origin, age, disability, or other legally protected characteristics, are repugnant and completely inconsistent with our objectives. Retaliation against individuals for raising good faith claims of harassment and/or discrimination is prohibited.

AEP Diversity Policy

AEP is committed to fostering an inclusive and welcoming community that values diversity in all its forms. We believe that one of the most meaningful lessons of studying abroad is learning to navigate and appreciate differences with curiosity and an open mind. While engaging across differences can sometimes be challenging or uncomfortable, these moments are essential for growth and learning. We recognize that every member of our community, even with the best intentions, may occasionally make missteps. Our commitment is to provide a supportive environment where respectful and honest dialogue helps us learn from these experiences, ensuring that every student has the opportunity to thrive and broaden their perspective.

Weekly Schedule

Week 1

CEE Introductory Lecture Series

AEP Introductory Lecture Series

Week 2

Why is Europe undergoing an energy transition?

This opening week introduces the motivation for the course. Students learn what the energy transition means, why Europe is pursuing decarbonisation, and why climate policy is also an economic, technological, and geopolitical challenge. The lecture introduces the energy trilemma, which will be used throughout the course to discuss the balance between sustainability, affordability, and security of supply. Students also examine climate change as a global collective-action problem: Europe alone cannot solve it, but European action can still matter. Simple game theory intuition, including the free-rider problem and the Prisoner's Dilemma, is used to explain why international climate cooperation is difficult.

The seminar focuses on comparing countries using emissions, population, GDP, and energy data. Students examine the difference between total emissions and per-capita emissions, and they discuss whether Europe should continue pursuing climate neutrality if other large emitters move more slowly.

Myth(s) to debunk: "Europe can solve climate change on its own."

Optional background material: Mankiw, Principles of Economics, Chapter 1, "Ten Principles of Economics", European Commission - overview of the European Green Deal; Our world in data – CO2 emissions, Bhattacharyya, Energy Economics, Chapters 1 and 2.

Week 3

What does Europe's energy system actually look like?

Before discussing solutions, students need to understand the existing energy system. This week explains the difference between primary energy, final energy, useful energy, and electricity. Students learn how energy is transformed and consumed across transport, buildings, industry, heating, and electricity generation. The main point is that electricity is only one part of the energy system, even though it receives much of the public attention.

The seminar uses Eurostat or IEA energy balances. Students practice converting between energy units, interpreting energy flows, calculating sectoral energy shares, and comparing energy use across selected European countries. The discussion asks why renewable electricity alone cannot decarbonise the whole economy.

Myth(s) to debunk: "Electricity is the whole energy system.", "Renewable electricity alone can decarbonise the economy", "Energy efficiency automatically reduces total energy demand."

Optional background material: Eurostat Energy Statistics Explained; IEA overview materials on energy balances, Bhattacharyya, Energy Economics, Chapters 2 and 3.

Week 4

Why is electricity different?

This week explains why electricity markets require special treatment. Electricity must be balanced continuously, large-scale storage is limited, and supply and demand must be coordinated through the grid. Students learn the basic logic of wholesale electricity markets, merit order, marginal pricing, market coupling, balancing markets, interconnections, and negative prices.

The seminar is built around a market simulation. Students represent different power plants and construct a simplified merit-order curve. They determine the market clearing price under different demand conditions and examine what happens when gas prices rise or renewable generation increases. The discussion asks whether it is fair or efficient for electricity prices to depend on the most expensive generator needed to meet demand.

Myth(s) to debunk: “Cheap renewable electricity always means cheap consumer bills.”

Optional background material: Mankiw, Principles of Economics, Chapter 4, European Commission – electricity market design; ACER-Market rules for different electricity market timeframes; Kirschen and Strbac, Fundamentals of Power System Economics chapter 3; Bhattacharyya chapter 10.

Week 5

Which technologies should power Europe?

Once students understand electricity markets, they compare the technologies that can produce electricity. The lecture covers coal, gas, nuclear, hydro, wind, solar, and biomass. Students learn that technologies differ not only in emissions, but also in capital costs, operating costs, fuel costs, capacity factors, dispatchability, reliability, flexibility, construction time, and public acceptance.

The seminar asks students to compare technologies using simple calculations. They calculate annual electricity generation from capacity and capacity factor, compare fuel costs, estimate emissions, and discuss why no single technology can solve every problem. The discussion asks whether Europe should search for one best technology or build a diverse portfolio.

Myth(s) to debunk: “There is one best energy technology.”

Optional background material: IEA- Projected Costs of Generating Electricity; IEA – Renewable electricity; IEA overview materials on electricity generation technologies. Kirschen and Strbac, Fundamentals of Power System Economics chapter 4, Bhattacharyya, Energy Economics, Chapters 8 and 11.

Week 6

Can renewable electricity reliably power Europe?

This week focuses on the integration of wind and solar power. Students learn that renewable electricity is essential for decarbonisation, but variable generation creates system challenges. The lecture introduces residual demand, curtailment, storage, batteries, pumped hydro, demand response, transmission expansion, interconnections, capacity adequacy, and reserve margins.

The seminar uses simplified hourly demand, wind, and solar data. Students calculate residual demand, identify hours of surplus and shortage, estimate storage needs, and discuss what happens during prolonged periods of low renewable output. The discussion asks whether Europe can rely entirely on renewable electricity.

Myth(s) to debunk: “Batteries solve all renewable integration problems.”, “More wind and solar always reduce emissions automatically.”

Optional background material: David MacKay, Sustainable Energy: Without the Hot Air, Chapter 26, “Fluctuations and storage”, NREL - Integrating Variable Renewable Energy: Challenges and Solutions, IEA – Integrating solar and wind, Kirschen and Strbac, Fundamentals of Power System Economics, Chapter 5.

Week 7

Is the cheapest technology really the cheapest?

This week introduces the Levelized Cost of Electricity and then explains its limitations. Students learn how LCOE depends on investment costs, operating costs, fuel costs, discount rates, lifetimes, and capacity factors. They also learn why LCOE does not fully capture timing, flexibility, integration costs, system value, or reliability.

The seminar is calculation-based. Students calculate LCOE for several technologies and test how results change when discount rates, capacity factors, and fuel prices change. They then discuss why the technology with the lowest LCOE is not always the best technology for the system as a whole.

Myth(s) to debunk: “The cheapest option on paper is always the cheapest option in reality”, “High upfront cost always means expensive electricity.”

Optional background material: Lazard Levelized Cost of Energy report; Paul Joskow, “Comparing the Costs of Intermittent and Dispatchable Electricity Generating Technologies.”, Ueckerdt, Hirth, Luderer, and Edenhofer, “System LCOE: What are the costs of variable renewables?”, Mankiw, Principles of Economics, Chapter 13.

Week 8

Can electricity decarbonise everything?

After focusing on electricity, the course now moves to the wider economy. Students examine whether clean electricity can decarbonise transport, heating, buildings, and industry. The lecture covers electrification, electric vehicles, heat pumps, industrial heat, steel, cement, aviation, shipping, hydrogen, synthetic fuels, biomass, carbon capture, and sector coupling.

The seminar uses sectoral case studies. Students compare passenger cars, heating, steel, cement, aviation, and shipping, asking which sectors can be electrified easily and which are harder to decarbonise. They compare direct electrification with hydrogen-based pathways and discuss why efficiency losses matter.

Myth(s) to debunk: “Everything can be electrified”, „Hydrogen will replace natural gas everywhere.” “Electric vehicles simply shift emissions from roads to power plants.”

Optional background material: David MacKay, Sustainable Energy: Without the Hot Air, Chapters 20 and 21, European Commission – Energy systém integration, Florence School of regulation – sector coupling

Week 9

Why do energy prices and geopolitics matter?

This week brings energy security and fossil fuel markets into the course. Students learn why oil and gas still matter, even during the transition. The lecture covers oil markets, natural gas markets, OPEC, LNG, pipeline dependence, the Russian gas crisis, energy price volatility, inflation, energy poverty, industrial competitiveness, strategic reserves, critical minerals, and clean technology supply chains.

The seminar uses historical and recent examples of energy shocks. Students calculate import dependency, examine the effect of gas price increases on electricity prices, and discuss how energy price shocks affect households and firms. A scenario exercise asks students how Europe should respond if it suddenly loses a large share of gas imports.

Myth(s) to debunk: "Oil and gas no longer matter because Europe is transitioning to renewables", "Renewable energy eliminates geopolitics."

Optional background material: IEA Energy Security reports; REPowerEU – affordable secure and sustainable energy for Europe, Eurostat - Energy in Europe: imports dependency, Bhattacharyya, Energy Economics, Chapter 20

Week 10

How should governments accelerate the transition?

This week introduces climate and energy policy. Students learn why climate change is a market failure and why governments use carbon pricing, emissions trading, subsidies, standards, and industrial policy. The lecture covers externalities, Pigouvian taxation, the EU Emissions Trading System, free allocation, carbon leakage, CBAM, renewable support schemes, Contracts for Difference, Carbon Contracts for Difference, Fit for 55, the Renewable Energy Directive, and the Net Zero Industry Act.

The seminar is built around an EU ETS trading game. Students represent firms with different abatement costs and trade emissions allowances. They learn why emissions trading can reduce total compliance costs and how allowance prices create incentives. The discussion asks whether governments should tax carbon, subsidise clean technologies, regulate emissions, or combine several instruments.

Myth(s) to debunk: "Carbon taxes and emissions trading only make governments richer", "Subsidies are always better than carbon pricing."

Optional background material: Mankiw Principles of Economics – Chapter 10 and 11, Tietenberg and Lewis, Environmental and Natural Resource Economics, Chapters 14 (also some parts of chapters 2 and 16), EC - About the EU-ETS, EC – CBAM, Robert Stavins - Carbon Taxes vs. Cap and Trade: Theory and Practice

Week 11

How do we decide the best pathway?

This week brings the course together through energy system modelling. Students learn why models are used to study long-term decarbonisation pathways and why model results depend on assumptions, constraints, technologies, and policy targets. The lecture introduces the basic logic of modelling rather than the technical details of any one model. Students compare different modelling approaches, including optimization models, simulation models, input-output models, and computable general equilibrium models, and discuss what kinds of questions each approach can answer. Particular attention is given to optimization models such as TIMES. Students learn the intuition behind objective functions, constraints, technology choices, scenarios, sensitivity analysis, and uncertainty.

The seminar uses simplified model outputs. Students compare alternative transition pathways and evaluate differences in cost, emissions, electricity mix, hydrogen use, biomass use, carbon capture deployment, import dependency, and residual emissions. The discussion asks whether models can tell policymakers what to do, or whether they are better understood as tools for exploring trade-offs.

Myth(s) to debunk: “Energy system models predict the future.”

Optional background material: IEA – scenarios in the world energy outlook, David MacKay, Sustainable Energy: Without the Hot Air, Chapter 27, Farzaneh, Energy Systems Modeling: Principles and Applications, Chapter 1

Week 12

Student presentations I

The first presentation week is devoted to student projects on controversial energy transition claims. Each group presents the claim it investigated, explains why the claim matters, presents evidence, discusses counterarguments, and reaches a careful conclusion. The conclusion may be that the claim is debunked, partly debunked, not debunked, or unresolved.

The seminar consists of presentations, questions, and structured debate. After each presentation, students are asked to defend their reasoning, identify their strongest evidence, explain the assumptions behind their conclusion, and discuss what could change their mind.

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Week 13

Student presentations II and course synthesis

The final week completes student presentations and brings the course together. The discussion returns to the central message of the semester: Europe's energy transition is not a single-technology problem with a simple solution. It is a system-wide transformation shaped by physical constraints, economic incentives, infrastructure, policy choices, uncertainty, geopolitics, and public acceptance.

Students reflect on the full course pathway: why Europe is transitioning, how the energy system works, why electricity is special, how technologies differ, why renewable integration is challenging, why cost comparisons can mislead, where electrification works and where it does not, how energy prices and geopolitics shape policy choices, and how models help us compare possible futures. The final takeaway is that there is no silver bullet. Students should leave the course better able to evaluate claims critically, ask better questions, and understand the trade-offs behind Europe's energy transition.