

Hessen:IWU – International Winter University 2027

More information: <https://wup.h-da.de/>

Syllabus:

Energy Lifestyles: A Technical Comparison Between Nations

PROFESSOR

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COURSE DESCRIPTION

Energy Lifestyles: A Technical Comparison Between Nations is an interdisciplinary course designed to examine how different countries generate, transmit, and consume energy across residential, commercial, industrial, and transportation sectors. Recognizing that participants come from a range of academic and professional backgrounds, the course is intentionally structured to support multiple levels of technical engagement while maintaining a common foundation of understanding.

Students will analyze national energy systems using global datasets such as those from the International Energy Agency (IEA) and Lawrence Livermore National Laboratory (LLNL), developing the ability to interpret energy flow diagrams, identify inefficiencies, and evaluate the role of energy imports in national security. Core engineering principles—including energy conversion, system efficiency, and flow dynamics—are introduced in an accessible manner and reinforced through practical application.

To accommodate varying levels of technical experience, the course incorporates layered learning opportunities. All students will engage in conceptual analysis, comparative evaluation, and discussion-based exploration of energy systems. In parallel, optional and embedded advanced components challenge students to apply first-principles reasoning, perform simplified quantitative analyses, and validate energy-related claims using data-driven approaches. These elements allow technically inclined students to deepen their analysis without limiting accessibility for those with non-engineering backgrounds.

Throughout the course, emphasis is placed on moving beyond descriptive comparisons toward evidence-based reasoning. Students will be expected to formulate and defend conclusions using both qualitative insights and, where appropriate, quantitative justification. By integrating technical, economic, and cultural perspectives, the course prepares students to critically assess global energy strategies and participate in informed discussions on sustainable energy development.

LEARNING OBJECTIVES

By the end of the course, students will be able to:

- **Evaluate national energy systems** by interpreting energy flow data and comparing patterns of generation, transmission, and consumption across multiple sectors and countries, with a focus on identifying key differences in efficiency, sustainability, and energy security.

- **Assess the impacts of energy choices** by analyzing the technical, economic, and cultural implications of renewable and nonrenewable energy sources, and formulating evidence-based comparisons and recommendations for sustainable energy strategies in different national contexts.

COURSE MATERIALS

Web access. Important links are:

1. <https://www.footprintcalculator.org/home/en>
2. <https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource>
3. <https://ourworldindata.org/grapher/per-capita-energy-use?country=~BRA>
4. <https://flowcharts.llnl.gov/commodities/energy>

WORKLOAD

This course consists of 50 contact hours and 120 hours of guided self-study (45 minutes each). Self-study includes reading assignments, preparation and follow-up of lectures, independent research, case study work, project and presentation preparation, and exam preparation.

<i>Date</i>	<i>Topic</i>	<i>Location</i>
December 2026	Academic Introduction – Who Is Mr. Piller / Midwest USA Energy Lifestyle. Establish the interdisciplinary nature of the course and assign the first student presentation connecting daily life to national energy use.	Online
December 2026	Footprint Calculator – Live Modeling Session. Evaluate calculator outputs, discuss assumptions, and introduce basic validation of estimated versus observed energy use.	Online
December 2026	Final Housekeeping – Expectations, Group Work, and Grading. Clarify course structure, explain the layered expectations for conceptual and technical learners, and prepare students for evidence-based discussion.	Online
Jan 04, 2027	Course Introduction and Energy Use in the United States Stereotypes. Test common assumptions about U.S. energy use through discussion and comparative data.	Darmstadt
Jan 05, 2027	Energy Lifestyles Overview – Presentation of Class Lifestyles. Student-led presentations examining energy behavior, assumptions, and measurable lifestyle differences across countries	Darmstadt
Jan 06, 2027	Systems Thinking: Inputs, Logic, Outputs, and Energy Units. Introduce systems reasoning, units, and conversions that support both conceptual understanding and technical comparison.	Darmstadt
Jan 07, 2027	The Myth of Green Energy and Lifecycle Thinking. Examine energy sources through lifecycle analysis, tradeoffs, and the difference between perception and system-level reality.	Darmstadt
Jan 08, 2027	Energy Flow Charts: LLNL and IEA – Understanding Formats and Metrics. Interpret energy flow diagrams and use them to identify losses, inefficiencies, and structural differences between nations.	Darmstadt

Jan 11, 2027	Comparing National Energy Imports and Energy Security. Assess how imports, domestic production, and geopolitical constraints shape national energy security.	Darmstadt
Jan 12, 2027	Transmission Concepts: Pressure, Flow, Series vs Parallel Systems. Apply engineering analogies to understand system behavior, losses, and energy delivery constraints.	Darmstadt
Jan 13, 2027	Electricity Generation: AC/DC, Steam Turbines, and the Power Grid. Explore how electricity is generated, transmitted, and balanced across a modern grid. Residential, Commercial, and Industrial Energy Use. Compare sector-specific demand patterns and identify where efficiency improvements can have the greatest impact.	Darmstadt
Jan 14, 2027	Transportation Energy Sources and Efficiency. Analyze transportation systems, fuel choices, electrification, and the consequences for total energy demand.	Darmstadt
Jan 15, 2027	Seminar: Final Test / Presentations. Final presentations require students to compare countries using evidence, clear reasoning, and at least one supported technical or quantitative claim.	Darmstadt

EXCURSIONS (subject to change)

- heag mobile: local public transportation authority with a large fleet of electric busses
- Mainova: local energy provider

ASSIGNMENTS

Consistent active participation and engagement in group work are expected throughout the course. Between the virtual sessions and in-person seminars, students will be required to complete a group project, which will be presented as part of the course program.

<i>Assignment</i>	<i>Description</i>	<i>Deliverable</i>	<i>Weight</i>
Personal Energy Lifestyle Reflection	Analyze your own energy use and lifestyle patterns to establish a baseline understanding of energy consumption.	Short written summary or 2-3 slide overview	10%
Footprint Calculator Analysis	Use the assigned calculator tools, compare results to real-world estimates, and identify key assumptions and discrepancies.	3-4 slide summary or short write-up	10%
Participation & In-Class Engagement	Active participation in discussions, exercises, and scenario-based activities throughout the course.	Ongoing (instructor assessed)	20%
Group Project – Research & Comparative Analysis	Research and compare a selected country's energy system to the United States and Germany within a chosen sector.	Group work (data + structured analysis)	20%
Final Presentation	Present key findings, comparisons, and recommendations in a structured and concise format.	5-slide presentation + delivery	25%

Evidence-Based Claim Requirement	Include at least one clear, specific claim that is supported by data, estimation, or direct comparison. The claim must go beyond description and show a defensible conclusion about the energy system being studied.	Included in presentation	10%
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FINAL EXAM

Objective: To research and compare the energy use of a selected country (excluding Germany and the USA) in a specific sector with that of the USA and Germany. Groups will be identified in the course meeting by the second meeting.

Presentation Requirements:

- Create a 5-slide summary presentation of your paper.
- Present the highlights of your findings: key comparisons, conclusions, and recommendations.
- The presentation will be delivered during the final class session.
- Select one country (excluding Germany and the USA).
- Choose one energy sector: Transportation, Industrial, Commercial, or Electric Production.
- Compare the selected country's energy use in the chosen sector to the USA and Germany.
- Use technical data and credible sources to support your comparisons.

PRACTICE MATERIALS

See the list of online resources to be used.

PROFESSIONALISM & CLASS PARTICIPATION

Students are expected to attend all class sessions and dedicate approximately 1–2 hours per day to preparation through assigned readings and independent study. This preparation will enable students to engage actively in class by answering questions, contributing their own ideas and perspectives, and participating in discussions in a meaningful and informed manner.

MISSED CLASSES

Students may not miss more than 10% of the total contact hours in order to successfully complete the course. In cases of absence, it is the student's responsibility to stay informed about the content and assignments covered during the missed sessions. Absences due to illness must be submitted as a written email before the course to the Winter University Program coordinator.

ACADEMIC STANDARDS

Upon successful completion, 6 ECTS will be awarded for the class.

According to the rules of ECTS, one credit is equivalent to 25-30 hours student workload.

GRADING SCALE

Percentage	Grade		Description
90-100%	15 points	1.0	very good: an outstanding achievement
	14 points		
	13 points	1.3	
80-90%	12 points	1.7	good: an achievement substantially above average requirements
	11 points	2.0	
	10 points	2.3	

70-80%	9 points	2.7	satisfactory: an achievement which corresponds to average requirements
	8 points	3.0	
	7 points	3.3	
60-70%	6 points	3.7	sufficient: an achievement which barely meets the requirements
	5 points	4.0	
0-60%	4 points	5.0	not sufficient / failed: an achievement which does not meet the requirements
	3 points		
	2 points		
	1 point		
	0 points		

This course description was issued/updated May 21, 2026. The program is subject to change.

More information about the program on our website

