

# ES - ENERGY SYSTEMS

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ES Class Schedule (<https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/ES/>)

## Courses

**ES 470 Fuel Cells & Hydrogen Sources credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/ES/470/>)**

The role of hydrogen as a global energy form, hydrogen production by nuclear, fossil and renewable energy sources; hydrogen handling, safety; transportation and storage methods including high-pressure, cryogenic, metal hydrides and chemical hydrides; basic science and technology of fuel cells, including electrochemical processes; fuel cell thermodynamics; low- and high-temperature fuel cells; applications including portable electronics, automotive vehicles, distributed and back-up power, and space power. 3 undergraduate hours. 3 graduate hours. Credit is not given toward graduation for. Credit is not given toward graduation for ES 470 and NPRE 470. Prerequisite: CHEM 102, MATH 285, and PHYS 212.

**ES 471 Seminar in Energy & Sustainability Engineering credit: 1 Hour. (<https://courses.illinois.edu/schedule/terms/ES/471/>)**

Challenges of developing energy systems and civil infrastructure that are sustainable in terms of resource availability, security, and environmental impact. Guest lecturers focus on: (i) global challenges – future energy demand, geologic sources of energy, climate change, energy-water nexus, energy and security; (ii) markets, policies and systems – economic incentives, policy and law, life cycle analyses; (iii) opportunities for change – CO<sub>2</sub> sequestration, renewable power, bioenergy feedstocks, biofuels for transportation, energy use in buildings, advanced power conversion, the smart grid. 1 undergraduate hour. 1 graduate hour. Credit is not given toward graduation for. Credit is not given toward graduation for both ES 471 and ENG 471. Prerequisite: MATH 220 or MATH 221; one of CHEM 104, CHEM 204, PHYS 101, PHYS 211. Recommended: NPRE 201.

**ES 475 Wind Power Systems credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/ES/475/>)**

Wind energy systems-historical development, safety aspect, environmental considerations, wind properties, site selection, wind turbine design; transmission systems; mechanical, electrical, aerodynamic and environmental engineering of modern wind turbines; fatigue failure; power production; economics and environmental aspects; accident prevention and mitigation; CFD of wind flow and blade interactions; energy storage options; hydrogen production; electrical power transmission issues; licensing; alternative wind energy systems; design project involving a wind farm or construction of a specific type of wind turbine. 3 undergraduate hours. 4 graduate hours. Credit is not given toward graduation for. Credit is not given toward graduation for ES 475 and NPRE 475. Prerequisite: CS 101, MATH 241; one of CHBE 421, ECE 110, ECE 205, ME 310, TAM 335.

**ES 571 Theory of Energy and Sustainability Engineering credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/ES/571/>)**

Mathematical, scientific, engineering, and economic bases needed to analyze sustainable energy systems and civil infrastructure. Evaluation of current practice and future development of (i) energy extraction and conversion processes from geological, biological, and non-biological resources; (ii) energy usage for transportation, in residential and commercial buildings, and by industry. Credit is not given toward graduation for. Credit is not given toward graduation for both ES 571 and ENG 571. Prerequisite: Credit or concurrent registration in ES 471.