AS.425 (ENERGY POLICY AND CLIMATE)

AS.425.601. Principles and Applications of Energy Technology. 3 Credits.
The course examines the major energy technologies underlying energy supply and consumption, their applications, and their integration with the electric grid. Students will gain a solid understanding of science, economics, environmental impacts associated with the design and operation of different energy technologies on a stand-alone and integrated basis. The course coverage includes: an introduction to energy, heat, work, energy conversion and efficiency; solar, wind, hydro and other renewable electric generation technologies, fossil, and nuclear generation; renewable integration issues such as the role of energy storage to balance supply and demand. Energy security and climate change issues are considered throughout the course. Lower carbon transportation will be introduced, with a focus on hybrids and battery energy vehicles. The course will touch on some major policies impacting the development, deployment, and utilization of technologies.

AS.425.602. Science of Climate Change and its Impact. 3 Credits.
The course begins examining the basic processes of the climate system. The course, then, moves to the study of the changing climate. While natural changes will be studied, the emphasis will be on anthropogenic climate change. Various models for predicting future climate change will be presented, including the assumptions and uncertainties embedded in each model. The regional climate impacts and impacts on subsystems will be examined, including changes in rainfall patterns, loss of ice and changes in sea level. The possible ecological effects of these predicted changes will also be examined. Offered online and on twice per year.

AS.425.603. Climate Change Policy Analysis. 3 Credits.
After a study of the historical development of climate change policy, this course analyzes current policy options for mitigating and adapting to long-term climate change. The course will examine various approaches available in the U.S. for national-level policy, including regulatory and market-based approaches, particularly cap and trade and carbon taxation. Various models for designing a cap and trade system will be studied, including the European experience and regional programs in the United States. Special attention will be paid to methods for setting initial prices and accounting for discounting of future benefits. The course will focus primarily on national-level carbon management policies, but international agreements will also be included, as well as equity considerations on a global level.

AS.425.604. Energy & Climate Finance. 3 Credits.
This course introduces students to environmental markets and the policies that create them, focusing mainly on emissions trading systems to mitigate climate change. The course also provides an introduction to attributes of the financial sector through its analysis of markets for environmental commodities Students learn the economic theory behind market-based environmental policy instruments, such as tradable renewable energy credits, carbon offsets, and water rights in a semester of lectures featuring presentations from practitioners, including state and federal government, private companies subject to market-based emissions regulation, commodity brokers, and representatives from international institutions. Offered online on-site twice per year.

AS.425.605. Introduction to Energy Law & Policy. 3 Credits.
This course will provide an overview of the major laws and policies that shape and regulate the complex energy system the United States and, to a lesser degree, the world. The goal is to provide students with a framework for understanding the energy laws and policies of today and those likely to be important in coming years. The course will review laws and policies for all major types of energy, including fossil fuels, nuclear, and renewables, as well as issues related to extraction, conversion, distribution, use, and conservation. Laws and policies ranging from local level to state, federal, and international levels will be included. Laws and policies will be presented again in the context of profound and rate changes occurring in the energy system, climate change and other environmental issues, economics, national security, and population growth. The course will be largely empirical, but attention will be given to major theories. Most aspects of the course will be illustrated by reference to contemporary issues, such as the recently unveiled Clean Power Plan, court decisions, climate change negotiations, and changes in state policies and federal tax policies for renewables. Offered on-site at least once every two years.

AS.425.606. Social Science Research Methods for Energy & Environmental Policy. 3 Credits.
Many energy, climate, and environmental issues are inherently human problems, yet many natural scientists and policymakers attempt to conduct and review social science research without training or experience in the social sciences. This course is designed to teach students the proper protocol of social science methods like case studies, narratives, interviews, focus groups, ethnographies, oral histories, and mixed methods as they apply to energy and environmental issues and policy. Students will also do an in-depth exploration of survey design, validation, deployment, and data collection. Part of the course involves an investigation of examples for each methodology in the energy, climate, and environmental science and policy sphere. The other part of the course is largely hands-on, giving students the opportunity to practice collecting and/or working with qualitative and quantitative social science data within the different methodologies. Weaved throughout the course is a discussion regarding the ethical concerns of human subject research, informed consent, and the Institutional Review Board (IRB) process. By the end of this course, students planning capstone or independent research in the energy, climate, or environmental sciences will have a working research plan that includes social science methodology or mixed methods to address their problem of practice. Prerequisites: must have taken at least one core course in either the EPC program or the ESP program. Prerequisites: must have taken at least one core course in either the EPC program (425.601, 425.602, 425.603, 425.604, 425.605) or the ESP program (420.601, 420.603, 420.604, 420.608, 420.611, 420.614).
Prerequisite(s): Prerequisites: must have taken at least one core course in either the EPC program (425.601, 425.602, 425.603, 425.604, 425.605) or the ESP program (420.601, 420.603, 420.604, 420.608, 420.611, 420.614).

AS.425.615. Understanding Public Attitudes for the Communication of Climate and Energy Policy. 3 Credits.
Public attitudes influence the political feasibility of passing new legislation on climate change policy, and consumer decisions contribute to as much as 40% of national emissions. As a result, governmental, non-profit, and commercial sectors have become interested in low-cost, non-regulatory "soft policy" approaches based on social science to inform public decision-making and behavior change. Communication —whether in the form of information provision, participatory decision-making, or social marketing—is among the foremost of these strategies. This course aims to expose students to social science research and methodology on human attitudes, behaviors, and decision-making with respect to climate and energy policy so they can directly apply it in their professional organizations. This course will challenge students not only to think about the varied communication factors that influence human decision-making and behavior, but to use that information in designing and evaluating programs. Special attention is given to the application of behavioral economics to climate, energy, and other environmental issues, and students will learn the fundamentals of social science statistical analysis using SPSS software.Prerequisite: AS.420.301 – Quantitative Methods or Statistics

AS.425.617. Energy, Eutrophication, and Inundation in Coastal Louisiana. 3 Credits.
This course will evaluate the many compounding factors of wetlands loss and sea-level rise in coastal Louisiana, will assess the impact of wetlands and habitat loss on wildlife and bird populations in the coastal zone of Louisiana, and will examine the ongoing menace of eutrophication in Gulf of Mexico waters. A portion of the course will be spent analyzing flood control efforts in New Orleans and along the Mississippi River Delta, their advantages and disadvantages, and future risk in the context of global climate change. Vulnerability analysis, environmental impact, and mitigation strategies associated with energy infrastructure, pipelines, and pipeline canals connecting offshore oil and gas to south Louisiana will be considered and assessed. Further contemplation will be given to efforts by oil and gas companies to minimize environmental impact along the Louisiana coast. The impact of the Coastal Wetlands Planning and Restoration Act will be debated and other policy initiatives explored. Students will leave this field experience with a better understanding of the complex cultural, environmental and climate, economic, and political factors at play in southern Louisiana. Prerequisite: any core course in either ESP or EPC programs (AS.420.601, AS.420.603, AS.420.604, AS.420.608, AS.420.611, AS.420.614, AS.425.601, AS.425.602, AS.425.603, AS.425.604, AS.425.605)

AS.425.618. Energy, Policy and Environmental Impact in China. 3 Credits.
Climate change is a direct result of anthropogenic emissions over decades (since the beginnings of the Industrial Revolution). This most populated country (more than 1.3 billion) in the world has experienced considerable economic growth in the past 20 years, and as a result, some of the world's largest local environmental impacts have been experienced. The impacts are sweeping, and only recently, the country is attempting to address the issues by monitoring, using replacement technologies and implementing nationwide policies (e.g., favoring electric vehicles and limiting car traffic in cities). This field trip will explore some of the impacted sites from environmental pollution and state-of-the-art research to improve energy technologies and policies to improve the situation in China.

AS.425.619. Renewable Energy and Climate Change Projects in California. 3 Credits.
California has abundant natural resources and has long been the center of attention for renewable energy within the USA. The US Department of Energy indicates that California has just over 24% of its energy coming from renewable energy production, one of the highest for a large population state. Traditionally, California has also lead the nation in terms of proactive climate change and sustainability issues.<o:p></o:p> This field trip will explore very innovative and leading sustainability projects in San Francisco. We will also visit the solar labs in nearby University of California, Berkeley, followed by a visit to nearby energy projects (e.g. Tesla, Google). Part of the trip will include discussing renewable energy projects with city and state officials. <o:p></o:p>

AS.425.620. Climate Risk: Society and The Economy. 3 Credits.
This course introduces students to theory and analytics of risk assessment and risk management with respect to climate change, including scenario analysis, stress testing and corporate risk analysis practices. Physical climate risks to be covered include: 1) fire and extreme weather risk and their impact on insurability of assets and infrastructure; 2) heat, drought, food production and their impact on crop yields and population migration; and 3) sea-level rise and its impact on real-estate, corporate and municipal risks. Climate change transition risks to be covered include: 1) the impact of policy risks on individual sectors of the economy; 2) technology transition and the risk associated with stranded assets; and 3) corporate and sovereign liability risk and the role of climate risk disclosure. Students in this course will learn to analyze the impact of climate risk on corporations, cities, and infrastructure and to evaluate the cost and benefits of climate risk mitigation strategies. AS.425.603 is recommended but not required.

AS.425.622. Renewable Energy and Climate Change Projects in Europe. 3 Credits.
The course will highlight current and near-future renewable energy and climate change mitigation and adaptation projects in an on-ground learning experience with national stakeholders in Europe. The intensive field course will be divided roughly into two parts. First, the course will be held in Luxembourg and hosted by the Luxembourg Institute of Science and Technology where students will be presented with an overview of state-of-the-art tools that are used to study energy technologies and their application in urban, industrial, and natural contexts. Several day trips will include visits to nearby bio-plants, wind farms, and solar energy projects. The course will then move to adjacent Rotterdam, Netherlands, and will include additional daily trips to various innovative urban space and energy projects. The second part of the trip will journey to Hamburg, Copenhagen, and Stockholm where the class will stop to talk with subject matter experts in energy and sustainability along the way and to visit foremost wind energy sites. Throughout the trip students will be expected to connect theoretical concepts of renewable energy, climate change, and sustainability with practical applications and policy.

AS.425.623. Transportation Policy in a Carbon-constrained World. 3 Credits.
Transportation systems provide essential services for individuals, business, and every sector of the economy. However, transportation is a major expense, causes significant negative side effects, and is now the largest source of greenhouse gas emissions in the United States. This course examines the complex system-of-systems that is modern transportation as well as the many technologies and policies that can mitigate the negative effects of transportation while maintaining or improving transportation services. These include cleaner vehicles, lower emission fuels, and changes to travel demand. It also explores disruptive innovation in transportation, including the emerging roles of information technology and the potential transition to connected and automated vehicles. Estimates of impacts of these technologies and policies on energy use, infrastructure, emissions, and other metrics are presented and discussed. This course has a U.S. focus with a balance of technology and policy content and a strong interactive component. Course Prerequisite: AS.425.601 – Principles and Applications of Energy Technology.

AS.425.624. Wind Energy: Science, Technology and Policy. 3 Credits.
Topics include the assessment of wind resources, basic principles of wind turbines and power transmission, electric markets and wind power, technological and economic aspect of storage of intermittent wind power, legal issues at state and federal levels, international water issues, and environmental impact assessment processes for wind developments. Offered on-site at least once every two years. Prerequisite: 425.601 Principles and Applications of Energy Technology.

AS.425.625. Solar Energy:Science, Technology & Policy. 3 Credits.
This course focuses on the two primary solar technologies i the contemporary market: photovoltaic cells and concentrate solar power, with a focus on PV. The course will investigate techniques for increasing efficiency, expanding storage, and decreasing price. Solar energy for use as both distributed and grid-independent resources is considered. The course covers science and technologies, as well as the environmental impact on solar technologies. Additionally, the course examines the main structure considerations for solar technology development. Prerequisite: 425.601 Principles and Applications of Energy Technology.

AS.425.626. Climate Anthropology and Changing Communities. 3 Credits.
Coastal, arctic, and arid ecosystems are significantly affected by climate change. This course invites us to think about small rural communities that have been profoundly affected by climate change. By exploring multiple ethnographic case studies and applying multiple theoretical models, the course offers anthropological insights into how the people in these areas interact with their environment over their lives. While examining the inhabitants' knowledge-based views of climate and local socioecological systems, students in this course will develop more robust, flexible models of anthropological analysis for climate change (in general) and for smaller ecosystems (in particular). By examining the impact of climate devastation on the local scale, the course contributes to a better understanding of how environmental changes impact people, traditions, economies, politics and health on the global scale, and help students develop new ideas for effective climate communication, community engagement, and the development of future climate and energy policy that addresses the needs of communities.

AS.425.628. Renewable Energy Project Development and Finance. 3 Credits.
This course examines the financial, legal and regulatory topics related to the development of renewable energy (RE) projects (wind, solar, geothermal, hydro etc.) in the US. The bulk of the course focuses on utility scale projects, with the latter section on smaller scale renewable distributed energy resources (DER). The course is divided into sections on finance, siting, basic technical features of the electric grid, and regulatory background. The finance section will provide fundamentals of corporate and project finance, then focus on the ownership and financing structures used for developing renewable energy projects. Basic financial terms and conditions such as power purchase agreements, engineering/ construction/ procurement contract, fuel supply arrangements, and operation and maintenance contracts will be reviewed. The project siting and development section will review models for feasibility studies, environmental assessment and permitting at state and Federal levels. The electrical grid section will discuss at a high level how the power system works, including basics of transmission and generation, with a focus on concepts useful for developing projects, including the transmission interconnection process. Multiple case studies will be used throughout the course to highlight successful models and approaches. At the end of the course the students will have critical skills to work on project development and finance components of RE projects in the US. Prerequisite: There are no prerequisites.

AS.425.630. Cities and Climate Change. 3 Credits.
This course examines cities as the primary centers of energy demand; as major sources of greenhouse gases; as places most vulnerable to climate change impacts; and as logical focal points for mitigation and adaptation solutions. Local level government climate policy and financing options are also examined, including alternative energy production, resilient water systems, green buildings, energy efficient transport and sustainable infrastructure generally, local level offsets, and urban-based Clean Development Mechanisms. Analytical methods are introduced to understand current approaches to decision-making. Offered online at least once every two years. Prerequisites: Climate Change Policy Analysis.

AS.425.634. Climate Change and Health. 3 Credits.
This course examines the potential impacts on human health from global climate change and the possible responses to and adaptations for these impacts. Topics include impacts on health of climate extremes, climate change and infectious diseases, health and climate refugees, national assessments of health impacts of climate change, monitoring the health effects of climate change, and public health policies for climate change. Prerequisite: Science of Climate Change and Its Impacts.

AS.425.635. Climate and Earth System Modeling. 3 Credits.
Provides a survey of the history, use, applications, and broader significance of climate and Earth system modeling. Students will gain an understanding of the process of model development; the evolution of model complexity and performance over time; and the usefulness and application of climate, Earth, and other associated models to various problems. In particular, the utility and role of models for mitigation and adaptation policy and planning will be explored. Participants will also engage with model data and code, although experience with coding and advanced statistics are unnecessary, and students from all backgrounds are welcome. The course will result in a deeper understanding of climate models and the crucial policy-relevant information they offer about future Earth system conditions. Prerequisite: 425.602 - Science of Climate Change and its Impacts or permission of instructor.

AS.425.636. Emerging Energy Technologies and Applications. 3 Credits.
This elective course builds on a number of ideas covered in the core Principles and Applications of Energy Technology course (425.601) - and as with the first course uses and integrates a broad range of ideas from science, engineering and economics. The main focus of the course will be to broaden and deepen the coverage of the how some of the emerging energy technologies work, that were either not covered or only lightly covered in the core course. Electricity generation or storage related topics include (1) Fuel cells and batteries, including hydrogen fuel cells, batteries with different lithium-ion chemistries, and flow batteries, including integration with solar and wind (2) ocean wave devices, with an emphasis on the energy in traveling ocean waves, and how some of this wave energy can be absorbed and converted to electricity, through ideas related to natural frequency and forced damped oscillations, (3) new approaches to carbon capture and sequestration (CCS), such as the proposed Allam cycle - which is a type of closed cycle combustion turbine (CT), where the use of super-critical carbon dioxide rather air as the working fluid facilitates CCS (4) nuclear energy, from small modular fission to fusion. The course will also look at some important applications of electricity, including light emitting diodes (LEDs). The 2014 Nobel prize for physics went to inventors of the first blue LEDs using high band-gap semi-conductors, like indium gallium nitride which has made their widespread use for high quality white light applications possible. LEDs - as will be explained - are similar to (the p-n junctions in) PV cells but with higher band gaps, and operated to run backwards using an electrical source, so that electrical power is converted to visible light with much higher efficiency than with traditional incandescent light bulbs. Prerequisite: 425.601 Principles and Applications of Energy Technology, equivalent experience, or permission of instructor.
Prerequisite(s): Prerequisite: 425.601 Principles and Applications of Energy Technology, equivalent experience, or permission of instructor.

AS.425.637. International Climate Change Policy. 3 Credits.
This course focuses on the development, analysis, and implementation of international policy frameworks and mechanisms for climate change mitigation and adaptation. It includes a review of the history of international responses to climate change at the multilateral and bilateral levels, including in depth examination of the agreements of the United Nations Framework Convention on Climate Change (UNFCCC) and the Conference of the Parties (COP) as well as important bilateral agreements. The course explores how international climate change policy is affected by the national priorities and capacities of countries, and how these circumstances shape the evolution of both climate change policy and related areas such as trade and energy. It is recommended, but not required, that students take AS.425.602 - Science of Climate Change and its Impacts and/or AS.425.603 - Climate Change Policy Analysis before taking this elective.

AS.425.638. Adaptation to Climate Change. 3 Credits.
Global climate change risks are increasingly complex and may ultimately affect virtually every facet of our economic, energy, community, and environmental systems. At the same time, policy and investment responses to climate resiliency needs are similarly complex, controversial, and high stakes. Perhaps no issue facing leaders of today and tomorrow is more cross- cutting in nature or in greater need of improved understanding and capability than climate change risk. This course will provide a comprehensive framework for understanding, assessing, and applying climate change risk, vulnerability, a hazard assessment for the development of risk reduction an adaptation response. In the process, it will examine the status, limitations, and strengths of current assessment and action planning approaches across varying sectors, scales, and impact areas. The course will also include a review of methods prioritizing actions and addressing feasibility, flexibility, and logistical needs as applied to specific facilities, such as military installations, as well broader communities and multistate regions. Individual and group learning exercises will be involved. Offered on-site at least once every two years.

AS.425.639. Energy Markets and Strategy from Europe to Asia. 3 Credits.
Europe, the Middle East & North Africa (MENA), and Asia are interdependent geoeconomic domains with interlinked energy markets. This course will provide an overview of the main topics that characterize the structure and fundamental dynamics of energy markets in these regions and how energy security and economic development strategies shape the fate of nations. Students will learn the historic, economic, political, structural, and operational aspects of the regions' energy industries, with a particular emphasis on the production and transportation of petroleum and natural gas. The course will also explore how economic development, energy and national security, environmental considerations, and technology evolution shape and disrupt these relationships. Students will learn how the strategies of nations, national and private energy companies, and the role of international and intergovernmental organizations, such as OPEC and the European Commission, interact to shape the future direction of energy markets and the planet. The course will familiarize students with publicly available sources of data on energy in these regions.

AS.425.644. Principles & Applications of Energy Technology II. 3 Credits.
This course builds on a number of ideas covered in the core EPT course, and as the first course uses and integrates a broad range of ideas from science, engineering, and economics. The course has two distinct but overlapping themes that will be often be covered in parallel. First, the course will broaden and deepen the coverage of the how some of the energy technologies discussed in the core course work, with a slight more formal discussion and use of ideas from mechanics and thermodynamics, including the role of entropy; a few newer potential technologies, such as fusion and ocean, will also be covered. Second, the course will extend the coverage of the economics and operation of energy markets to provide a deep understanding of how to value energy generation assets facing an uncertain future on both a stand-alone and integrate basis, and how these considerations play out in real electric markets, including the role of energy, capacity, and ancillary services. The course will include coverage of the potential role of energy storage and/or demand side management in integrating large-scale renewable energy into the grid from both an operational and economic perspective. Offered on-site at least once every two years.

AS.425.645. Global Energy Policy. 3 Credits.
Energy policy is about more than sheer market design. Policy agendas have become increasingly complex, adding sustainability and development to traditional energy security concerns. In response, a patchwork of institutional frameworks has emerged, including clubs (OPEC, IEA), treaties, the Energy Charter Treaty (ECT), agencies, the International Renewable Energy Agency or policy networks, and the Renewable Energy & Energy Efficiency Partnership. The course introduces students to the global dimensions of energy policy, discusses shifting agendas, and assesses the institutional spectrum of global energy governance. Offered online at least once every two years.

AS.425.646. US Offshore Energy: Policy, Science and Technology. 3 Credits.
Offshore energy is progressively becoming a significant part of the U.S. energy mix. Oil from offshore platforms now accounts for roughly one-third of the U.S. domestic production, and significant interest has emerged for developing renewable energy resources in the ocean and the Great Lakes. Large-scale offshore wind projects have been proposed along the East Coast, and there is also interest in developing wave energy off the West Coast and the Pacific islands. Ocean current and tidal energy are the other emerging sources. This course will take a multi-disciplinary approach to offshore energy analysis. We will discuss both renewable resources such as offshore wind, and conventional resources such as offshore oil and gas. Topics covered will include: resource assessment, state and federal regulations, economics of offshore energy, environmental impact and benefits, space-use conflicts, cultural/tribal issues, public perception, offshore energy technology, and energy infrastructure. We will also review case studies on the proposed Cape Wind project and the Deepwater Horizon oil spill. In addition, we will discuss the recently launched National Ocean Policy initiative and how it is influencing offshore energy regulation. Subject-matter experts from federal regulatory agencies will be invited as guest speakers. By the end of the course, students will understand policies and regulations governing offshore energy in the U.S. They will also be conversant with the economics of resource development, technological drivers for harnessing the resources, and the scientific advances in assessing and mitigating environmental impact from energy production in offshore areas. Offered onsite at least once every two years.

AS.425.647. Energy and Water Security in South Asia. 3 Credits.
South Asia (India, Pakistan, Bangladesh, Afghanistan, Nepal, Sri Lanka, Bhutan and Maldives) is home to more than 1.7 billion people (nearly 25% of the global population). It is also a region of rapidly growing economies, rising energy consumption, and increasing environmental stress. Fossil fuels, particularly coal is the major source of electricity in the region, contributing to rising greenhouse gas emissions and worsening air quality. India in particular is promoting the use of indigenous coal to power its economic growth. At the household level, inefficient use of biomass for cooking and heating continues to be a major health and environmental hazard. Moreover, fresh water stress and pollution has reached alarming levels in the region with far reaching impacts on agriculture and human health. <o:p></o:p> South Asia is uniquely vulnerable to climate change impacts. On the one hand, receding Himalayan glaciers in Nepal, India, Pakistan and Bhutan are exacerbating water stress and threatening food security for more than a 1 billion people. And on the other hand, Bangladesh and Maldives are prone to sea level rise and coastal flooding from powerful tropical storms. <o:p></o:p> Creating a sustainable energy and freshwater pathway is intrinsically linked to innovative development approaches tailored to local and regional variabilities. In order to curb growing emissions, the region is promoting renewable energy sources such as solar, wind, and micro hydro power. However, the unmet demand for energy, particularly electricity remains so large in South Asia that fossil fuels are expected to be a major part of the future energy mix. Water stress is being managed through a mix of traditional and modern techniques. <o:p></o:p> Given the demographic size of the region and the pent-up energy demand, it can be argued that the success of global climate change initiatives (such as the 2015 Paris agreement) in large part is contingent on creating a low-carbon energy future in South Asia. The challenges are national and regional, but the implications are clearly global. <o:p></o:p> The course will provide a broad overview of the energy and freshwater challenges in South Asia. At the end of the course, students will be conversant with the current energy and water issues, future energy mix and water demand projections, and the technical and policy initiatives to balance growing energy demand with a low-carbon energy pathway and freshwater demands through ingenious initiatives. Students will also benefit from a greater understanding of the unique climate change vulnerabilities of the region and the mitigation initiatives to minimize impacts. <o:p></o:p>

AS.425.651. The Electric Grid: Technology and Policy. 3 Credits.
This course aims to introduce the students with an overview of electric power industry including the fundamentals of power system generation, transmission, and markets. Various power generation technologies and system network characteristics will be introduced. Key elements of power system operation such as unit commitment, economic dispatch, and optimal power flow will be discussed to provide the background for understanding how the power grid operates and to lay the foundation for understanding the environmental impact from power generation and system operation. An overview of grid planning will be provided. Students will also be exposed to power markets and complex relationship between market and system. Later, students will be exposed to the topics of US energy policy that particularly pertains to power industry. Relevant energy policies of certain countries on global setting for the electricity sector will also be discussed. The latest developments in power industry such as smart grid, microgrid, distributed energy resources and other topics will also be covered.

AS.425.652. Nuclear Energy: Technology, Policy, and Regulations. 3 Credits.
Nuclear energy is a potent energy source that is widely feared and misunderstood, yet continues to play an integral role in the global energy landscape today and in the future. This course will focus on the different forms and use of nuclear energy, the history of nuclear energy and regulation, the fundamentals of fission and fusion nuclear power, the radiological health applications, and the electromagnetic and other radiation in the environment. Students will also learn about federal and international policies and regulations that govern the civilian use of nuclear energy and implications for climate mitigation. Current events related to nuclear power at the international level will also be covered in the course. Prerequisite: AS.425.601 – Principles and Applications of Energy Technology or permission of instructor.
Prerequisite(s): Prerequisite: AS.425.601 – Principles and Applications of Energy Technology or permission of instructor.

AS.425.689. Energy and Environmental Graduate Seminar. 3 Credits.
This graduate seminar course provides exposure to leading topics and vanguard research in environmental science, conservation science, energy and environmental law, and climate change science and adaptation, and offers discussion on practical applications of energy technology and energy/environmental policy. Students will evaluate how each study contributes to the advancement of theory, builds on previous research, and poses questions for future research. Students will also critically analyze professional presentation styles and technical content throughout the semester and will then synthesize best practices for professional communication in their own practice. This course does not meet the Environmental Science and Policy residency requirement.

AS.425.800. Research Design for Capstone Projects in Energy and Environmental Sciences. 3 Credits.
The Capstone Project enables students to apply and synthesize the material learned in other courses, develop expertise on a specific topic related to climate change science or policy, work closely with experts in the field of study, and improve professional writing and presentation skills. In the semester prior to conducting the project, students must identify a proper topic and mentor who is both familiar with the chosen topic and willing to guide and oversee the project. The mentor must be a faculty member teaching in the program, a supervisor from the student's place of work, or any expert with appropriate credentials. Formal proposals must be submitted at least two weeks prior to the start of the semester in which the project be completed. Prior to the enrollment in the course, the proposal must be reviewed and accepted by the course instructor.

AS.425.801. Independent Study. 3 Credits.

AS.425.888. Capstone Continuation Course.
Noncredit