MARYLAND HIGHER EDUCATION COMMMISSION
ACADEMIC PROGRAM PROPOSAL

PROPOSAL FOR:

____ NEW INSTRUCTIONAL PROGRAM

✓ SUBSTANTIAL EXPANSION/MAJOR MODIFICATION

____ COOPERATIVE DEGREE PROGRAM

✓ WITHIN EXISTING RESOURCES or ____ REQUIRING NEW RESOURCES

(For each proposed program, attach a separate cover page. For example, two cover pages would accompany a proposal for a degree program and a certificate program.)

Johns Hopkins University
Institution Submitting Proposal

Fall 2016
Projected Implementation Date

Master of Science
Award to be Offered

Energy Policy and Climate
Title of Proposed Program

2102-01
Suggested HEGIS Code

44.0501
Suggested CIP Code

Krieger School of Arts and Sciences
Department of Proposed Program

Beverly Wendland, Dean
Name of Department Head

Philip Tang
Contact Name

alo@jhu.edu
Contact E-Mail Address

(410) 516-6087
Contact Phone Number

03/09/2016
Signature and Date

President/Chief Executive Approval

N/A
Date

Date Endorsed/Approved by Governing Board

JOHNS HOPKINS
UNIVERSITY

MAR 21 2016

March 18, 2016

Dr. James D. Fielder, Jr.
Secretary
Maryland Higher Education Commission
6 N. Liberty Street, 10th Floor
Baltimore, MD 21201

Dear Dr. Fielder:

On behalf of Provost Robert Lieberman, Dean Beverly Wendland, and our Krieger School of Arts and Sciences, I write to request your review and endorsement of the enclosed proposal. The Krieger School proposes to substantially modify its existing and previously endorsed **Master of Science in Energy Policy and Climate** (HEGIS code: 21202-01, CIP code 44.0501) to offer an online option.

The Master of Science in Energy Policy and Climate has been offered through the division of Advanced Academic Programs since 2010. The program is designed to prepare interdisciplinary professionals to address the challenges posed by climate change and the potentially transformative role of sustainable energy systems.

The modified program is consistent with the mission of the university and with the State of Maryland's goals for postsecondary education. The proposal is fully endorsed by Johns Hopkins University.

A business check (#11448004) for the review of this proposal has been sent to the Commission. Should you have any questions or need further information, please do not hesitate to contact me at (410) 516-6087 or ptang@jhu.edu. Thank you for your continuing support of Johns Hopkins.

Sincerely,

Philip Tang
Vice Provost for Academic Affairs

cc: Dr. Robert Lieberman
Dr. Beverly Wendland
Dr. Kathleen Burke
Dr. Ratna Sarkar
Mr. James Brailer
Ms. Mary Ellen Flaherty
Mr. Tom McDermott
Ms. Jennifer Martin

Enclosures

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The Johns Hopkins University
Krieger School of Arts and Sciences
Proposal for Substantial Modification to an Existing Program

Master of Science in Energy Policy and Climate

A. Centrality to institutional mission statement and planning priorities

1. Program description and alignment with mission

The Johns Hopkins University Krieger School of Arts and Sciences proposes a substantial modification to the existing and previously endorsed Master of Science in Energy Policy and Climate (HEGIS code 2102-01, CIP code 44.0501) to offer an online option.

The M.S. in Energy Policy and Climate, offered through Krieger School's division of Advanced Academic Programs (JHU-AAP) since 2010, is designed to prepare interdisciplinary professionals to address the imposing challenges posed by climate change for human institutions and ecosystems and the potentially transformative role of sustainable energy systems. The program enables students to develop a firm grasp of the science of climate change and the potential impacts of it during this century and beyond. Moreover, they develop substantial understanding of energy technologies, including both fossil fuel-based systems and renewable energy options, and expertise in energy law and policy making. This innovative degree recognizes that all sectors working at the energy and climate nexus share common goals – creating more sustainable and resilient energy systems that can withstand the challenges of climate and environmental change. This will remain the focus of the proposed fully online option for the degree. Program graduates hold leadership positions in the industry, government, and the associated non-profits.

The mission of The Johns Hopkins University is to educate its students and cultivate their capacity for life-long learning, to foster independent and original research, and to bring the benefits of discovery to the world. In addition, the mission of JHU-AAP is to offer high quality graduate courses, certificates and degree programs containing a mixture of theory and practice that serve current and long term needs of today's adult learners. Finally, the mission of the Energy Policy and Climate Program is to provide a strong foundation of knowledge upon which innovative policy programs and promising leaders can develop. The proposed online option would help implement those goals by educating students from both a practical and theoretical perspectives.

2. Alignment with institutional strategic goals

The M.S. in Energy Policy and Climate's online option fits well within JHU-AAP's cluster of environmental programs which are designed to educate individuals interested in working on science-informed policy. JHU-AAP is noted for its high quality graduate programs for working professionals. The programs educate students in various disciplines to be tomorrow's most promising and knowledgeable leaders.

B. Adequacy of curriculum design and delivery to related learning outcomes

1. Program outline and requirements

The M.S. in Energy Policy and Climate currently exists as a campus-based program at JHU's Washington, D.C. Center. As in all JHU-AAP programs, the curriculum was developed for working professionals in industry, government and the non-profit sector, allowing students to take courses at a part-time pace (although full-time is an option for some and especially for those between jobs). Students are brought up-to-speed quickly on a specific content or issue area, are asked to use new and their existing processing skills, and to develop competency in gathering, analyzing, and reporting on data in an applied situations.

For the degree, students complete 10 courses, including a capstone project that provides an opportunity to address a practical, real-world challenge using the skills and knowledge they have gained and synthesized throughout their studies. Students must complete four required core courses, a Capstone course, and select five electives from among those offered in the program, the environmental cluster (Environmental Sciences and Policy, Geographical Information Systems) or from another AAP program such as from the Government or Applied Economic programs.

Required courses
425.601 Principles and Applications of Energy Technology
425.602 Science of Climate Change and its Impact
425.603 Climate Change Policy Analysis
425.604 Energy and Climate Finance
425.800 Capstone Project in Energy Policy and Climate

Electives courses from the Energy Policy and Climate program
425.623 Transportation Policy in a Carbon-constrained World
425.624 Wind Energy: Science Technology and Policy
425.625 Solar Energy: Science, Technology & Policy
425.630 Cities and Climate Change
425.645 Global Energy Policy
425.646 US Offshore Energy: Policy, Science and Technology

Electives from other JHU-AAP Programs
Environmental Sciences and Policy:
420.614 Environmental Policymaking and Policy Analysis
420.645 Environmental Consequences of Conventional Energy Generation
420.651 Risk Assessment and Risk Management
420.665 Climate Change on the Front Lines: The Study of Adaptation in Developing Countries

Geographical Information Systems:
420.601 Geographic Information Systems

420.602 Remote Sensing: Earth Observing Systems and Applications
420.603 Geospatial Data Modeling

Government:
470.773 Energy and Environmental Security

2. Educational objectives and student learning outcomes

The educational objective of the M.S. in Energy Policy and Climate is to provide students the scientific background and analytical tools to address the growing importance of the climate-change-energy nexus so that they may work toward designing or implementing appropriate and effective policies or apply these in public, private, or not-for-profit sectors.

Upon completion of the M.S. in Energy Policy and Climate, students will:

- Acquire expertise through coursework and the capstone process in one or more areas of Energy Policy and Climate, such as energy technology (fossil-fuel based or renewables), energy law and policy, climate change and its societal and environmental impacts (adaptation and mitigation), national and international climate change policy, energy and climate finance;
- Critically analyze and evaluate existing and proposed models, strategies, and policies, from a variety of sources, both academic and nonacademic;
- Develop excellent oral and written communication skills that will enhance career objectives in public sector, non-profit and/or private organizations; and
- Demonstrate proficiency with qualitative or quantitative research methodologies and exhibit critical thinking skills in important academic or public policy areas through the completion of a capstone project.

3. General education requirements

Not applicable.

4. Specialized accreditation and/or certification requirements

Not applicable.

5. Contractual agreement with other institutions

Not applicable.

C. Critical and compelling regional or statewide need as identified in the State Plan

1. Demand and need for the program

The M.S. in Energy Policy and Climate program is particularly attractive to professionals already working in the broadly defined energy and climate change sector, which includes government and government-related institutions, non-profits, utilities, and private

corporations. The program is moving into its sixth year and has already developed a strong reputation in the Washington, D.C. region and has capitalized on its close location to the centers of government and policy formation. It is easily accessible to many of those who seek or hold positions in a wide range of government fields. In addition, the structure of the program allows professionals already working in the field to increase their knowledge and upgrade their skills without interrupting their careers to become full-time students. The proposed online option for the M.S. in Energy Policy and Climate will extend the opportunity for those beyond the Washington, D.C. region to earn this proven and innovative degree.

2. Alignment with the 2013-2017 Maryland State Plan for Postsecondary Education

The 2013-2017 Maryland State Plan for Postsecondary Education articulates six goals for postsecondary education: 1) quality and effectiveness; 2) access, affordability and completion; 3) diversity; 4) innovation; 5) economic growth and vitality; and 6) data use and distribution. The proposed modification is well aligned with the State Plan.

The M.S. in Energy Policy and Climate is intended to educate students from both a practical and a theoretical perspective about energy technology, climate change science and impacts, and the policy contexts for both. This is consistent with Goal 1 of the State Plan, "Quality and Effectiveness," which asserts that Maryland will enhance its array of postsecondary education programs to more effectively fulfill the evolving educational needs of its students, the state, and the nation. Similarly, the proposed program is consistent with Goal 4, "Innovation," which articulates Maryland's aspiration to be "a national leader in the exploration, development, and implementation of creative and diverse education and training opportunities that will align with state goals, increase student engagement, and improve learning outcomes..." Goal 5, "Economic Growth and Vitality," is centered on supporting a knowledge-based economy through increased education and training; this too, is aligned with the goals of the program.

D. Quantifiable and reliable evidence and documentation o market supply and demand in the region and service area

1. Market demand

In today's environment, a growing number of students need to be mobile to follow career opportunities. Some are deployed by the military, government agencies, or private corporations while completing their degrees. Students find the flexibility and convenience of online instruction attractive and report a high level of satisfaction with the quality of instruction and the learning they obtain in the online offerings. JHU-AAP is proud of its innovative classes and the high quality of its online offerings. All of its courses are capped at relatively low numbers; the M.S. in Energy Policy and Climate that will be 20 students.

In terms of potential growth in online demand, in Fall 2015, the M.S. in Energy Policy and Climate had over 60 total registrations, of which about 30% percent were in online courses. As a comparison, the much larger and more mature Environmental Sciences and

Policy program (with a much longer online presence) has about 70% of its enrollments in online courses for Fall 2015. The Energy Policy and Climate could become similar to the Environmental Sciences and Policy program in the numbers of online students in future.

2. Educational and training needs in the region

See E-1 of the proposal.

3. Prospective graduates

The goal of the M.S. in Energy Policy and Climate would be to graduate twice as many students per year as the current face to face program.

E. Reasonableness of program duplication

1. Similar Programs

We believe that there are no comparable offerings for the proposed online option of the existing M.S. in Energy Policy and Climate. The combination of energy and climate change is unique, and although there are some programs looking at energy policy and management, to date, we find few onsite stand-alone programs, in the U.S. or internationally. There are a number of programs with a strong engineering focus, and energy certificates of various types exist at numerous universities. There are an increasing number of master's degrees in climate change, often embedded in geography or environmental science programs.

Duke University - The program at Nicholas School of the Environment at Duke University is the closest in terms of curriculum goals. The school offers a Master of Environmental Management (MEM) degree in both an onsite and online version. This program "teaches students how to analyze and manage natural environments for human benefit and ecosystem health." One of the concentrations is 'Energy and the Environment' which "trains students to work toward a sustainable energy future." The online version of the MEM degree does not offer this concentration.

Penn State University – The intercollege Master of Professional Studies in Renewable Energy and Sustainable Systems degree if offered fully online and is an "interdisciplinary master's degree program designed to prepare professionals in the fields of renewable energy and sustainability systems to lead the world's transformation from an unsustainable, fossil energy economy to a renewable, sustainable basis of operation." It offers four technical options in sustainability management and policy, or in wind, solar, or bioenergy. The degree can be pursued on a part-time basis.

University of Delaware - The Master's of Energy and Environmental Policy (MEEP) is a residential traditional master's degree with thesis based in that university's Center for Energy and Environmental policy with a focus on "interdisciplinary graduate education, research, and advocacy in energy and environmental policy."

2. Program Justification

Modifying the existing M.S. in Energy Policy and Climate degree to be offered fully online is consistent with a commitment to online learning at Johns Hopkins University, and specifically at JHU-AAP where closet to 70% of enrollments are online. Online learning furthers the Energy Policy and Climate program's mission of reaching today's adult learners with high quality course offerings that blend applied knowledge, theory, and policy on energy technology and climate change in an innovative learning environment that can take advantage of novel pedagogic technologies and instructors who provide expertise and perspectives from places beyond Washington, D.C.

Furthermore, Johns Hopkins receives a steady and increasing stream of inquiries each semester from prospective students in the U.S. who would prefer an online version of the program. Students are transferred for their work out of the immediate Washington, D.C. region or are deployed for military service. Many of these students would benefit from a fully online option for the existing M.S. in Energy Policy and Climate so that they can complete their degree and advance their career no matter where they are. A fully online program will also be increasing attractive to international students some of whom can come to the U.S. for only a limited time due to work or other obligations, and others who cannot come at all but can complete the program fully online.

F. Relevance to Historically Black Institutions (HBIs)

Any student meeting the admissions requirements after attending a regionally accredited institution and completing a baccalaureate degree, including any HBIs, could apply to the program. The program could serve as an extension of the opportunities provided by HBIs and graduates of HBIs could improve their competitiveness and reach their professional goals by enrolling in and completing the degree program.

G. Evidence of compliance with the Principles of Good Practice

See Appendix B for the evidence that this program complies with the Principles of Good Practice noted above.

The Higher Education Opportunity Act (HEOA) enacted in 2008 requires that an academic institution that offers distance education opportunities to students 1) has a process established to verify that the student who registers is the same student who participates in and completes the offering and receives academic credit for it, 2) has a process established, to verify that student privacy rights are protected, and 3) has a process established that notifies the student at about any additional costs or charges that are associated with verification of student identity. In this graduate program the following actions have been taken to satisfy these requirements: 1) students may only enter the academic website for the online courses they take by providing their unique student ID and password they receive when they are admitted to the programs, 2) all FERPA privacy rights are preserved by limiting access very specifically in the University student information system to only those permitted by law to have access to restricted student information, and 3) there are no additional costs assessed to the student for the measures we use to verify student identity.

H. Adequacy of faculty resources

See Appendix C for a list of representative faculty who teach in the program. As with all JHU-AAP programs the use of part-time adjunct faculty is both intentional and important. JHU-AAP is committed to marrying theory and practice, and this is particularly important in a master's program designed for current and aspiring professionals and practitioners in Energy Policy and Climate. It is vital that faculty have current practical experience in the fields of public policy, management, and public administration, as well as advanced degrees. All of our faculty have at least the equivalent of a master's degree, although almost 90% have a Ph.D. or other terminal degree in their field. Many of our faculty have been in the program since its inception, and many are developing online versions of courses they have already successfully taught in an onsite format.

I. Adequacy of library resources

The Milton S. Eisenhower Library on the Homewood campus is ranked as one of the nation's foremost facilities for research and scholarship. Its collection of over three million bound volumes, several million microfilms, and over 13,000 journal subscriptions has been assembled to support the academic efforts of the University. The interlibrary loan department makes the research collection of the nation available to faculty and students. The library also provides easy access to a wide selection of electronic information resources, including the library's online catalog, and numerous electronic abstracting and indexing tools. Many of the databases are accessible remotely. The library offers a variety of instructional services, including electronic classrooms designed to explain the library resources available for research and scholarship. Librarians help students electronically and the library maintains an extensive web site to take visitors through all of its services and materials.

J. Adequacy of physical facilities, infrastructure and instructional equipment

All courses will be offered online therefore no new facilities will be needed. Existing AAP facilities should provide adequate space and equipment for faculty, staff, and supporting needs.

K. Adequacy of financial resources with documentation

See Appendix D for detailed financial information.

L. Adequacy of provisions of evaluation of program

JHU-AAP has an online student course evaluation process that is completed at the midterm of each semester and after the offering of each course. This process will be applied to the proposed M.S. in Energy Policy and Climate online program. This evaluation also includes student reviews of the faculty for each course offered. Each semester the Program Director evaluates the course offerings and faculty performances based on these reviews. On an annual basis, the curriculum will be reviewed by the Program Director and Associate Program Director, with input from the Program Chair, Advisory Board, faculty, students, and administrators as appropriate to determine if new topics need to be covered or new courses developed in order to keep the program fresh and cutting edge.

M. Consistency with the State's minority student achievement goals

Johns Hopkins is strongly committed to cultural diversity and the recruitment and retention of underrepresented minority students. Specific outreach to HBIs is planned to help ensure students at these schools are aware of this new program and its potential to improve their competitiveness in the job market and reach their professional goals if they are admitted to it and successfully complete the degree program.

N. Relationship to low productivity programs identified by the Commission

Not applicable.

Appendix A

Course List and Descriptions

Core Requirement Courses

425.601 Principles and Applications of Energy Technology (4 credit hour)
This course examines energy supply and consumption, and how these activities impact the environment, with a focus on understanding the potential technology, market structure and policy implications for climate change. Students will gain a solid understanding of the science, economics, environmental impact associated with various electricity generation technologies, including renewable energy, conventional generation (existing and future), carbon storage and sequestration, and electricity storage. Transportation topics will address a variety of technologies, including hybrids and fuels cells, as well as the potential role for alternative fuels, including biofuels. Climate change and the potential impact and mitigation of carbon dioxide will be considered throughout the course. This class will be available online starting Fall 2015.

425.602 Science of Climate Change and its Impact (4 credit hour)
This 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 cover and changes in sea level. The possible ecological effects of these predicted changes will also be examined. This class will be available online starting in Summer 2016.

425.603 Climate Change Policy Analysis (4 credit hour)
After a study at the historical development of climate change policy, this course analyzes current policy options for mitigating for and adapting to long-term climate change. The course will examine various approaches available in the US for national level policy, including the regulatory approach and the 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 discounts. 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. This class will be available online starting Spring 2016.

425.602 Energy & Climate Finance (4 credit hour)
Energy and Climate Finance introduces students to environmental markets and the policies that create them, focusing mainly on emissions trading systems (ETS) 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. This class will be available online starting Fall 2015.

425.800 Capstone in Energy Policy and Climate (4 credit hour)
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 project topic and mentor who is both familiar with the chosen topic and willing to guide and oversee the project. The mentor may 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 is to be completed. The proposal must be reviewed by the associate program chair prior to enrollment in the course. Permission of Instruction required. This class will be available online starting in Summer 2016.

Electives Courses from the EPC Program

425.623 Transportation Policy in a Carbon-constrained World (4 credit hour)
This course examines how transportation decisions and policy can affect climate change, and the transportation solutions available to help solve the problem of climate change. Three sets of policies are examined that can reduce GHGs from the transportation sector, cleaner vehicles, low GHG-emitting fuels and better management of travel demand. Each policy is covered in detail in this course. Prerequisites: Principles and Applications of Energy Technology. First online offering will be in Spring 2017.

425.624 Wind Energy: Science, Technology and Policy (4 credit hour)
Topics include the assessment of wind resources, basic principles of wind turbines and power transmission, electricity markets and wind power, technological and economic aspects of storage of intermittent wind power, legal issues at state and federal levels, international water issues, and environmental impact assessment processes for wind developments. Prerequisite: Principles and Applications of Energy Technology. First online offering will be in Fall 2016.

425.625 Solar Energy: Science, Technology and Policy (4 credit hour)
This course focuses on the two primary solar technologies in the contemporary market; photovoltaic cells (PV) and concentrated solar power (CSP), 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 of solar technologies. Additionally, the course examines the market structure considerations for solar technology development. Prerequisite: Principles and Applications of Energy Technology. First online offering will be in Summer 2017.

425.630 Cities and Climate Change (4 credit hour)
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. Prerequisites: Climate Change Policy Analysis. First online offering will be in Summer 2016.

425.645 Global Energy Policy (4 credit hour)
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 have emerged, including clubs (OPEC, IEA), treaties, Energy Charter Treaty (ECT), agencies, International Renewable Energy Agency (IRENA) or policy networks, Renewable Energy & Energy Efficiency Partnership (REEEP). The course introduces students to the global dimensions of energy policy; discusses shifting agendas; and assesses the institutional spectrum of global energy governance. This course already exists online.

425.646 US Offshore Energy: Policy, Science and Technology (4 credit hour)
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. First online offering will be in Spring 2017.

Relevant Courses from Other Environmental Programs

420.614 Environmental Policymaking and Policy Analysis (4 credit hour)
This course provides students with a broad introduction to U.S. environmental policymaking and policy analysis. Included are a historical perspective as well as an analysis of future policymaking strategies. Students examine the political and legal framework, become familiar with precedent-setting statutes such as NEPA , RCRA , and the Clean Air and Clean Water Acts, and study models for environmental policy analysis. Cost benefit studies, the limits of science in policymaking, and the impact of environmental policies on society are important aspects of the course. A comparison of national and international policymaking is designed to provide students with the global perspective on environmental policy. This course already exists online.

420.645 Environmental Consequences of Conventional Energy Generation (4 credit hour)
This course will investigate the environmental consequences of conventional energy resources of the world and future prospects for protecting the environment while generating energy in a more sustainable way. Specifically, this course will focus on the historical and future role of conventional energy sources and the consequences of their extraction which will invite comparisons to more recent trends in energy generation. Students will be introduced to the nexus of social, technical, engineering and environmental challenges of providing sustainable energy supplies to an increasingly urban and technologically connected global population. Topics include petroleum, traditional natural gas, coal, nuclear, hydroelectric, and geothermal supplies as well as recent trends in shale hydrologic fracturing methods of obtaining petroleum resources. Global production, distribution, usage and impacts of these resources will be discussed. First online offering will be in Spring 2017.

420.651 Risk Assessment and Risk Management (4 credit hour)
Analysis of risk is becoming an increasingly important component of regulatory decision making. Based on the premise that risk assessment has no "right" answers, this course explores what risk perception, risk management, and risk communication mean. Students are introduced to terminology and concepts necessary in risk communication. Case studies help to explain the complexities of risk assessment and management. Students learn how to balance the costs and benefits of risk reduction and how to account for the uncertainties in risk estimates. Offered online or onsite, annually. Prerequisite: 420.614 Environmental Policymaking and Policy Analysis, equivalent course, or experience. This course already exists online.

420.665 Climate Change on the Front Lines: The Study of Adaptation in Developing Countries (4 credit hour)
Poor and developing countries are predicted to bear the brunt of climate change. This course will focus on key sectors such as agriculture, forestry, biodiversity, water resources, human health, and tourism and the ways in which poorer and developing counties are impacted by and adapting to climate change. This course may focus on a region or a specific country depending on the instructor. Assessment and evaluation of demographic trends, environmental challenges such as retreating ice, potential flood hazards, ecosystem impacts, as well as health issues will be incorporated. International instruments such as adaptation funds, carbon funds, clean development mechanisms, and reduced deforestation/degradation strategies and policies will be investigated in a comparative analysis of impacts and adaptation responses of countries around the world. This course already exists online.

430.601 Geographic Information Systems (GIS) (4 credit hour)
In this introductory course, students become familiar with the concepts and gain the experience necessary to appreciate the utility of Geographic Information Systems in decision-making. Topics covered include the fundamentals of data structures, geo-referencing, data classification, querying, cartography, and basic spatial data analysis. The course provides an overview of the capabilities of GIS software and applications of GIS. Class time is divided between lectures and GIS exercises that reinforce critical concepts. Students must complete a term project as part of the course. This course already exists online.

430.602 Remote Sensing: Earth Observing Systems and Applications (4 credit hour)
This course introduces remote sensing as an important technology to further our understanding of Earth's land, atmospheric, and oceanic processes. Students study remote sensing science, techniques, and satellite technologies to become familiar with the types of information that can be obtained and how this information can be applied in the natural and social sciences. Applications include assessment of land cover and land use, mapping and analysis of natural resources, weather and climate studies, pollution detection and monitoring, disaster monitoring, and identification of oceanographic features. This course already exists online.

430.603 Geospatial Data Modeling (4 credit hour)
This course moves beyond the fundamentals of GIS to explore the constraints surrounding data modeling as well as the methods to model spatial data. Students review current research in the field, learn relevant modeling techniques, and utilize advanced software tools for analysis. The course focuses on various kinds of spatial data, how it is collected, handled, processed, and analyzed through GIS technologies. As the term progresses, students deal extensively with different types of data presentations and the manipulation of those data in GIS models. Students develop a significant GIS project over the course of the semester and present their findings at the end. This course already exists online.

470.773 Energy and Environmental Security (4 credit hour)
This course surveys the multiple and overlapping aspects of energy and environmental security. Students analyze the contentious proposition that increased competition for environmental and energy resources threaten national security and may be the source of future wars across the globe. The course also examines how such threats may be mitigated. This course already exists online.

Appendix B

Evidence of Compliance with the Principles of Good Practice (as outlined in COMAR 13B02.03.22C)

(a) Curriculum and Instruction

(i) A distance education program shall be established and overseen by qualified faculty.

This proposal for an online option for the M.S. in Energy Policy and Climate is being submitted as part of a cluster of Environmental Programs in Johns Hopkins's Advanced Academic Programs (JHU-AAP), which already has well-established online program in the existing M.S. in Environmental Sciences and Policy and the M.S. and Certificate in Geographical Information Systems Programs with highly-regarded and capable faculty. Most of the faculty teaching in the existing onsite degree program will also serve as instructors in the online program. Any new instructors recruited to teach in the online M.S. program would be required to meet the same qualifications as those teaching in other master's degree programs in JHU-AAP, including completion of an orientation to online teaching.

(ii) A program's curriculum shall be coherent, cohesive, and comparable in academic rigor to programs offered in traditional instructional formats.

The curriculum for the online program has been designed in consultation with experts in the field to ensure its coherence and cohesiveness. All the courses in the online program will be as rigorous as any course offered in JHU-AAP in traditional instructional formats. The courses will follow the same rigor that has been applied to the online courses of the other highly successful online JHU-AAP degree programs. A formal online course development process is used to support online course development. The online course development process is overseen by the Instructional Resource Center within AAP, an academic support unit consisting of instructional technologists, trainers, and instructional designers. The process incorporates the Quality Matters™ research-based set of eight standards for quality online course design to ensure the academic rigor of the online course is comparable or better to the traditionally offered course.

(iii) A program shall result in learning outcomes appropriate to the rigor and breadth of the program.

Upon completion of the M.S. in Energy Policy and Climate, students will:

- Acquire expertise through coursework and the capstone process in one or more areas of Energy Policy and Climate, such as energy technology (fossil-fuel based or renewables), energy law and policy, climate change and its societal and environmental impacts (adaptation and mitigation), national and international climate change policy, energy and climate finance;

- Critically analyze and evaluate existing and proposed models, strategies, and policies, from a variety of sources, both academic and nonacademic;
- Develop excellent oral and written communication skills that will enhance career objectives in public sector, non-profit and/or private organizations; and
- Demonstrate proficiency with qualitative or quantitative research methodologies and exhibit critical thinking skills in important academic or public policy areas through the completion of a capstone project.

(iv) A program shall provide for appropriate real-time or delayed interaction between faculty and students.

The online M.S. in Energy Policy and Climate will be delivered using Blackboard, JHU's course management system. This platform supports asynchronous interaction between faculty and students. Students and faculty also have the option to participate in real-time interaction through weekly web-conference office hours, supported by Adobe Connect.

(v) Faculty members in appropriate disciplines in collaboration with other institutional personnel shall participate in the design of courses offered through a distance education program.

The program has established a process for identifying the appropriate faculty to design an online course. All the faculty are selected based on discipline expertise, professional and teaching experience and completion of an online course development training course.

(b) Role and mission

(i) A distance education program shall be consistent with the institution's mission.

See section A.1 of this proposal.

(ii) Review and approval processes shall ensure the appropriateness of the technology being used to meet a program's objectives.

All the courses in the program are designed with the support of an instructional designer, instructional technologists, and multimedia specialists. The instructional designer and multimedia specialists serve as instructional technology consultants to assist in identifying and recommending the most effective learning technologies for accomplishing the course's learning objectives. The course instructor and instructional designer identify all of the learning components of the course, and how the course will be facilitated to achieve the most optimal learning outcome for the students. This is an iterative process whereby the course goes through several levels of review prior to the course actually being developed. Once the course is complete, it undergoes external review using Quality Matters™ online course pedagogic quality criteria. When the course launches (goes live), the design team continually monitors it, and consults with the instructors to make adjustments to the course, if needed. All new online courses

participate in a mid-term and end-of-term course evaluation process. The mid-term feedback is used to determine if any mid-point term corrections are needed. And the end-of-term evaluation is used to assess whether further course refinements are needed prior to the next time the course is offered.

(c) Faculty support

(i) An institution shall provide for training for faculty who teach with the use of technology in a distance education format, including training in the learning management system and the pedagogy of distance education.

Faculty in this online program are supported by JHU-AAP's Instructional Resource Center (IRC), the AAP Director of Faculty and Student Services, as well as the Program Director and Associate Director. The IRC provides oversight for all online course developments, including faculty training and development. The IRC has a formal, structured faculty development approach for preparing faculty to develop and teach an online course. All faculty are required to complete at least three Blackboard training sessions and a course in the use of Adobe Connect. These training sessions provide an overview of online learning pedagogy and introduce the faculty to some of the technologies they will be using to develop their online courses. Faculty may also sign up for one-on-one training sessions with staff of the IRC, attend faculty development sessions provided by the Office of Faculty and Student Services, and consult with the faculty in the other environmental courses for additional pedagogical or technical support. A third-party help desk as well as internal help desk consultants also assist in faculty technical support.

(ii) Principles of best practice for teaching in a distance education format shall be developed and maintained by the faculty.

The IRC offers training on how to be an effective online instructor based on best practices from research and other related sources. All new online instructors are required to participate in this training prior to teaching their first online course.

(iii) An institution shall provide faculty support services specifically related to teaching through a distance education format.

The IRC provides a wide range of faculty support services for faculty engaged in online instruction. Faculty have access to multimedia specialists, instructional designers, technical trainers, and a 24/7 technical help desk to provide the necessary support required to effectively deliver distance education programs. In addition, JHU-AAP offers faculty development training opportunities in online pedagogy and new instructional technologies throughout the year specifically designed for online instructors.

(d) An institution shall ensure that appropriate learning resources are available to students including appropriate and adequate library services and resources.

The students will have online access to the Milton S. Eisenhower Library, ranked as one of the nation's foremost facilities for research and scholarship. Its collection of 3.7 million bound volumes, 121,000+ print and e-journals, and 985,000+ e-books support the university's academic and research enterprise. The interlibrary loan department makes the research collection of the nation available to faculty and students. The library provides easy access to a wide selection of electronic information resources, including the library's online catalog, and numerous electronic abstracting and indexing tools. These databases are accessible remotely. Librarians help students electronically and the library maintains an extensive web site to take visitors through all of its services and materials. Online chats and other services are available to distance students as is mail-service of hard-copy only materials.

(e) Students and student services

(i) A distance education program shall provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.

JHU-AAP maintains numerous web-based resources to inform prospective students about the information they may need as an online student. These resources include the JHU-AAP website at http://advanced.jhu.edu and the JHU-AAP online catalog, which includes detailed programmatic information, academic support services, financial aid, costs, policies, and specific information for online learning. As new online students are admitted and enrolled, they receive timely emails with important information to help them prepare to become an online student. These emails include information on how to create their JHU log-in account for the course management systems, technical requirements, available academic support services and new online student orientation course.

(ii) Enrolled students shall have reasonable and adequate access to the range of student services to support their distance education activities.

JHU-AAP online students have access to the following academic support services:

- *Academic advising.* Students are assigned an advisor when admitted. Students work individually with the advisor to develop a course of study that meets the requirements of the program and the career goals of the student. The advisor contacts all the students each semester to check on progress and answer questions. Courses that deviate from the program plan and have not been approved by an advisor may not count toward degree requirements.

- *Library services.* Students have online access to the Milton S. Eisenhower Library, ranked as one of the nation's foremost facilities for research and scholarship. The interlibrary loan department allows students access to resources at any other university in the nation. The library provides easy access to a wide selection of electronic information resources, including the library's online catalog, and numerous electronic abstracting and indexing tools. Many of the databases are accessible remotely. Librarians are available to assist students remotely and the library maintains an extensive web site to take visitors through all its services and materials.

- *Services for students with disabilities.* The Johns Hopkins University is committed to making all academic programs, support services, and facilities accessible to qualified individuals. Students with disabilities who require reasonable accommodations can contact the AAP Disability Services Administrator, aapdisability@jhu.edu .

- *Transcript access.* Official transcripts will be mailed upon written request of the student at no charge.

- *Student ID JCard.* The JCard serves as the student's university identification card. This card is mailed to the home address of every registered student. The JCard acts as the university library card and provides access to student software discounts where available.

(iii) Accepted students shall have the background, knowledge, and technical skills needed to undertake a distance education program.

Prior to admission into an online program, prospective students are invited to "test drive" a course to determine if the online learning environmental is suitable to their learning style. Accepted online students must meet the admissions requirements of graduate students in JHU-AAP and the specific requirements of the M.S. program. New online students are required to complete the "New Online Student Orientation" course prior to beginning their first online course. This course covers a broad range of topics on how to be a successful online student such as, Blackboard basics, online student learning expectations, how to access the library, how to conduct online research, and how to participate in online discussions.

(iv) Advertising, recruiting, and admissions materials shall clearly and accurately represent the program and the services available.

All relevant program information is keep up to date on the JHU-AAP web site.

(f) Commitment to support

(i) Policies for faculty evaluation shall include appropriate consideration of teaching and scholarly activities related to distance education programs.

Faculty teaching online courses are strongly encouraged to participate in at least one to two professional development opportunities annually to improve their online teaching skills. They are also encouraged to embrace the scholarship of teaching relevant to online instruction.

(ii) An institution shall demonstrate a commitment to ongoing support, both financial and technical, and to continuation of a program for a period sufficient to enable students to complete a degree or certificate.

Advanced Academic Programs has a commitment to online teaching as demonstrated by the resources in its Instructional Resource Center that provide course development, instructional, and technical support to new and current faculty. Refer also to Appendix D.

(g) Evaluation and assessment

(i) An institution shall evaluate a distance education program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.

Online courses are highly structured with clear Learning Objectives outlined for the course and each module of the course. Student assessments are structured to achieve these Learning Objectives through varied and frequent assessments including participation in Discussion Boards, problem sets, short papers and reports, and longer synthetic papers and presentations. Most EPC courses are brand new courses being developed online using the most up to date technological and pedagogical standards and under the guidance of JHU-AAP's Instructional Resource Center.

JHU-AAP has an online student course evaluation process that is completed at the midterm of each semester and after the offering of each course. This process will be applied to the proposed M.S. in Energy Policy and Climate online program. This evaluation includes student reviews of the faculty for each course offered. Each semester the director for the program evaluates the course offerings and faculty performances based on these reviews. On an annual basis, the curriculum will be reviewed by the program chair, director, faculty, and administrators as appropriate to determine if new topics need to be covered or other changes made following JHU-AAP procedures for such review. Formal processes for academic program review of AAP graduate programs are also in place.

(ii) An institution shall demonstrate an evidence-based approach to best online teaching practices.

The JHU-AAP Instructional Resource Center, which offers instructional design and faculty support staff, continually participates in professional development activities to keep abreast of evidence-based approaches to online teaching practices. These online teaching practices are then incorporated into the new online instructor training sessions.

(iii) An institution shall provide for assessment and documentation of student achievement of learning outcomes in a distance education program.

As part of the online course design process in JHU-AAP, course assessments are required to be aligned with stated course learning outcomes. The new online program option for the M.S. in Energy Policy and Climate proposed here will incorporate authentic-based learning assessments that demonstrate student's application of learned concepts.

Appendix C

Faculty

Thomas Haine, Ph.D. (full-time), Program Chair, Morton K. Blaustein Chair and Professor, Department of Earth and Planetary Sciences. Dr. Haine is a well-known scholar on ocean circulation and the ocean's role in climate, and his research focuses on improving estimates of the geophysical state of the ocean circulation through analysis of field data and circulation model results, particularly in high latitude oceans. He provides overall guidance and academic oversight for the proposed degree program.

Antoinette WinklerPrins, Ph.D. (full-time), Director for Environmental Programs in JHU's Advanced Academic Programs. In addition to the EPC program she oversees the MS in Environmental Sciences and Policy (ESP) program, and the MS and Certificate Programs in Geographical Information Systems (GIS). She is a geographer known for her work on issues of environmental knowledge and agricultural management systems, livelihoods, and anthropogenic soils, having spent ten years in the faculty of Michigan State University and three years as a program officer at the National Science Foundation. At Michigan State she was a pioneer in online education with an award-winning course on world regional geography. She teaches online, onsite, and field-based courses in agriculture and food systems, climate change adaptation, and sustainability science.

Dan S. Zachary, Ph.D. (full-time), Associate Director of the M.S. in Energy Policy and Climate Program. Dan's research has focused on mathematical and physical modelling for policy support, geo-statistics, earth-atmosphere systems (connections with anthropogenic emissions), global energy sustainability and general (statistical) forecasting methods. He has developed a forecasting method with colleagues from Australia (University of South Australia and Finders University) for global oscillations (El Niño) and recently has re-developed the technique for short term air pollution forecasting to be used with ground, airborne and space measurements. Dan has taught at the University of Geneva, American University at Sharjah, and Embry-Riddle Aeronautical University (Luxembourg). He teaches the online version of the core course, Principles and Applications of Energy Technology, Wind Energy: Science, Technology and Policy (onsite and online), and the Capstone for Energy Policy and Climate (onsite and online).

Jerry L. Burgess, Ph.D. (full-time), Associate Program Director of the M.S. in Environmental Sciences and Policy Program. Jerry received his doctorate in ecology from Johns Hopkins University and has highly interdisciplinary research interests cross the disciplines of biology, ecology, geology and soil science to explore community dynamics and invasive ecology in urban, rural and forested landscapes. Originally from the South, he became interested in the natural sciences after traveling into coalmines with his father. Trained as a metamorphic and structural petrologist, in his early research he has used petrologic and geochemical tools to investigate igneous and metamorphic rocks and relate their petrogenesis to the growth and evolution the Canadian Appalachians. He has spent time in two professional spheres: one as an educator where he served as the STEM science chair in various school systems; and the other as a scientist involved in understanding environmental

issues such as soil and groundwater remediation. As an educator, his topics of focus include bringing research results into teaching and learning and inculcating inquiry based learning into a broader use in the geosciences and public school settings. Recently he has become engaged in the structure and dynamics of geo-ecosystems. In particular, seeking to understand the edaphic relationship between geologic substrate, soils and plants using a complimentary suite of approaches that integrate field observations with novel techniques (e.g. stable isotopes) and controlled environmental systems (e.g. growth chambers, greenhouse settings) to address questions that intersect plant physiological ecology, soil ecology and geology in an ecosystem context. Jerry teaches online and onsite core courses on ecology and geology in the ESP program as well as an elective on the environmental consequences of conventional energy production.

Daniel Barrie, Ph.D. (adjunct) is a program manager in National Oceanic and Atmospheric Administration's (NOAA's) Climate Program Office (CPO), part of the Office of Oceanic and Atmospheric Research, one of NOAA's six line offices. Within CPO, he co-manages the Modeling, Analysis, Predictions, and Projections (MAPP) program, which focuses on model development, improvements to predictions and projections of climate conditions, and analysis of the climate system toward improved modeling and predictions. He teaches the core course on the Science of Climate Change and its Impacts and will be teaching a new course on climate change modelling. He has taught primarily onsite but will be teaching the core course online.

Austin Brown, Ph.D. (adjunct) is a senior analyst for strategic planning in the Washington, DC office of the National Renewable Energy Laboratory (NREL). He leads analysis projects informing the portfolio and strategic direction of the US DOE's office of Energy Efficiency and Renewable Energy (EERE). His work focuses on clean transportation, including efficient and electrified vehicles, renewable fuels, and transportation system interactions with the built environment. He teaches a popular elective course, Transportation Policy in a Carbon Constrained World. He teaches this course onsite and is developing it in an online format.

Véronique Bugnion, Ph.D. (adjunct) is a co-founder and CEO of ClearlyEnergy, a provider of innovative search solutions to simplify energy decisions. Prior to ClearlyEnergy, Véronique was Global Head of Carbon and Natural Gas for Thomson Reuters, a role where she developed trading, data and research products for wholesale commodity markets. Thomson Reuters acquired Point Carbon in 2010, where Véronique held the role of Global Head of Trading Analytics, with responsibilities for developing advanced web-based analytic products for the electricity, natural gas and carbon markets. Prior to working with Thomson Reuters and Point Carbon, Véronique worked with Goldman Sachs and Constellation Commodities Group where she focused on the deregulated power, natural gas and emissions markets. She teaches the core course on Energy and Climate Finance.

Amardeep Dhanju, Ph.D. (adjunct) is a senior policy analyst with the Bureau of Ocean Energy Management (BOEM)/Avanti, where he is coordinating the National Ocean Policy initiative. Amardeep also co-chairs the Marine Planning Implementation subgroup created by the National Ocean Council (NOC) to coordinate regional ocean planning across the US. In addition, Amardeep provides support on various international initiatives at BOEM towards managing offshore energy and mineral resources in an environmentally responsive manner. He teaches a new elective on US Offshore Energy: Policy, Science and technology. He has taught the course onsite and is developing it in an online format.

Craig Hart, Ph.D. (adjunct) is an Associate Professor at the School of Environment and Natural Resources at People's University of China in Beijing conducts research on energy efficiency, renewable energy technologies, forest carbon sequestration, and carbon capture and storage technologies. He is also an attorney practicing in the fields of project finance, carbon management and capital markets. He has lived and worked in the United States, Middle East and Asia, representing project developers, banks and investors in energy and infrastructure project finance, carbon finance, and private and public offerings of debt and equity. He teaches the core course on Energy and Climate Finance in an online format.

Miriam Heller, Ph.D. (adjunct) is the Principal of MHITech Systems which provides systems analysis and consulting services that draw on 25 years of experience applying systems thinking to design, modeling, and multi-criteria decision and risk analysis of sustainable, often complex, infrastructure and process and discrete manufacturing. Her recent and current sustainability-related work addresses adapting infrastructure for climate change, sustainable information and communication technology metrics, uncertainty quantification, and sustainable engineering professional certification. Miriam's professional experiences span academia (University of Southern California's director of information technology research advancement; University of Houston Industrial Engineering faculty), private sector (Digital Equipment Corp.; Citibank Credit Services), NGOs (World Resources Institute), and public sector (Office of Technology Assessment; National Science Foundation). She teaches an elective course on Cities and Climate Change. She has taught the course onsite and is developing it in an online format.

Thomas Jenkin, DPhil. (adjunct) is Senior Energy Analyst at the National Renewable Energy Laboratory (NREL) and is based in DC. He works on a range of energy-related activities including better understanding the value of R&D and existing and future energy technologies, including the potential role of electricity storage and infrastructure issues. Prior to joining NREL in 2004, Thomas spent 10 years working in strategic and economic consulting to the energy industry, with a focus on the electric and natural gas sectors. He teaches the core course on the Principles and Applications of Energy Technology as well as an advanced elective, Principles and Applications of Energy Technology II. Dr. Jenkin was one of the founding members of the EPC faculty.

Robert Means, J.D. (adjunct) is a is an expert in energy policy and regulation, with more than thirty years of experience in dealing with energy issues as an academic, consultant, and regulator. Bob has advised clients on regulatory issues and served as an expert witness in more than ninety proceedings before the courts and before federal and state regulatory agencies in the United States and the National Energy Board of Canada. Issues analyzed in his testimony have included access to transportation, market power, and the proper determination of rates for electric utilities and natural gas and oil pipelines. The US Federal Energy Regulatory Commission relied on his testimony and analysis in adopting its current rate making methodology for oil pipelines. Bob also serves as an electricity advisor for the State Department's Iraq desk and is responsible for monitoring the development of the Iraq's electricity system and for assessing policy options relating to that development. He has served as chief of party or member for teams advising governments in South and Southeast Asia, the Middle East, and Latin America on issues of energy policy and regulation. He teaches the core course on Climate Change Policy as well as electives on the U.S. electrical grid and renewable energy. Mr. Means was one of the founding members of the EPC faculty. He has taught onsite but will be teaching the core course in an online format.

Thomas Peterson, M.B.A. (adjunct) is the founder of The Center for Climate Strategies (CCS), a consulting group that assists governments and stakeholders with comprehensive climate change strategy development, implementation and consensus building. CCS has led development of 24 state climate action plans, provided technical and policy support to over 44 U.S. states and four regions, and supported emerging work in the provinces of China, and the border states of Mexico. CCS has over 40 team members, with headquarters in Washington, D.C. and partners in Beijing, China and Juarez, Mexico. CCS is widely recognized as the nation's premiere catalyst for sub national climate policy development, integration and analysis. He teaches a popular elective on Adaptation to Climate Change as well as a course on International Climate Change Policy. He has taught primarily onsite but hopes to develop his courses into online versions in the future.

Liam Phelan, Ph.D. (adjunct) is a geographer with research interests in transdisciplinary research methodologies, complex adaptive systems, political economy, Earth system thresholds and governance, resilience, climate change, and insurance. He is well known for his research on higher education, particularly online teaching and learning and is a Senior Lecturer and Online Teaching and Learning Coordinator with Grad School at the University of Newcastle in Australia. He teaches a popular elective on Global Energy Policy. He teaches exclusively in the online environment.

Deborah Sunter, Ph.D. (adjunct) is an AAAS Science and Technology Policy Fellow at the Department of Energy, Advanced Manufacturing Office. Her current interests include renewable energy systems, advanced manufacturing techniques, and the interaction of science and policy in academia, industry and government. She specializes in the computational modeling of thermo-physics in multiphase systems, and she has developed a novel solar absorber tube. The need for a global environmental solution led her to do research abroad in both Japan and China as well as in the U.S. She teaches a new elective on Solar Energy: Science, Technology and Policy. She has taught the course onsite and is developing it in an online format.

Appendix D

Finance Information

TABLE 1: RESOURCES					
Resources Category	**2015**	**2016**	**2017**	**2018**	**2019**
1. Reallocated Funds	-	-	-	-	-
2. Tuition/Fee Revenue (c + g below)	$645,000	$797,220	$957,993	$1,127,694	$1,306,716
a. Number of F/T Students	-	-	-	-	-
b. Annual Tuition/Fee Rate	-	-	-	-	-
c. Total F/T Revenue (a x b)	-	-	-	-	-
d. Number of P/T Students	25	30	35	40	45
e. Credit Hour Rate	$1,075	$1,107	$1,140	$1,175	$1,210
f. Annual Credit Hours per Student	24	24	24	24	24
g. Total P/T Revenue (d x e x f)	$645,000	$ 797,220	$ 957,993	$ 1,127,694	$ 1,306,716
3. Grants, Contracts & Other External	-	-	-	-	-
4. Other Sources	-	-	-	-	-
TOTAL (Add 1 – 4)	**$645,000**	**$797,220**	**$957,993**	**$1,127,694**	**$1,306,716**

Resources narrative:

1. Reallocated Funds: The proposed program will be funded by tuition revenue and will make no use of reallocated funds.

2. Tuition and Fee Revenue: Tuition revenue is based on the number of students multiplied by the credit hour rated times annual credit hours per student. Credit hour rate is based on 4 credit hour equivalents per course. Figures calculated using a 3% growth rate,

3. Grants and Contracts: No grants or contacts are required for the successful implementation of the program.

4. Other Sources: The program does not expect any funding from other sources.

TABLE 2: EXPENDITURES:					
Expenditure Categories	**2015**	**2016**	**2017**	**2018**	**2019**
1. Faculty (b + c below)	$76,260	$77,358	$120,958	$122,387	$123,552
a. # Sections offered	–	–	–	–	–
b. Total Salary	$60,600	$61,416	$101,848	$102,697	$103,563
c. Total Benefits	$15,660	$15,942	$19,110	$19,690	$19,988
2. Admin. Staff (b + c below)	–	–	–	–	–
a. # FTE	–	–	–	–	–
b. Total Salary	–	–	–	–	–
c. Total Benefits	–	–	–	–	–
3. Support Staff (b+c below)	–	–	–	–	–
a. # FTE	–	–	–	–	–
b. Total Salary	–	–	–	–	–
c. Total Benefits	–	–	–	–	–
4. Equipment	3100	3200	3400	3400	4500
5. Library	–	–	–	–	–
6. New or Renovated Space	–	–	–	–	–
7. Other Expenses	$2,000	$2,000	$2,000	$2,000	$2,000
TOTAL (Add 1 – 7)	**$159,635**	**$161,931**	**$249,333**	**$252,192**	**$255,622**

Expenditures narrative:

1. Faculty: Includes 50% Zachary and 1 Adjunct per term in years 1 and 2, 2 Adjuncts in years 3-5.

2. Administrative Staff: No new staff expected.

3. Support Staff: No new staff expected

4. Equipment: Funds included for possible field course expenses.

5. Library: Currently sufficient.

6. New or Renovated Space: Currently sufficient.

7. Other Expenses: Additional funds for marketing and promotion of new program plus items related to launch, including increased conference attendance for Associate Program Director to promote new program.