Course information:
Copy and paste current course information from Class Search/Course Catalog.

Academic Unit: School of Geographical Science and Urban Planning
Department: ________________

Subject: GCU  Number: 364  Title: Energy in the Global Arena  Units: 3

Is this a cross-listed course? (Choose one) No
If yes, please identify course(s): 

Is this a shared course? No  If so, list all academic units offering this course:

Course description:
Energy in the Global Arena
Production, transportation, and consumption of energy, emphasizing the electric power industry and its environmental problems.
Allow multiple enrollments: No
Repeatable for credit: No  Primary course component: Lecture
Grading method: Student Option
Offered by: College of Liberal Arts and Sciences -- School of Geographical Sciences and Urban Planning

Requested designation: (Choose One) S/L
Note - a separate proposal is required for each designation requested

Eligibility:
Permanent numbered courses must have completed the university’s review and approval process.
For the rules governing approval of omnibus courses, contact the General Studies Program Office at (480) 965-0739.

Area(s) proposed course will serve:
A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study.

Checklists for general studies designations:
Complete and attach the appropriate checklist
- Literacy and Critical Inquiry core courses (L)
- Mathematics core courses (MA)
- Computer/statistics/quantitative applications core courses (CS)
- Humanities, Fine Arts and Design core courses (HU)
- Social and Behavioral Sciences core courses (SB)
- Natural Sciences core courses (SO/SG)
- Global Awareness courses (G)
- Historical Awareness courses (H)
- Cultural Diversity in the United States courses (C)

A complete proposal should include:
☒ Signed General Studies Program Course Proposal Cover Form
☒ Criteria Checklist for the area
☒ Course Syllabus
☒ Table of Contents from the textbook and list of required readings/books

Contact information:
Name: Mike Pasqualetti  Phone: 54548
Mail code: 5302  E-mail: pasqualetti@asu.edu

Department Chair/Director approval: (Required)
Chair/Director name (Typed): Elizabeth Wentz  Date: 2/3/14
Rev. 1/94, 4/95, 7/98, 4/00, 1/02, 10/08, 11/11/12/11, 7/12
Arizona State University Criteria Checklist for

SOCIAL AND BEHAVIORAL SCIENCES [SB]

Rationale and Objectives

The importance of the social and behavioral sciences is evident in both the increasing number of scientific inquiries into human behavior and the amount of attention paid to those inquiries. In both private and public sectors people rely on social scientific findings to assess the social consequences of large-scale economic, technological, scientific, and cultural changes.

Social scientists' observations about human behavior and their unique perspectives on human events make an important contribution to civic dialogue. Today, those insights are particularly crucial due to the growing economic and political interdependence among nations.

Courses proposed for General Studies designation in the Social and Behavioral Sciences area must demonstrate emphases on: (1) social scientific theories and principles, (2) the methods used to acquire knowledge about cultural or social events and processes, and (3) the impact of social scientific understanding on the world.
Proposer: Please complete the following section and attach appropriate documentation.

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>Identify Documentation Submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒</td>
<td>☐</td>
<td>1. Course is designed to advance basic understanding and knowledge about human interaction.</td>
</tr>
<tr>
<td>☒</td>
<td>☐</td>
<td>2. Course content emphasizes the study of social behavior such as that found in:</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>• ANTHROPOLOGY</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>• ECONOMICS</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>• CULTURAL GEOGRAPHY</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>• HISTORY</td>
</tr>
<tr>
<td>☒</td>
<td>☐</td>
<td>3. Course emphasizes:</td>
</tr>
<tr>
<td></td>
<td>☐</td>
<td>a. the distinct knowledge base of the social and behavioral sciences (e.g., sociological anthropological).</td>
</tr>
<tr>
<td></td>
<td>☒</td>
<td>b. the distinct methods of inquiry of the social and behavioral sciences (e.g., ethnography, historical analysis).</td>
</tr>
<tr>
<td>☒</td>
<td>☐</td>
<td>4. Course illustrates use of social and behavioral science perspectives and data.</td>
</tr>
</tbody>
</table>

THE FOLLOWING TYPES OF COURSES ARE EXCLUDED FROM THE [SB] AREA EVEN THOUGH THEY MIGHT GIVE SOME CONSIDERATION TO SOCIAL AND BEHAVIORAL SCIENCE CONCERNS:

- Courses with primarily fine arts, humanities, literary, or philosophical content.
- Courses with primarily natural or physical science content.
- Courses with predominantly applied orientation for professional skills or training purposes.
- Courses emphasizing primarily oral, quantitative, or written skills.
Explain in detail which student activities correspond to the specific designation criteria. Please use the following organizer to explain how the criteria are being met.

<table>
<thead>
<tr>
<th>Criteria (from checksheet)</th>
<th>How course meets spirit (contextualize specific examples in next column)</th>
<th>Please provide detailed evidence of how course meets criteria (i.e., where in syllabus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. human interactions</td>
<td>the most important interactions involve energy resource availability</td>
<td>see color-coded syllabus</td>
</tr>
<tr>
<td>2. social behavior found in geography, etc.</td>
<td>cultural geography is one of the social sciences</td>
<td>see color-coded syllabus</td>
</tr>
<tr>
<td>3. knowledge base and/or methods</td>
<td>key methods and knowledge specific to geography are stressed throughout</td>
<td>location, distribution, transport, environmental costs are stressed throughout.</td>
</tr>
<tr>
<td>4. sb science or perspectives</td>
<td>energy is considered as a social issue with the technical component rather than the other way around</td>
<td></td>
</tr>
</tbody>
</table>
INTRODUCTION

Energy is the most important natural resource. The location, processing, distribution, use and impacts of all energy resources are of strong professional interest to geographers, and geographers are employed in all phases of energy supply and demand.

While location of supply and demand is important, geographers are also involved in the spatial analysis of locating hazardous or obnoxious facilities, the sources and dispersal of pollution, land use conflicts from energy development, and the movements of people in response to energy influences.

Energy in the Global Arena examines all the principal energy resources, with particular attention to the interplay of geopolitics, environment, and economics in meeting energy demands around the world.
INTERNET
The internet will be used extensively for a variety of course materials and assignments. You can access the internet materials on BlackBoard. You are responsible for what is on that site.

EVALUATION
- Class attendance is essential and participation is expected.
- Grades will be based on a 400 point minimum
  - Two 100 point tests (some questions from these exams will also appear on the final)
  - Cumulative 200-point final
- There are very strict policies in place prohibiting make-up tests
- Tests will be based on lecture, readings, assignments, maps and power point presentations, and reviews
- Tests are scored on a point-only basis, with no letter grades given until the final grade. Plus and minus grades will be given.

Academic honesty – Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see http://provost.asu.edu/academicintegrity.

Special note on plagiarism: If you submit work that is not your own, you will be fully disciplined in accordance with university policies. Plagiarism or cheating in any form will not be tolerated. It is your responsibility to be aware of, understand, and adhere to the rules and regulations of Arizona State University. In the “Student Academic Integrity Policy” manual, ASU defines “Plagiarism” [as] using another's words, ideas, materials or work without properly acknowledging and documenting the source. Students are responsible for knowing the rules governing the use of another's work or materials and for acknowledging and documenting the source appropriately.” Academic dishonesty, including inappropriate collaboration, will not be tolerated. There are severe sanctions for cheating, plagiarizing and any other form of dishonesty. For further details, please consult http://provost.asu.edu/academicintegrity

General Studies Review Color Key to SB Criteria:
1. human interaction.
2. Course content emphasizes the study of social behavior such as that found in
   - ANTHROPOLOGY
   - ECONOMICS
   - CULTURAL GEOGRAPHY
· HISTORY
· LINGUISTICS
· POLITICAL SCIENCE
· SOCIAL PSYCHOLOGY
· SOCIOLOGY

3. Course emphasizes:
   a. the distinct knowledge base of the social and behavioral sciences (e.g., sociological anthropological).
   OR
   b. the distinct methods of inquiry of the social and behavioral sciences (e.g., ethnography, historical analysis).

4. Course illustrates use of social and behavioral science perspectives and data.

n.b. Those that satisfy more than one evenly are multi-colored
Required Books

- **Energy**
  - Author: Goldemberg
  - ISBN: 9780199812929
  - Price New: $16.95
  - Price Used: $12.75

- **Memories of a Meltdown**
  - Author: Makhzangi
  - ISBN: 9789774162619
  - Price New: $15.95
  - Price Used: $12.00

- **Global Energy Dilemmas**
  - Author: Bradshaw
  - ISBN: 978045650664
  - Price New: $26.95
  - Price Used: $20.25
  - Rental Used Price: $13.46

- **Crude World**
  - Author: Maass
  - ISBN: 9781400075454
  - Price New: $15.95
  - Price Used: $9.60
  - Rental Used Price: $7.97

Supporting (optional) Books

- **Politics of the Global Oil Industry**
  - Author: Falola
  - ISBN: 9780313351845
  - Price New: $25.00
  - Price Used: $18.75
  - Rental Used Price: $12.49

- **Untapped**
  - Author: Gazin
  - ISBN: 978015033726
  - Price New: $20.95
  - Price Used: $12.60
  - Rental Used Price: $10.46

- **New Great Game: Blood & Oil in Central Asia**
  - Author: Kleven
  - ISBN: 9780892147729
  - Price New: $15.00
  - Price Used: $11.25

- **Petrostate**
  - Author: Goldman
  - ISBN: 978195340730
  - Price New: $74.00
  - Price Used: $65.50

- **Renewable Revolution**
  - Author: Kamal
  - ISBN: 978149711951
  - Price New: $35.95
  - Price Used: $27.00
  - Rental Used Price: $17.95
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>January</strong></td>
<td><strong>INTRODUCTION</strong></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The geography of energy</td>
<td>Pasqualetti - <em>The Geography of Energy and the Wealth of the World</em> – on BlackBoard</td>
</tr>
<tr>
<td>16</td>
<td>Eco-City: Freiburg, City of the Future</td>
<td>Visiting expert: Bjoern Hagan, Assistant Research Professor, School of Geographical Sciences and Urban Planning</td>
</tr>
<tr>
<td>21</td>
<td>The history of energy</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>23</td>
<td>Energy and geopolitics</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>28</td>
<td>Global patterns of energy supply &amp; demand</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>30</td>
<td>Electricity generation and distribution</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td><strong>February</strong></td>
<td><strong>FOSSIL FUEL FUNDAMENTALS</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Coal and its legacy</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>6</td>
<td>FIRST EXAMINATION</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Oil in world trade</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maass – <em>Crude World: The Violent Twilight of Oil.</em> (Read as much as necessary to understand his principal arguments.)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>13</td>
<td>Oil (continued)</td>
<td>Lecture and power point Falola (optional)</td>
</tr>
<tr>
<td>18</td>
<td>Natural gas: fracking and a new abundance</td>
<td>Lecture and power point</td>
</tr>
</tbody>
</table>

**ENERGY REGIONS OF THE WORLD**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Lecture and power point</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>The Middle East: oil and instability</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Russia and the Caspian Basin: big reserves and big politics</td>
<td>Goldman (optional) Kleveman (optional)</td>
</tr>
<tr>
<td>27</td>
<td>China: supply, demand, and international implications</td>
<td></td>
</tr>
</tbody>
</table>

**March**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Lecture and power point Ghazvinian (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Africa: poverty, war, and the resource curse</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SECOND EXAMINATION</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>South America: an emerging player in our hemisphere</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>The North Sea: wealth, decline and possible consequences</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>The Arctic Basin: resource-rich and contentious</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>North America: the developing alliance</td>
<td>Pasqualetti – <em>The Alberta Oil Sands from Both Sides of the Border</em> – on BlackBoard</td>
</tr>
</tbody>
</table>
## NUCLEAR POWER

### April

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nuclear power: how it works and where it is</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>3</td>
<td>Nuclear power accidents and influence</td>
<td>Lecture and power point&lt;br&gt;Makhzangi – <em>Memories of a Meltdown</em>&lt;br&gt;Pasqualetti – <em>Landscape Permanence and Nuclear Warnings</em></td>
</tr>
</tbody>
</table>

## RENEWABLE ENERGY

### 8

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Algae or efficiency</td>
<td>Guest lecture&lt;br&gt;Kamal (optional)</td>
</tr>
<tr>
<td>10</td>
<td>Efficiency: big and overlooked</td>
<td>Jeff Barrie: “Kilowatt Ours” (video)</td>
</tr>
<tr>
<td>15</td>
<td>Hydropower: promise and shortcomings</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>17</td>
<td>Wind: quick growth and continued public push-back</td>
<td>Lecture and power point&lt;br&gt;Pasqualetti – <em>Wind Power Challenges and Opportunities on BlackBoard</em></td>
</tr>
<tr>
<td>22</td>
<td>Geothermal energy: where it is and how it can contribute?</td>
<td>Lecture and power point</td>
</tr>
<tr>
<td>24</td>
<td>Solar energy: the ultimate prize?</td>
<td>Lecture and power point</td>
</tr>
</tbody>
</table>

### GLOBAL ENERGY FUTURES

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>Solar energy</td>
<td>Lecture and power point</td>
</tr>
</tbody>
</table>

## May

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th><strong>Environmental costs and energy decisions</strong></th>
<th>Lecture and power point</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Review</td>
<td>Lecture</td>
</tr>
<tr>
<td>8</td>
<td><strong>FINAL EXAMINATION  7:30 - 9:20 AM (in SCOB 150)</strong></td>
<td></td>
</tr>
</tbody>
</table>
For the GS Committee regarding readings. For the texts, I allow them to read them at their own pace, as applicable to the topics being considered. I do not assign particular pages and I do not test for specific knowledge from these books. They are to read the entire book over the course of the semester to reinforce what I say in class. When specific readings are assigned, they are in the form of articles on BlackBoard. As for the recommended readings, they are identified in the syllabus as particularly pertinent to the topics being covered. I do that as a service to the students. I do not test for these books.
## Contents

**Figures, Tables, and Boxes**

| 2 |

**Acronyms**

| viii |

**Index**

| ix |

1 **Introduction**

| 1 |

2 **The Global Energy Dilemmas Nexus**

| 23 |

3 **Sustaining Affluence: Energy Dilemmas in High-Energy Societies**

| 80 |

4 **Legacies and Liberalization: Energy Dilemmas in the Post-Socialist States**

| 84 |

5 **Fueling Growth: Energy Dilemmas in the Emerging Economies**

| 120 |

6 **Energizing Development: Energy Dilemmas in the Developing World**

| 149 |

7 **Conclusions**

| 181 |

**Appendix: Country Classification**

| 194 |

**Bibliography**

| 197 |

**Index**

| 206 |
## CONTENTS

Preface: The Descent of the Whale .............................. 1

The Four Seasons of Chernobyl ................................

   Spring ............................................. 11
   Summer .......................................... 13
   Fall .............................................. 46
   Winter .......................................... 59

Moscow Queues ........................................... 72

81
“Damn it... The narrative argument that brings these stories together is persuasive, intelligent, and passionate.”
—The Christian Science Monitor

CRUDE
WORLD

THE VIOLENT
TWILIGHT OF OIL

PETER MAASS
CONTENTS

Introduction  3
1 Scarcity  9
2 Plunder  26
3 Rot  53
4 Contamination  81
5 Fear  101
6 Greed  120
7 Desire  136
8 Alienation  165
9 Empire  185
10 Mirage  199
Conclusion  217
Acknowledgments  227
Appendix A: World Crude Oil Reserves  231
Appendix B: U.S. Crude Oil Imports  232
Notes  233
Bibliography  259
Index  263
CONTENTS

LIST OF TABLES xi
LIST OF FIGURES xiii
PREFACE xv

1 Energy: The Basic Concepts 1

What are forces? 1
What is work? 1
What is energy? 2
Which are the common forces in nature? 2
What is friction? 5
How does one measure energy? 5
Can energy be created from nothing? 7
What is the First Law of Thermodynamics? 8

PART I HOW IS ENERGY USED TODAY? 11

2 Present Energy Use 11

How much energy do humans need to keep alive? 11
How much energy do humans need for other activities? 11
5 Renewables

What are renewables?
What is biomass?
What are hydroelectric plants?
What is wind energy?
What are photovoltaic panels?
What is solar thermal energy?
What is solar thermoelectricity?
What is wave energy?
What is tidal energy?
What is geothermal energy?
What is the potential of renewable energies?
How much land is needed to produce energy from renewables?
What are the prospects for increased use of renewables?

6 Nuclear Power

What is nuclear power?
Why has the growth of nuclear energy declined since 1985?
What are the problems of nuclear waste disposal?
What is the nuclear "renaissance"?
What is nuclear fusion?

PART III THE PROBLEMS OF THE PRESENT ENERGY SYSTEM

7 Exhaustion of Fossil Fuels and Energy Security

Are fossil fuels being exhausted?
What is the "peak oil debate"?
8 Environmental Problems 76

Why are environmental problems so important today? 76
Which are the local environmental problems? 78
What is urban air pollution? 78
What is indoor air pollution? 79
Which are the regional environmental problems? 82
What is acid rain? 82
Which are the global environmental problems? 83
What is the greenhouse gas effect? 84
What is the connection between global warming and energy? 86
What is the Intergovernmental Panel on Climate Change? 88
What are the facts concerning climate change? 88
What are forecasts of climate models? 89
What are the environmental impacts from renewable sources? 90
What are the impacts of hydroelectricity plants? 91
How serious are oil leakages and spills? 92
Is deforestation caused by energy use? 93
What is the ecological footprint? 95

9 Energy Costs 97

What are the costs of energy? 97
What are externalities? 98
What are “learning curves”? 100
How large are energy subsidies? 101

10 Energy Efficiency 105

What are the existing technical solutions to the present energy system? 105
What is the potential of energy efficiency? 105
What are the advantages of energy efficiency? 106
What are the barriers to energy efficiency? 107
What is the potential for energy efficiency in power production? 108
What is the potential of energy efficiency in buildings? 109
How can we increase energy efficiency in buildings? 111
What is building retrofitting? 112
What is the impact of urbanization on energy use? 113
What is the energy efficiency potential in industry? 114
What is the energy efficiency potential in transportation? 115
What is the “rebound” effect? 117

11 New Technologies 119

What is cogeneration? 119
What is the role of new technologies for fossil fuels? 120
What is Carbon Capture and Storage? 121
What is the future of transportation? 123
Are natural gas, liquefied petroleum gas, and hydrogen alternatives for transportation? 123
Are electrically powered vehicles feasible? 124
What are fuel cells? 125
How much progress is being made in battery storage? 126
What is the role of energy storage? 127
What is the role of long-distance electricity transmission? 128
x Contents

What are smart grids? 129
What are the prospects of biomass? 129
Is ethanol a good substitute for gasoline? 130
What are the prospects of biodiesel? 131
Is there competition between bioenergy and food? 133

12 Policies 135

What are policy targets for renewable energy? 135
What are biofuels mandates? 135
What are Renewable Portfolio Standards? 136
What are CAFE standards? 137
What are “feed-in tariffs”? 137
What is the Climate Convention? 138
What is the Kyoto Protocol? 139
What is “cap and trade”? 141
What are carbon taxes? 141
What is technological “leapfrogging”? 142
What is sustainable development? 144

PART V NONTECHNICAL SOLUTIONS

13 Energy and Lifestyle 147

What is the relationship between energy and lifestyles? 147
Is technological development the only driving force for changing lifestyles? 149
What is the impact of transportation modes on lifestyles? 150
What are the major determinants of lifestyles changes? 151

APPENDIX 1 DECIMAL PREFIXES 153
APPENDIX 2 COMMON ENERGY UNIT CONVERSION FACTORS 154
GENERAL REFERENCES 155
INDEX 159

LIST OF TABLES

Table 1.1 Units of work, energy, and power 8
Table 2.1 Energy needs for different end uses 4
Table 2.2 Population and stages of development 5
Table 3.1 The main sources of energy 10
Table 3.2 The world’s primary energy consumption 11
Table 3.3 The world’s final uses of energy in 2002 12
Table 4.1 Fossil fuel reserves and production 27
Table 4.2 Fossil fuel reserves in different parts of the world (in percentages) 28
Table 5.1 Renewable energy production and theoretical potentials 30
Table 5.2 Typical power density calculations 30
Table 6.1 Comparison of the power potential of different energy sources 31
Table 8.1 The origin of CO₂ emissions 47
Table 8.2 Major oil spills disasters 48
Table 9.1 The cost of electricity production in OECD countries 49
Table 13.1 OECD final energy consumption by sector 98
Table 13.2 Non-OECD final energy consumption by sector 98
Table 13.3 World’s final energy consumption by region 99
Table 13.4 Energy consumption for transportation modes 99