NR 285/ Course Syllabus

APPLICATIONS OF RENEWABLE ENERGY IN CHINA

Catalogue Title: APPLICATIONS OF RENEWABLE ENERGY IN CHINA

Credits: 3

Term: Summer 2011

Meeting dates and times: June 2011

Location: Various locations in China to accomplish company visits beginning in Beijing. The 14-day course will conclude in Shanghai with travel through Shandong Province visiting companies and power generation and manufacturing facilities.

Instructor:

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Office hours by appointment

Course Description:

China's need for secure, affordable, and environmentally sustainable energy for its 1.3 billion people is palpable. China is already the second largest energy consumer in the world, having nearly doubled consumption over the past decade. With both energy-intensive industry and high-tech manufacturing, China now serves as factory to the world. Rising living standards mean more consumption, such as automobiles, with annual vehicles sales expected to exceed the United States by 2020. While most of China's electricity comes from coal and hydropower, the growing use of oil for China's burgeoning vehicle fleet is adding greatly to concerns about energy security - China already imports nearly half of its oil. Concerns about energy security, power capacity shortages, and air pollution are all adding urgency and pressure to switch to alternative technologies and fuels, including greater energy efficiency, 'clean coal' technologies, nuclear power, and renewable energy. Climate change also adds pressure - China will soon surpass the United States as the world's largest producer of carbon dioxide emissions, some say it already has.

Renewable energy technology deployment in countries as socio-economically diverse as China can vary in scale from tens of watts to hundreds of megawatts depending on the technology used, purpose and level of investment. In electrical systems, they can be used as stand alone power sources for low level lighting or water pumping or tied directly to large power grid transmission and distribution networks as generation stations. In thermal applications they can be used for cooking, water purification, as a sole source of hot water for showers, as an energy saving preheat for domestic hot water systems and to drive megawatt scale steam generators.
In the space of just a few years, China has become a global leader in renewable energy investment and industry, and much more growth is anticipated, writes Eric Martinot and Li Junfeng, authors of a new Worldwatch Institute report. Many countries including the United States and China see renewable energy equipment manufacturing as an economic driver follow the lead of Germany and Denmark. China currently gets 8% of its primary energy and 17% of its electricity from renewable sources. Wind power is the fastest-growing power-generation technology in China. The country is now the world's largest market for solar hot water systems, with nearly two-thirds of total global capacity. The government's goal of doubling the renewable energy share to 15% means that the amount of renewable energy will more than triple over a 15 year period. Some experts anticipate that this target could be exceeded, and that the share will keep rising beyond 2020.

In *Applications of Renewable Energy in China* students will:

1. Examine how renewable energy technologies are being deployed in China in both cities and rural areas. Our focus will be on solar photovoltaic and solar thermal with some wind and biomass. We will compare and contrast system deployment to American systems in the context of scale, installation practices and integration with other energy sources.
2. Visit solar, wind and biomass companies in China, including manufacturing facilities and company headquarters. China has some state of the art manufacturing facilities in the solar industry. Corporate goals and technology innovation will be compared and contrasted with American firms.
3. Meet with experts in the renewable energy sector in China including university faculty, government officials and industry leaders. The goals and expectations of renewable energy in Chinese society from these sectors will be compared and contrasted with those in the United States.
4. Understand the countries goals of exporting technology and internal consumption of solar technologies.

This course will include travel to various locations in China to accomplish company visits beginning in Beijing. The 14-day course will conclude in Shanghai with travel through Shandong Province visiting companies and power generation and manufacturing facilities.

**Course Goals:**

By the end of this course students will have a deep understanding of how renewable energy technologies are being deployed in China in both cities and rural areas as compared to the deployment of American systems in the context of scale, natural resource use, installation practices, and integration with other energy sources. They will also be introduced to the social, political and economic drivers for China's recent boom in renewable energy.

**Learning Outcomes:**

1. Exposure to the use of solar technologies (solar photovoltaic and solar thermal) in China. The topologies of the systems deployed will be understood at the 'one-line' level. Students will learn the systems well enough to compare and contrast with U.S. installations.
2. Understanding of the types and quality of manufacturing facilities in China. Some view China as all smokestacks – other as a high-tech capital of the world.
3. Exposure to China's value system with respect to the implantation of renewable energy. In the US, these are values are rooted in environmental concern for global climate change and job creation.
4. Look into renewable energy as an export commodity.
**Student Evaluation/Assessment:**

Your grade in this course will be determined as follows:
- **40%** for class participation;
- **60%** for the Renewable Energy Vermont Member Projects.

**Class Participation (40%):**

Each student is expected complete all readings, be present throughout the course at all scheduled meetings, actively contribute to the course discussions, and engage in online activities. A two page summary of a topic of choice will be required for each student.

**Renewable Energy Vermont Member Project (Total 60%):**

Working individually or in groups of 3-4, complete research as requested by the Renewable Energy Vermont member company you have been assigned and document findings as well as suggestions for the organizations to consider. Details of the assignment will be distributed separately. Students should plan to attend at least one pre-departure project planning session and review with instructor. To facilitate development of the groups, I encourage you to post your resume with a statement of your interests at the top of the first page in the Blackboard classroom space as soon as possible.

**Instructional Sequence:**

**KEY/MILESTONE DATES BELOW – MORE SPECIFIC SCHEDULE IS STILL BEING PLANNED**

**June 6, 2011**

Renewable Energy Technology Overview

Readings: Select readings from HomePower Magazine for introduction to solar photovoltaic and solar thermal

Renewable Energy Vermont companies with projects presented

**June 13, 2011**

Renewable Energy in China

Readings: REN21 - *Background Paper: Chinese Renewables Status Report*

REDP – *Report on the Development of the PV Industry in China*

Groups selected for Group Projects
June 20, 2011
US and China Renewable Energy Drivers


Initial review of project topics

June 27, 2011
Course Conclusion and Project Results Sharing
Trip logistics

General Course Information:

ACCESS:
In keeping with University policy, any student with a disability who needs academic/classroom accommodations should contact ACCESS. ACCESS coordinates reasonable accommodations for students with documented disabilities. They are located at A170 Living/Learning Center, and can be reached by phone at 802-656-7753, or by emailing access@uvm.edu. Visit their website at http://www.uvm.edu/access.

Code of Academic Integrity:
http://www.uvm.edu/%7Euvmpgg/ppg/student/acadintegrity.html

All academic work (e.g., homework assignments, written and oral reports, use of library materials, creative projects, performances, in-class and take-home exams, extra-credit projects, research, theses and dissertations) must satisfy the following four standards of academic integrity:

1. All ideas, arguments, and phrases, submitted without attribution to other sources, must be the creative product of the student. Thus, all text passages taken from the works of other authors must be properly cited. The same applies to paraphrased text, opinions, data, examples, illustrations, and all other creative work. Violations of this standard constitute plagiarism.

2. All experimental data, observations, interviews, statistical surveys, and other information collected and reported as part of academic work must be authentic. Any alteration, e.g., the
removal of statistical outliers must be clearly documented. Data must not be falsified in any way. Violations of this standard constitute fabrication.

3. Students may only collaborate within the limits prescribed by their instructors. Students may not complete any portion of an assignment, report, project, experiment or exam for another student. Students may not claim as their own work any portion of an assignment, report, project, experiment or exam that was completed by another student, even with that other student’s knowledge and consent. Students may not provide information about an exam (or portions of an exam) to another student without the authorization of the instructor. Students may not seek or accept information provided about an exam (or portions of an exam) from another student without the authorization of the instructor. Violations of this standard constitute collusion.

4. Students must adhere to the guidelines provided by their instructors for completing coursework. For example, students must only use materials approved by their instructor when completing an assignment or exam. Students may not present the same (or substantially the same) work for more than one course without obtaining approval from the instructor of each course. Students must adhere to all library course reserves regulations and refrain from mutilating library material, which are designed to allow students access to course materials. Violations of this standard constitute cheating.

When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

A related set of policies are listed under:
Code of Student Rights and Responsibilities
http://www.uvm.edu/~uvmppg/ppg/student/studentcode.html

Also see Our Common Ground statement of values at UVM
http://www.uvm.edu/about_uvm/?Page=values.html

Religious Holidays:
Students have the right to practice the religion of their choice. Each semester students should submit in writing to their instructors by the end of the second full week of classes their documented religious holiday schedule for the semester. Faculty must permit students who miss work for the purpose of religious observance to make up this work.

1 Powering China’s Development: The Role of Renewable Energy, Eric Martinot and Li Junfeng, Washington, DC, November 2007, 50 pp Worldwatch Institute