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U.S. Coast Guard Academy Marine Renewable Energy Seminar: Second Offering

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Abstract

In the spring 2012 semester at the U.S. Coast Guard Academy, a one-credit independent study course entitled Marine Renewable Energy Seminar was offered a second time, previously having been offered in spring 2009[1]. In this second offering of the course, three engineering students and ten non-engineering students enrolled in this elective course. The intention was to bring together different majors to learn about the many facets of marine renewable energy (policy, technology, economics, etc.) and to develop cross-discipline communication. Of the fourteen scheduled meeting times throughout the semester, eight seminars were presented, two class periods were used for debates, another two for student presentations, and the remaining periods for discussion. The final paper was on the student's perspective of the future of marine renewable energy with respect to the U.S. Coast Guard.

In this second offering of the seminar, the majority of the course content was similar in nature, with three seminars almost identical to a presentation from the first offering, while all other seminars were new, conveying the same content differently than in 2009. In the end-of-course survey of students, 75% of respondents replied that they had researched the issues discussed in class on their own after presentations or discussions, and 100% recognized the need for lifelong learning to stay current in the field. In 2009, 7% of students (2 respondents) found the library useful in success in the course, while 100% found the internet useful. In 2012, 12.5% (1 respondent) found the library useful, while 100% found the internet useful, so the way in which students are finding information is not changing. Overall, 100% of respondents positively responded to the statement "I learned something about marine renewable energy."

Course Structure

The course structure of the spring 2012 Marine Renewable Energy Seminar was a one-credit course that met once a week for the entire length of the semester. This was the same structure as in the Spring 2009[1], however the course was renamed from "Renewable Ocean Energy Seminar" in 2009 to use the more commonly used terminology. This was an elective course offered to undergraduate upperclassman (juniors and seniors) in addition to the required courses of the U.S. Coast Guard Academy. The course was co-taught in 2009 by an engineering instructor and a science instructor. In 2012, the course was again co-taught between engineering and science, with the same engineering instructor, and a different science instructor.

In 2009, there were 29 students registered in the seminar; in 2012, there were thirteen students registered. This drop in total registrants could have been an issue of scheduling, as all courses at the U.S. Coast Guard Academy are during the day, Monday through Friday, and all the students are full-time. Anecdotally, several other students expressed interest in the course, but either did not have that timeslot available in their schedule, or were underclassman. It is not perceived that the drop in registration indicates less interest in the topic of marine renewable energy.

On the first day of class, students were given a syllabus, outlining the course description, goal, objectives, prerequisites, grading, and policies, along with a draft schedule for the fourteen course meetings[2]. The description, goal, and objectives remained unchanged from 2009 to 2012:

Course Description: This is a cross-disciplinary, 1-credit seminar course. The key focus is on Marine Renewable Energy and its many tie-ins to the various U.S. Coast Guard Academy majors. Cross-disciplinary communication will be encouraged, while various questions will be investigated, such as:

1. *What types and how much energy are available in the oceans?*
2. *Who is responsible for overseeing design and functioning of marine energy installations?*
3. *What is the cost analysis of marine energy versus traditional energy sources, particularly fossil fuels?*
4. *What are the various technologies to harvest marine energy?*
5. *What are the implications of marine energy installations on navigation and national security?*
6. *What are the environmental impacts of marine energy installations?*
7. *Should marine energy be pursued?*

The course will include various presentations followed by in-class discussion.

Course Goal: To foster cross-disciplinary communication and promote an understanding of current energy issues in the setting of marine renewable energy.

Course Objectives: By the end of the course, it is expected that students are able to:

1. *List and discuss the viability of various marine energy sources.*
2. *Identify national regulators of marine energy policy.*
3. *Identify the costs of various marine energy sources and compare to traditional energy costs.*
4. *Show familiarity with existing marine energy technologies.*
5. *Demonstrate awareness of environmental, navigational and security issues linked to marine energy installations.*
6. *Argue for or against the further development of marine renewable energy.*
7. *Communicate in terms that all majors (engineering, science, operations research, management, and government) can understand.*

The objectives were based on Bloom's Taxonomy[3], attempting to develop the students from remembering (1. List) to highest level of cognitive domain, analyze, evaluate and create (6. Argue, and 7. Communicate).

The grading breakdown did change substantially from 2009 to 2012, as can be seen in Table 1. Less weight was given to course participation and the final paper, while two debates were added to the schedule and grading in lieu of two open-discussion classes.

In 2009, the homework was comprised of two relevant current event reviews and two relevant webpage evaluations. Samples of the required format were provided in the syllabus and posted on the online learning management system. Students were then to orally summarize their

Table 1: Marine Renewable Energy Seminar Grading Breakdown, 2009 and 2012.

Grading, 2009:	Grading, 2012:
20% Class participation 40% Homework 40% Final written paper	10% Class participation 20% Device presentation 20% Region presentation 30% Debates (2) 20% Final written paper

assignments on class discussion days. This homework breakdown proved to be flawed in that there was not enough time during class discussions for all the students to present their assignments, and with only two deadlines for the semester (midterm and final) for assignments, many students waited to the very last day possible to submit their assignment. In order to ensure that students achieved the same goals of the homework, but in a more manageable structure, the homework was replaced in 2012 by a device presentation and region presentation, both done in groups, with all groups presenting on the same day. Additionally, the debates were assigned prior to the class debate day, so students were expected to come prepared. It was determined that this system was much more effective based on student feedback in class and instructor reflection.

The final paper remained unchanged from 2009 to 2012; it was a memorandum written to the U.S. Coast Guard Headquarters outlining the student's thoughts for the role of the U.S. Coast Guard in marine renewable energy over the next five to ten years.

The 2012 final schedule is summarized in Table 2, outlining the topics and presenters. Three presentations were almost identical to 2009, indicated by the asterisk. In 2009, two of nine presentations were from invited external speakers; while in 2012, four of the eight presentations were from invited external speakers. The next section summarizes the content of each topic.

Course Content Summary

1. The introduction was presented by the co-instructors of the course who are also the authors of this paper. During the fifty-minute class period, introductions were made by the faculty and students, and then the students were guided to the various resources available on marine renewable energy for the course. This included showing the books available through the library, and emphasizing the suggested, but not required, text by Boyle, *Renewable Energy: Power for a Sustainable Future*[4]. Then the website for Ocean Energy Systems[5], an International Energy Agency technology initiative, was projected and some material was highlighted.

2. *Marine Energy Sources* was presented by the science faculty co-instructor of the course. The presentation was a slight modification from the one used in 2009, so the content was the same as noted in Table 2. The different types of energy that are found in the ocean were presented, broken down into the categories of thermal (Ocean Thermal Energy Conversion, or OTEC), mechanical, including both potential and kinetic (waves, tides, currents, salinity gradients), and other sources that are not in the ocean but available (offshore wind energy and offshore solar energy). Solar and lunar energy sources where then summarized, and national and global energy densities by type were presented, along with some mechanical basics for how to capture the energy.

Table 2: Spring 2012 Marine Renewable Energy Seminar Schedule. Presentations are in italics; an asterisk (*) indicates the same or similar presentation from 2009.

Class	Topic	Presenter Background
1	Introduction	
2	*Marine Energy Sources**	Course Science Instructor
3	Debate 1	
4	*A First-Order Approximation of Available Tidal Power off of Race Point**	U.S. Coast Guard Academy Engineering Faculty
5	Device Presentations	
6	*New England Marine Renewable Energy Center (MREC)*	New England MREC director
7	*Southeast National Marine Renewable Energy Center (SNMREC)*	SNMREC Executive Director
8	*Carbon Trading Game*	U.S. Coast Guard Academy Mathematics Faculty
9	*Marine Renewable Energy and the U.S. Coast Guard**	U.S. Coast Guard district chief
10	Region Presentations	
11	*Verdant Power*	Verdant Hydrodynamic Engineer
12	*Wind Turbines and Bird Kills*	U.S. Coast Guard Academy Science Faculty
13	Debate 2	
14	Course Evaluation	

3. The first debate was projecting into the future needing 20% more energy using an increased Traditional Energy Profile versus adding 20% Marine Renewable Energy to the current profile. Students were assigned to a side prior to the debate date with an outline of items that needed to be addressed during the debate, such as the distribution and availability of energy in the country, the cost, sustainability, environmental impact, and security issues.

4. *A First-Order Approximation of Available Tidal Power off of Race Point* was presented by the same engineering instructor as in 2009. In 2009, a newspaper article was published in the local newspaper[6], promoting tidal energy collection from the local tidal waters called race point, where the tides "race" to and from the Atlantic Ocean and Long Island Sound. The claims in the 2009 newspaper article were grossly overestimated, and the purpose of the 50 minute seminar was to give the students the opportunity to realize this by doing a first-order approximation of the power at Race Point based on geometric estimates and tidal velocity estimates. Students then had to determine how to get the units of power from velocity, water density, and area. Students worked in small groups and the results were compared at the conclusion of the seminar. It became clear from the results that the numbers for power presented in the article were much too high, and students learned how to estimate the power.

5. In two-person groups, students had five minutes for the device presentations. The topics were oscillating wave devices, overtopping wave devices, tidal barrages, tidal current devices, and thermal devices. The presentations were to cover an introduction, energy source, technology

basics, current installations, cost, environmental impact, and a conclusion. The desired outcome was for the students to teach each other about the basic energy technologies available.

6. The director of the *New England Marine Renewable Energy Center (MREC)*[7] traveled down to the U.S. Coast Guard Academy to present on what the Center was involved in. He discussed the current markets and resources available in New England, the technologies that the Center was aiding, the permitting challenges, and the Center's accomplishments and goals. New England has high potential for wind, followed by wave and tidal, and spatially sporadic current energy availability. MREC at the time was trying to get a platform installed off of Cape Cod in order for various technologies to be tested for proof of concept. Therefore, MREC has had to navigate the U.S. regulatory system for approval, with overlapping authorities from the Federal Energy Regulatory Commission (FERC), the Bureau of Ocean Energy Management (BOEM, formerly Mineral Management Service), as well as individual state regulations. MREC has also had interaction with coastal management authorities including NOAA, EPA, U.S. Coast Guard, Army Corps of Engineers and others. This was the first of many times that the students heard of the complicated regulatory system for marine renewable energy installations inherited from the offshore oil industry.

7. The Executive Director of the Center for Ocean Energy Technology (COET) at Florida Atlantic University (FAU) (designated in 2010 by the U.S. Department of Energy as the *Southeast National Marine Renewable Energy Center (SNMREC)*)[11], made the trip to the U.S. Coast Guard Academy. The presentation focused on the energy potential of the Gulf Stream passing along the southeast border of Florida as one of the most energy-dense ocean energy resources in the nation, both for tidal current energy and thermal gradient energy. Based on the climate of southern Florida, the idea of using the thermal gradient for air conditioning of apartment buildings was discussed in addition to electricity generation and hydrogen production from the Gulf Stream current. The rest of the presentation very much overlapped that of the New England MREC, where SNMREC was working towards a demonstration platform for technology proof of concept, and SNMREC has also had to navigate the U.S. regulatory system for marine renewable energy installations.

8. The *Carbon Trading Game* presented by a mathematics faculty presented the concept of carbon cap and trade. Students worked in groups, where they assumed the role of a small electric utility with both a coal plant and renewable energy plant. The game places a carbon cap policy where emissions require a credit to offset their impact. Each group then bid on the number of carbon credits desired at the current market price against the other groups in order use the less-expensive coal plant versus fulfilling their electricity demand with the more expensive renewable energy plant. The faculty used a pre-programmed spreadsheet to determine how many credits each group got once the cost was established. Profit or loss for each round was then calculated. A pre-game exercise was performed in order to acquaint the students with the impact of the different costs for carbon credits. Then, three rounds of the game were played, and what the students learned from the game was discussed at the end.

9. The *Marine Renewable Energy and the U.S. Coast Guard* presentation by the First District Chief of Energy & Facilities Branch[9] was very similar to the 2009 presentation by another person from the U.S. Coast Guard Headquarters, and outlined the various ways in which

the U.S. Coast Guard already plays a part in the industry, both as an advisory body on navigability, facility design, risk mitigation and law enforcement, and by having several small installations in places like in U.S. Coast Guard Sector Northern New England, where at tidal energy installation by Ocean Renewable Power Company provides electricity for the Eastport Station's utility boat when docked. The Chief again discussed the regulatory system currently in place with FERC, BOEM, and local authorities, and he projected that the current complex permitting process would have to be streamlined in order to allow future projects to move forward without complications.

10. The five minute region presentation had students, in groups of two, select a U.S. Coast Guard designated region (Districts 1, 7, 13, 14, and 17)[10] and then research the region and identify the marine renewable energy potential in that region. The presentations included an introduction, region overview of energy potential (wave, tidal, salinity, and thermal) and overlapping interests (navigation lanes, animal populations, etc.), an area of focus in the region, proposed energy installations, cost, environmental impact, and a conclusion. The intention of the assignment was to have student understand the complexity of incorporating marine renewable energy into an area of great potential.

11. The lead hydrodynamic engineer at *Verdant Power*[11] travelled up from metropolitan New York City to present at the U.S. Coast Guard Academy, and was able to use a presentation time outside of lecture when students from the entire Academy student body could attend. He presented the various projects that Verdant Power has already undertaken and outlined the engineering design iterations that they have done in order to get to be the first to receive a commercial license for tidal power in the U.S. from FERC.

12. The presentation about *Wind Turbines and Bird Kills* by one of the Academy science faculty outlined her collaborative research effort recording the bird kills from a coastal wind turbine and evaluating the risk for endangered bird species on the Atlantic Outer Continental Shelf[12]. The presentation showed that certain types of coastal birds seem to be able to avoid wind turbines, while others appear to be attracted to them and have increased numbers for kills. This presentation allowed students to be able to see a scientific approach for one aspect of environmental impact for offshore energy, and the concept of marine life kills for underwater devices was discussed at the end of the presentation.

13. The second debate had four teams to represent a Cape Wind Public Hearing: the company developing the Cape Wind project[13], the local fishermen, the Not-In-My-Back-Ocean (NIMBO) constituents, and the U.S. Coast Guard. Each group needed to discuss the location of the proposed project, impacts on navigation, tourism, the environment and aquaculture, and the projected cost. Students were able to identify conflicting interests based on the well documented Cape Wind project. The concept of having four teams rather than two opposing sides allowed for there to be overlapping interests and persuasion within the debate.

14. The last class was used to ensure all students had completed the end-of-course survey using the online learning management system utilized during the course as well as to collect the final written paper.

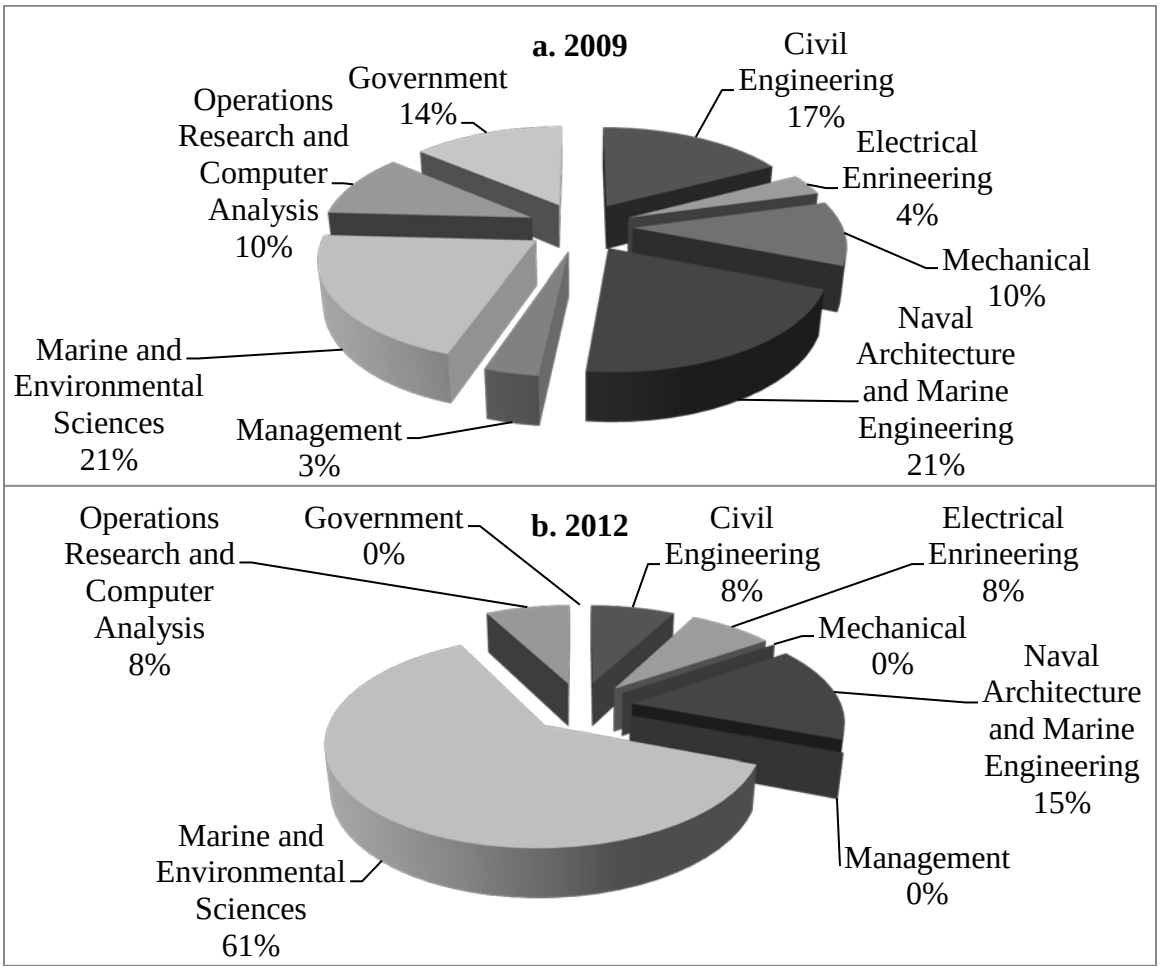

Figure 1: Declared Majors of (a.) the 29 Students enrolled in 2009 and of (b.) the 13 students enrolled in 2012 in the Marine Renewable Energy Seminar.

Student Course Feedback

Cross major representation was not as well achieved in 2012 as it was in 2009. In 2009 there was at least one person from each of the eight majors offered at the U.S. Coast Guard Academy[1], while in 2012 there were no management or government majors represented (Figure 1(a.) and 1(b.)). This could indicate a larger interest by Marine and Environmental Sciences (MES) students, or it could also indicate that the timeslot of the class worked best for MES students, while not so ideal for other majors. Either way, in 2012, there was still a good representation of the technical majors, but a complete lack of non-technical majors. In future offerings, increased advertisement to all majors could help promote enrollment by other majors, and is recommended in order to achieve the course goal of fostering cross-discipline communication.

The gender distribution shifted from 2009 to 2012. In 2009, there was an underrepresentation of females in the seminar, even when compared to the overall U.S. Coast Guard Academy gender distribution[1]. However, this trend was reversed in 2012, with an overrepresentation of females based on the U.S. Coast Guard Academy percentages for that year[14]. It should be noted that

Table 3: Percentage Gender distribution for the Marine Renewable Energy Seminar course versus the U.S. Coast Guard Academy, 2009[1] and 2012[14].

Gender	2009		2012	
	Course	U.S. Coast Guard Academy	Course	U.S. Coast Guard Academy
Male	90 %	73 %	38 %	64 %
Female	10 %	27 %	62 %	36 %

there is also a high number of females in the Marine and Environmental Sciences major, the most highly represented major in 2012. In 2009, the engineering instructor was female and the science instructor was male. In 2012, both the engineering and science instructor were female.

During the last week of the course, the online learning management system provided the students with a 63 question end-of-course survey and one slot for additional comments. Eight of the thirteen students enrolled completed the survey, with 7 providing additional comments. It is noted that anonymous online surveys prove difficult at getting good response rates, and it is recommended that the survey somehow be incorporated into class time in the future. In 2009, the survey was completed as a handwritten survey with a 100% response rate. The questions were identical to those presented in 2009.

The types of questions covered six areas: (1) overall impression of the course, (2) the instructors, (3) the presentations, (4) the students' self-assessment of topic competency, (5) the overall understanding of marine renewable energy, and (6) the research tools used by students. Possible responses were: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, and Not Applicable. In Table 4, those questions that highlight the course strengths and weaknesses of both 2009 and 2012 are presented. A positive response represents the sum of Strongly Agree and Agree, while a Negative response represents the sum of Disagree and Strongly Disagree.

Similar trends were seen in the course feedback between the two offerings. The students seemed to overwhelmingly enjoy the course and find it beneficial to have taken it, as well as find the instructors encouraging and competent. Also as in the previous offering, the students typically did not find the library useful, despite the library having the resources necessary to complete the research for the device and region presentations as well as the debate background. The internet seemed to be the primary resource for all students. Anecdotally, in 2012, one student brought their tablet computer into class for the debates with their resources uploaded for reference. It is recommended that the library resources be incorporated more directly into the course, and probably most successfully by integrating electronic library resources through the online learning management system.

The course goal of fostering cross-disciplinary communication seems to continually be underachieved, where approximately 50% of students responded that the course had improved the ability to communicate with students from other majors. The students, as noted in most classes, sat with other students of the same year and major, and only seemed to work across majors when forced by debate and presentation groupings (students had to partner with a

Table 4: Summary of end-of-course survey student feedback by percentage (2009[1], % of 29 respondents; 2012, % of 8 respondents). Positive represents a response of Strongly Agree or Agree. Negative represents a response of Disagree or Strongly Disagree. The remainder represents Neutral or Not Applicable.

	2009		2012	
	Positive	Negative	Positive	Negative
I enjoyed taking this course.	97 %	0 %	88 %	0 %
I'd be interested in a design project based on marine renewable energy	83	14	88	0
This seminar improved my understanding of issues surrounding marine renewable energy.	100	0	88	0
The instructors were encouraging of the students.	90	0	100	0
The instructors had competency in the subject of marine renewable energy.	100	0	100	0
I believe this course will benefit me during my career.	93	0	100	0
I researched the issues discussed in class on my own after presentations/discussions.	72	17	75	0
My ability to communicate with students from other majors has improved because of this course.	48	24	50	0
I recognize the need to engage in life-long learning to stay current in marine renewable energy.	90	0	100	0
This course allowed me to demonstrate creativity in thinking.	83	0	100	0
This course integrated many subjects well.	93	3	100	0
I found the library useful in success in this course.	7	48	13	64
I found the internet useful in success in this course.	100	0	100	0

different student from the device presentation to the region presentation). It is also noted that measuring ability to communicate, particularly over one semester in a one-credit course, is perhaps very intangible.

Of the eight presentations listed in Table 2 for 2012, the most useful as evaluated by the students in the end-of-course survey was Verdant Power. This seminar was opened to the entire academy, and was very well attended. The presenter, the lead hydrodynamic engineer at Verdant Power, was able to connect very well with the students and pique their interest. The next most useful presentations were Marine Energy Sources, which gave the students the foundation necessary to understand the rest of the course. The only seminar with negative responses was the Carbon Trading Game. It is interesting to note that in 2009, the least useful seminar was the

Social History of Climate Change. It can be noted that both of these "least useful" presentations were more tangential to the topic of marine renewable energy, as opposed to the most useful presentations, which were more directly within the realm of marine renewable energy. The students appear to have a preference to only focus on immediately pertinent topics, and not have tangentially related topics incorporated into the course.

The additional comments written in the 2012 survey did not focus on the same topics as in 2009. In 2009, the most popular suggestion was for at least one field trip. Perhaps because only two of the nine presentations came from people external to the U.S. Coast Guard Academy in 2009, while four of eight were external in 2012, and this suggestion was not repeated in 2012. In 2012, several students requested additional resources, including a request for a textbook. A textbook by Boyle[4] was considered as outlined in *McKeachie's Teaching Tips*[2], but as a one-credit elective, this was not adopted, and the book was made available to the students in the library and referenced by the instructors.

Another common feedback by three of the seven respondents who wrote comments in 2012 was that many of the presentations kept coming back to the same topics. Presentation order was selected based on presenter availability, and presenters were not directed with the information that the students had already heard about. In the future, more consideration could be made, particularly with presentation topics that are all-encompassing or general, and presenters could be given more direction based on what the previous presentations had covered to avoid too much repetition.

With the modifications to the homework given in 2009 to 2012, there was only one comment recommending combining the device and region presentation. In 2009, many comments referred to the reducing the number of homework assignments. The device and region presentations could be considered better assignments for the course over current event review and webpage evaluation, although there is room for more improvement, particularly in getting students to report more scientific information than just general overviews.

Evaluation of Course Objectives

As in 2009, the achievement of the course objectives by the students can be taken by evaluating the quality and content of the final paper. The students had to write a three to four page memorandum to the U.S. Coast Guard Academy parent organization headquarters, summarizing the current state of affairs in marine renewable energy and forecasting the future of marine renewable energy in the U.S.A. in the next five to ten years. Additionally, they had to state their vision for the U.S. Coast Guard Academy parent organization involvement in marine renewable energy, both benefits and challenges, in the same timeframe.

In 2009, 27 papers were deemed of excellent or high quality, while two were deemed to not communicate the purpose of the memorandum and not meet the objectives of the course. The twenty-seven acceptable memorandums were forwarded to the U.S. Coast Guard Academy parent organization headquarters. In 2012, twelve of the thirteen papers were deemed of excellent or high quality, but only the two best argued memorandums were selected to forward to

the U.S. Coast Guard Academy parent organization headquarters in order to ensure their consideration and value to headquarters.

The course objectives and instructor evaluation of their achievement by students based on the final papers is outlined here.

1. *List and discuss the viability of various marine energy sources.* The students recognized the various types of marine energy sources and were able to determine the more plentiful resources within the U.S.A. This was covered in the Marine Energy Sources presentation as well as with the device and region presentations.

2. *Identify national regulators of marine energy policy.* The students knew the national regulators of marine energy policy, and recognized the changes that had occurred to the regulating bodies over the last two years as the federal government restructures to accommodate this energy sector. Several presenters discussed marine energy regulators and the current complexity of the multiple regulators.

3. *Identify the costs of various marine energy sources and compare to traditional energy costs.* The students all recognize the prohibitive initial costs of marine energy sources, but often were able to identify that these costs would reduce with time and maturity of technologies. This objective was also covered in the first debate of Traditional Energy Profile vs. Marine Renewable Energy and the device presentations.

4. *Show familiarity with existing marine energy technologies.* The students were able to list several exiting technologies by the end of the semester, as this was covered throughout the semester. Many students expressed preferences for particular technologies in their final papers, often with justification.

5. *Demonstrate awareness of environmental, navigational and security issues linked to marine energy installations.* This objective was accomplished in particular in the final paper due to the nature of the Institutional parent organization relationship to all of these issues. All students showed at least a high level of awareness of this objective.

6. *Argue for or against the further development of marine renewable energy.* All thirteen final papers argued for marine renewable energy, and several students had very well organized arguments.

7. *Communicate in terms that all majors (engineering, science, operations research, management, and government) can understand.* All the students were able to communicate in layman's terms in the final paper the benefits of marine renewable energy as well as the challenges. Many students incorporated maps and tables from external resources and pulled out the important information relevant to their argument.

Overall, the objectives were considered to be successfully completed based on the participation of the students throughout the semester and the quality of their final papers to achieve the final project guidance. Although perhaps not all experts in the field, a high level of knowledge,

comprehension, and critical thinking did appear to be achieved with the majority of the students, as they each created their own opinions based on the information provided to them and communicated those with their own analysis in the final paper, in accordance with Bloom's Taxonomy[3].

Conclusion

It appears that several of the previous issues with the course, such as not enough external presenters and poorly-timed assignments, were corrected in the second offering of this course. Additionally, an overrepresentation of female students in the class was experienced only in 2012, with an underrepresentation in 2009. The 2009 offering benefited from higher enrollment and better representation across the majors. A change in the time offered during the school week may improve this as well as increased advertisement of the course. As this course is open to all upper-class students, an offering every two years seems appropriate for the future, as this allows one opportunity for all students to take this elective course during their time at the U.S. Coast Guard Academy.

In 2009, 79% of student survey respondents said that they would take the course again if there were new presentations, 97% said they would recommend the course to students within their major, and 93% said they would recommend it to students in other majors. In 2012, 75% of student survey respondents said that they would take the course again if there were new presentations, 75% said they would recommend the course to students within their major, and 75% said they would recommend it to students in other majors. The trend continues to be overall very positive.

Based on the final paper, the course objectives were successfully achieved, with only one of the thirteen papers not achieving a rating of high or excellent quality. It is highly recommended to incorporate electronic library resources into the online learning management system used in conjunction with this course in order to involve the U.S. Coast Guard Academy library more in student learning.

Currently, this seminar has been proposed to be offered again in the spring of 2014 with the same instructors as 2012. The online learning management system is planned to be used to directly link to the library in order to encourage students to use well-vetted resources as primary references for the research during this course. Additionally, the order of presentations will be considered and shared with each of the presenters, so that there is not too much overlap between presentations, such as the emphasis on the U.S. regulatory system for marine renewable energy in 2012 by at least four presenters. A field trip to a nearby installation, such as Verdant[11] or possibly Cape Wind[13], would also be a desired improvement on the course.

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