Energy Education in Schools Project

Environmental Science 410

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Energy Education in Schools

Introduction

For an environmental science practicum class three environmental science students came together to help work on energy education and curriculum in local schools. Working in conjunction with the City of Arcata and various other interested parties around the area, the goal is to educate students at an early age in a meaningful way in hopes of influencing their views on energy and their consumption patterns. Education has been a very useful tool in altering people's behavior. There is a belief that with interesting and thought provoking activities within the classroom students can be made more aware of the various means of producing energy as well as the impacts of consuming various types of energy. The aim of this project is to help make energy curriculum and other various resources available to interested parties in the Arcata community.

Energy Education in Schools
Problem Background:

Education has been one of the issues at the forefront of the political spectrum. California is no exception; in this state we have the largest school system in the country. With 1 in every 8 American students attending school in California, the scale of the problem here in California is magnified as compared to the problems of other states. Many of the schools in California were built before energy efficiency was included in the planning process. 1/3 of all schools in California are in need of a major renovation. Many of these schools are in poor condition and waste a lot of energy. Each year schools spend over $450 million dollars on energy. By simply increasing the energy efficiency of school building designs could save $150 million dollars statewide. All of these statistics are provided by the collaborative for high performance schools that were designed to help school districts and planners make informed decisions regarding schools. The poor planning and management of our schools is just one of the problems that plagues our schools system here in California, another major concern is energy education curriculum.

The school system in California has neglected energy conservation and alternative energy in the curriculum for too long. In the past there has been little or no attention paid to the education of students concerning these topics. There is a need to raise awareness through education about energy conservation and alternative energy sources to prepare students for the changing face of resource availability and energy use in the state of California. It is the students in school today who are going to shape the future of energy and energy consumption. What they are taught now will have a lasting impact on their views on energy. People need to be aware of all options available to them and there is a need to inform the public about what other option are available when it comes to energy production.

Problem Statement:

There is a lack of school curriculum dealing with energy conservation and forms of alternative energy in schools.

Objectives:

The following objectives need to be accomplished in this project:

1. Make available by May 19, 2002 a set of curriculum resources for teachers to use in order to bring energy education subject matter into the classroom.
2. Raise energy awareness in school children via energy education related curriculum by integrating energy education lessons for at least six hours per school year.
3. Provide school teachers and staff with contacts between schools in order to allow teachers at different schools to coordinate with one another and share information.
4. Provide the City of Arcata's Energy Committee with case studies and examples of energy efficiency in schools and the implementation of that energy efficiency by May 19, 2002.

Weighing Alternatives

In order to meet our objectives for this project, we devised four alternate solutions. In addition to the descriptions of the alternatives below, each of the alternatives would also involve a presentation to the City of Arcata's Energy Commission concerning our chosen plan. As follows are summaries and a comparison table of the four alternatives.

Alternative One

Alternative One focuses on a series of field trips by local schools to locations within the surrounding Arcata area to view alternative energy systems. Field trip destinations would include places such as CCAT, Six Rivers Solar, and the Arcata Marsh, and would be chosen by the teachers at each school so as to emphasize the area of alternative energy they wish to introduce to their students. We would provide location-specific curriculum to the teachers involved for their use as background/follow-up material to the field trips.

This alternative would involve busing children back and forth between their schools and the field trip destination, teachers scheduling field trip times with the destination locations, teachers incorporating the location's curriculum into classes, and students missing regular class session(s) while on the field trip.

Highlights : Students able to see our community's working alternative energy-based systems in person and experience them hands-on where possible.

Drawbacks : Much teacher planning/effort required, busing of children to and from sites required.

Alternative Two

Alternative Two proposes a weeklong curriculum series focusing on alternative energy. This "Alternative Energy Week" would introduce the basic concepts, ideas, and solutions of alternative energy to

local schools, with energy and alternative energy systems being the main focus of all subject matter taught during that week. This would be accomplished by incorporating energy curriculum into existing lesson plans (e.g. energy vocabulary/spelling words, alternative energy-based math and science problems) and bringing in additional subject matter dealing with energy in order to better cover all facets of this issue.

This alternative would involve teachers fitting the weeklong curriculum plans into the school year, preferably during the same week that other schools in the district are also using this set of curriculum. Our group would provide the Alternative Energy Week curriculum set to schools for distribution to interested teachers.

Highlights : One-week session allows a more in-depth study of the subject matter for both students and teachers. All curriculum resources provided to teachers. One-week session can be used as a "diversion" for students from regular subject matter to help them keep their interest mid-year.

Drawbacks : Ability to incorporate a full week of energy-based curriculum may vary between classes, and under some circumstances may not be possible.

Alternative Three

Alternative Three consists of the distribution of energy based curriculum and lesson packets to interested schools and teachers. These packets would be organized by target age group (elementary, middle, high school) and would include a large variety of potential alternative energy-based curriculum and lesson plans. Interested teachers would be able to choose lessons from these packets as they see appropriate for their individual classes.

This alternative relies on interested and motivated teachers in our local schools to read through the packets and choose how to incorporate the material into their classes.

Highlights : Very flexible for teachers, can introduce a wide breadth of information on alternative energy to students. Encourages networking among schools.

Drawbacks : Requires teacher planning and highly motivated teachers to consistently incorporate this curriculum into their lesson plans.

Alternative Four

Alternative Four uses a set of videos to help teach students about alternative energy. The videos would be viewed in class and would introduce to students a wide array of the problems of energy consumption and alternative-energy based solutions around the world. Our group would provide a listing of pre-screened videos to school, and the individual teachers based on their preference would select the video set to be shown in class.

Highlights : Easy for teachers to use, little planning required. Videos are capable of showing a wider range of material than could be seen just in the local area.

Drawbacks : Not an interactive approach, retention of information by the students may be questionable.

Table 1

Comparison of Alternatives Matrix

	Alternative 1	*Alternative 2*	*Alternative 3*	*Alternative 4*
Meets Objective 1- Make available energy ed. curriculum	X	X	X	X
Meets Objective- Raise student energy awareness	X	X	X	X
Meets Objective 3- Provide teachers with a contact list			X	
Meets Objective 4- Provide the school board with energy savings info.	X	X	X	X
Easy for Teachers to utilize		X	X	X
Low Cost		X	X	
Incorporates into current curriculum	X	X	X	X
Flexible	X		X	X
Interactive for students	X	X	X	
Comprehensive		X	X	

Decision

Based upon the summaries of the alternatives and the judgment criteria set forth on the comparison matrix, our group has chosen to pursue Alternative 3, the energy based curriculum and lesson packets. We feel this alternative would best meet our goals and the needs of the teachers and students involved.

Implementation

To implement the energy education in schools project the following must be accomplished:

1. Establish a contact list within the local school district of those teachers and administrators who are interested in energy education in the schools. This will be done to let teachers at various schools to coordinate with each other and share information on energy education. The contact list will be amended on a continual basis as more interested parties are identified. The entire group will work on establishing this contact list by May 15, 2002.

2. A presentation will be made to the Arcata City Energy Committee including an information packet containing specific case studies on energy efficiency in schools. This packet will contain the effectiveness of previous programs that have been implemented in other school both in California and across the nation. The entire group will give a presentation to the City of Arcata's energy advisory board on April 29, 2002.

3. Using the contact list of interested parties; a presentation will be given to the interested teachers and administrators about the energy education in schools project. During these presentations resources will be provided to help teachers and administrators set up curriculum and school wide programs to educate the students about energy. These packets would be organized by target age groups (i.e. elementary, middle and high schools) and will contain lesson plans, alternative energy based curriculum, activities, and resources. This will give teachers the flexibility to choose what activities or lesson plans are most applicable to their class or region. The hope is that by teaching the students about energy and related topics that this will help induce energy saving behaviors. Team members and the City of Arcata will be responsible for giving the presentation prior to the start of school in the fall of 2002.

4. There will be meetings held in the community twice annually in which all interested parties will attend. The meetings will highlight success stories as well as the newest technologies and information available about

energy and energy education. The schools, students and representatives from the City of Arcata will conduct these meetings as well as members of this group for as long as their schedules permit attending the meetings.

Monitoring and Evaluation

The monitoring of the energy efficiency in schools project will be as follows:

A survey will be distributed semi-annually to the teachers participating in the energy education in schools project. The survey will also examine what effective the energy education curriculum is having on students and what works in the curriculum and what needs to be worked on. The survey will be discussed at the semi-annual meetings that will be held in the community.

Evaluation

The program will be evaluated based on the overall effectiveness of the educational program based on teacher and administrator responses. At the beginning of the school year teachers will conduct knowledge assessment to determine the initial understanding of their students. A second knowledge evaluation will be conducted at the completion of the school year to assess the participating students comprehension on the energy education material presented. Surveys will also distributed to the teachers to inquire as to the overall student awareness of alternative energy and related topics. The teacher will evaluate the students on the different parts of the curriculum as they are used both in and out of the classroom. Students will be able to voice their likes and dislikes of the program as well as ways in which they think the program could be improved. The teachers will then compile the findings of these evaluations into their written survey (see appendix A).

A Humboldt State University masters student named Emily Evans is developing an environmental education evaluation checklist. This checklist is to be used in conjunction with different types of environmental education; it evaluates the applied and written curriculum for teachers. The complete environmental education curriculum checklist is included in Appendix B, teachers should fill out the evaluation checklist for the semiannual meetings as well as the written survey. Both of these tools, the survey and the checklist, will be used to evaluate the energy education curriculum program.

Conclusion

Energy is one of the most pressing issues of our time, as we now begin to look towards the future and a more sustainable source of energy, education is one of the major components in implementing new sources of energy. People need to be made aware of the choices available to them as well as be informed on the impacts of the choice they make. The energy education in schools project aims to do just that, the hope is through this program students will be made aware of energy and various methods for producing this energy. By reaching these students at a young age they will be more aware of the impacts of energy consumption as well as various forms of alternative energy. The hope is these enlightened students will be the ones making the choices about how energy will be produced in the future as well as making personal choices concerning energy consumption. This program is simply a foundation for energy education, to fully education every American it will take schools, parents, friends and motivated students/citizens. This group of environmental science students hopes that this is the first step on a long overdue journey towards understanding energy and all its impacts.

Appendix A: Teacher Survey Forms

Name of School:

Date:

Grade Level:

For each of the following questions please follow all directions, answer all questions and give specific examples where possible. Please feel free to give specific websites where you found information or a specific lesson plan.

#1. How many different lessons or activities concerning energy education did your classes participate in this past semester?

#2. How many were from the provided energy education curriculum packet?

#3. What activities did you find most rewarding or educational?

#4. What activities did your class find most rewarding or educational?

#5. What activities did you find least rewarding or educational?

#6. What activities did your class find least rewarding educational?

#7. Any concerns or questions or suggestions you may have?

#8. Success stories, what worked.

#9. Additional Comments:

Appendix B: Environmental Education Curriculum Evaluation Instrument

Goals and Objectives	**Applied Curriculum**				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Objectives focus on awareness, knowledge, attitude, skills, participation, and environmentally responsible behaviors	___	___	___	___	___	___	___	___
2. Do the objectives cover and interrelate to a wide range of environmental issues and problems	___	___	___	___	___	___	___	___
3. Lessons address instructional goals	___	___	___	___	___	___	___	___
4. Curriculum is effective with reference to meeting both objectives and goals	___	___	___	___	___	___	___	___
5. Clearly defined goals and objectives	___	___	___	___	___	___	___	___
6. Are there adequate opportunities for the students to practice the program's objectives	___	___	___	___	___	___	___	___

Content	*Applied Curriculum*				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Are ideas expressed through unifying themes and big ideas, not facts?	___	___	___	___	___	___	___	___
2. Demonstrate a sense of wonder and respect for the natural world	___	___	___	___	___	___	___	___
3. Multidisciplinary	___	___	___	___	___	___	___	___
4. Material is appropriate for level of students (including Limited English Proficiency students)	___	___	___	___	___	___	___	___
5. Material can be applied to students' community and bioregion	___	___	___	___	___	___	___	___
6. Content of lesson is multisided, politically neutral, and separate from advocacy or propaganda	___	___	___	___	___	___	___	___
7. Addresses educational standards	___	___	___	___	___	___	___	___
8. Considers known resource management practices and philosophies of indigenous cultures	___	___	___	___	___	___	___	___

Environmental Content	*Applied Curriculum*				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Focus on basic ecological principles or resource management concepts	___	___	___	___	___	___	___	___
2. Provides students with the skills to take environmental action	___	___	___	___	___	___	___	___
3. Promotes academic learning related to the natural environment	___	___	___	___	___	___	___	___
4. Are the roles of environmental ethics, citizenship, and stewardship explored?	___	___	___	___	___	___	___	___
5. Is environmental responsibility modeled in design, underlying philosophy, and suggested activities by the lessons and materials (e.g., using recycled materials and properly disposing of wastes)?	___	___	___	___	___	___	___	___
6. Are there clear linkages presented between human and natural communities?	___	___	___	___	___	___	___	___
7. Are there clear linkages between different ecological communities?	___	___	___	___	___	___	___	___
8. Is inter-generational responsibility, linking today's actions with future consequences, implicit in the instructional methods?	___	___	___	___	___	___	___	___
9. Addresses the consequences of human action?	___	___	___	___	___	___	___	___

Pedagogy	*Applied Curriculum*				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Challenging but doable; asks students to go beyond their perceived limits	___	___	___	___	___	___	___	___
2. In depth lessons instead of survey style	___	___	___	___	___	___	___	___
3. Students engage in concept learning and problem solving	___	___	___	___	___	___	___	___
4. Uses a range of media and teaching strategies	___	___	___	___	___	___	___	___
5. Provide opportunities where participants are actively involved	___	___	___	___	___	___	___	___
6. Provides an opportunity to be actively involved in culturally enriching personal and social experiences	___	___	___	___	___	___	___	___
7. Provides a balance of team work/ group and individual activities	___	___	___	___	___	___	___	___
8. Stimulates the desire to engage in community service	___	___	___	___	___	___	___	___

9. Offers students opportunities to learn through service		
10. Students are required to confront real world problems, issues, and questions	____ ____ ____ ____	____ ____ ____ ____
11. Requires students to use the knowledge and skills that professionals would use in the real world	____ ____ ____ ____	____ ____ ____ ____
12. Sustained regular or extended application; must provide for an extended time interval of work	____ ____ ____ ____	____ ____ ____ ____
13. Asks students to express themselves in a variety of ways; oral, written, artistic, physical, mathematical, and scientific	____ ____ ____ ____	____ ____ ____ ____
14. Provides exemplars to make tasks explicit and clearly defined	____ ____ ____ ____	____ ____ ____ ____
15. Students are held to high standards for their work	____ ____ ____ ____	____ ____ ____ ____
16. Asks students to take increasing responsibility for their own learning	____ ____ ____ ____	____ ____ ____ ____
17. Requires that students use the tools of inquiry, research, and or experimentation	____ ____ ____ ____	____ ____ ____ ____
18. Brings the community into the classroom and brings learning into the community	____ ____ ____ ____	____ ____ ____ ____
19. When applicable, projects foster strong work habits such as perseverance, organization, planning, follow-through, and self-discipline	____ ____ ____ ____	____ ____ ____ ____
20. Students are given ample time to revise their work	____ ____ ____ ____	____ ____ ____ ____
21. Conveys a notion that scientific fact is continually revised as human understanding about the world changes	____ ____ ____ ____	____ ____ ____ ____
	____ ____ ____ ____	____ ____ ____ ____
	____ ____ ____ ____	____ ____ ____ ____

Organization	*Applied Curriculum*				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Questions utilized follow a systematic approach	____	____	____	____	____	____	____	____
2. Internal Consistency i.e.: Are goals, objectives, instructional procedures, and student evaluation strategies consistent with each other.	____	____	____	____	____	____	____	____
3. Students are given time to reflect on the importance of the different class session and related field experiences	____	____	____	____	____	____	____	____

4. Enables students to perceive the relationship of new content with that presented previously		
5. Enables students to make logical connections between lesson components		
6. Demonstrates rigor of planning		
7. Continuity and progression within and between topics		

General Appeal	*Applied Curriculum*				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Focus on activities that are pleasant, memorable, and enjoyable								
2. Is the lesson or are the lesson materials attractive to teachers?								
3. Is the lesson or lesson materials appealing students?								
4. Projects are engaging and interesting and ask students to do meaningful and important work								

Assessment / Evaluation	*Applied Curriculum*				**Written Curriculum**			
	FM	*PM*	*MM*	*NM*	*FM*	*PM*	*MM*	*NM*
1. Evaluates student outcomes regarding specific objectives or sets of objectives, and goals								
2. Are measures included to assess the student's attainment of the program's objectives								
3. Allows students to demonstrate mastery of learning goals								
4. Provides opportunities for students to present their work before a meaningful audience that motivates them to do their best work								

User-Friendly	Written Curriculum			
	FM	PM	MM	NM
1. Lessons can effectively be used by teachers				
2. Are the teachers lesson plans adequate				

3. Is background information for the teacher adequate?	___	___	___	___	
4. Is background information for the teacher accurate?	___	___	___	___	
5. Are equipment/materials listed and reasonably accessible?	___	___	___	___	
6. Is the time required to complete each lesson indicated?	___	___	___	___	
7. Do the materials clearly list the subject discipline(s) integrated into each lesson?	___	___	___	___	

Appendix C: Case Studies and Examples of Energy Efficiency in Schools

Energy Efficiency in Schools

The California public school system is the largest in the nation, with 100,000 new students each year the public school system continues to grow at a great financial cost. The taxpayers of California are footing the bill for these expenses; greater and greater attention is being paid to building efficient schools. By building schools that meet the needs of the particular area and utilize the available resources of an area the California public schools will be able to best utilize their available financial resources. The idea is to use the money available as efficiently as possible so it can help as many students as possible. Many people are looking for possible cost savings in all types of areas; the question is what is the most appropriate way to save money.

One possible solution is repairing the schools that currently exist; many of the public schools in California are in need of a retrofit. If there is a decision to make a retrofit to a school, it seems as though it is in everyone's best interest to design the building as efficiently as possible, using efficient materials, using efficient appliances, using more windows to heat and cool just to name a few possibilities. This idea is not new; many schools throughout this country have already done just that and are piling up the savings they have earned. Examples of schools like these are endless on the internet; a simple search for "energy efficiency in schools" brings up more than you can even look at. School boards and individuals schools have records of many of these achievements in retrofitting schools.

For an example of the energy efficient retrofits on the school district level we can look at the San Diego Unified School District (SDUSD). The Environmental Protection Agency (EPA) for its "comprehensive energy-efficient upgrades" recognized the SDUSD in January 1998. By just retrofitting their lighting systems the SDUSD saved more than $3 million per year. The SDUSD saves more than 26 million kWh annually; saving the equivalent of pollution that is produced from 3,900 cars. It is clear from the San Diego example that these savings are real and easily doable, they financed the project by raising funds from selling tradable

Certificates of Participation, as well as by getting more than $3 million in rebates from their local gas and electric company. These types of retrofits are possible will a little hard work and creative thinking.

The problem with the idea of retrofitting schools is it can be costly and it is not always applicable for all situations. There are still many other options available to existing schools, lets stay in California but come north a little for San Diego for another example. Many schools in the Los Angles area joined a program known as Green Schools in Los Angles. The program consisted of four strands: 1) action (how energy is being saved), 2) instructions (learning about the energy-environment connection), 3) involvement (school community involvement) and 4) energy efficiency in homes. The schools that have participated in this program save quite a bit of money with no cost improvements. The students at Workman High School in the City of Industry began the Green Schools program in August 2000. The students did an energy audit and identified no cost energy savings, they suggested retrofitting ideas to school officials and got teachers to implement the no cost suggestions. From August 2000 to March 2001 the school saved in energy $11,391, money that is now available to other projects. Another note, this is not a one-time savings if practices are followed then savings should continue indefinitely. Students along with teachers at Wing Lane Elementary School, in La Puente CA helped the school to reduce electricity demand 5.7% and gas demand by 12.9%. Teachers taught the students about energy efficiency and assigned room monitors to monitor the lights, as well as making and distributing informational posters on energy efficiency and savings. All told this little elementary school saved $1,675. Every little bit helps, if all the schools would adopt similar practices the nation could consume less energy as a whole, and where better than to start saving energy than in school and even better start early with elementary students and schools.

Many new schools still need to be constructed to meet the demand of the increasing student population. The hope is that these new schools that are built will be done so in a wise, appropriate and sustainable manner. Schools are popping up all of the country that utilize nothing more than sunlight, passive solar design, and save

phenomenal amounts of money. A great example of an energy smart school is the Durant Middle School in Raleigh NC. This school was built in 1996 and in 1997 was named one of the top ten most environmentally friendly buildings in the United States. The school paid for all of its daylighting features from energy savings within the first six months! The school saves $165,000 a year in energy costs. The building utilized daylighting with a special sun-reflecting roof; the designers were able to lessen the cooling load of Durant Middle School by 70% of that of a typical school built then. This also saved the school on cooling and electrical systems and saved $115,000 in construction costs. Information on this school can be found through the internet or by contacting Gary Bailey, Innovative Design, Raleigh NC, 919-832-6303. Lets hope that this becomes the norm when it comes to building new schools, test are showing that students who go to a daylight school for more than two years out perform non-daylight school students by 14%. School built thoughtfully and appropriately is the goal we should all be reaching for.

This is some background information on energy efficiency in schools; it should serve as positive motivation as it shows what can be done and what is being done. As the California school system struggles to cope with the changing dynamics of their school system, the hope is they will continue to use some of the innovative approaches available to dealing with this issue. California is very rich in natural resources including good solar access; the time has come to utilize this solar energy both actively and passively in current and future schools. The hope is that California will once again be the leader for the rest of the nation and show that energy efficiency and savings cane be done, and that most times it will pay for itself and save money in the future. We hope that administrators and decision makers will include as many of these energy efficient design principles as possible. Examples are out there and resources are available all it takes is some simple detective work. Education is the place to start when it comes to changing people's behaviors in a positive manner. It would be great if the buildings that house the educational system had something to teach the students as well. It all makes sense and is easily implemented, I hope that all school districts around the country will try some of these

concepts in at least one school and use it for comparison. There is a great deal of confidence that the statistics and financial savings will speak for themselves as soon as we have people brave enough to try them.

Appendix D: Alternative Energies

Upon entering into the twenty first century, we face a time when global warming, resource shortages, the recent power crisis in California and the environment have become an issue of significant local importance. We have entered the age when just acknowledging the problem just will not do; we must push forward to further environmental goals. We must seek practical solutions to global problems through the use of renewable energy. At present time there are four types of renewable energy devices being researched in the world. They are solar, wind, water, and hydrogen fuel cells.

Many people today know about solar energy, they see solar panels installed on all sorts of things. What the solar panels are doing is changing the energy from the suns rays into direct current (DC). As the suns rays hit the solar panel some of the energy is transferred to the collectors, which change it into a DC voltage. Then the DC is converted into alternating current (AC) by a converter. The converter is the most costly in terms of energy loss. The AC is what people use for all of their power needs in the home or at school.

Another way of harnessing renewable energy is through wind power. Wind generated power has been around for a long time. The farmers in the old west used windmills to power water pumps in order to water the animals and irrigation. Windmills were also used for giant grinding wheels in order to make flour. Now a day's windmills are being used to produce power to feed the grid. The wind going across the blades causes the sprocket to move. As the sprocket turns it turns a motor that produces DC energy. The DC is then sent to a localized converter that changes the current to AC and then the energy is transmitted through the power lines into the grid. Research today is being done on blade design in order to maximize the efficiency of the windmill. Like the solar panels many people have also seen the rows of windmills in the bay area.

There are several different ways that the water is being used to produce energy. Energy harnessed from water, like wind power has been in use for several years. In the late nineteen hundreds of people used waterfalls to produce mechanical energy through the use of a water wheel. The next step was the building of several hydroelectric dams though out the country. Now research is being done on creating energy from ocean currents and waves.

Through the use of a buoy like device the energy from the up-down motion of the ocean would be used to create energy. The up-down motion would be used to turn a generator, which in tern would produce energy. Other devices that harness the energy of a wave are used in the breakwaters. This device uses the energy of a wave pushing against it to produce energy. This device is being used on harbor walls in order to produce energy

and to make the waters in the harbor calmer for the boats. Also types of underwater windmill are being used to produce energy. It works exactly like the windmill but uses ocean currents instead of wind currents to turn the sprocket and produce energy.

One of the newest technologies today on renewable energy is the hydrogen fuel cell. The hydrogen fuel cell gathers the energy produced from the chemical reaction of hydrogen and oxygen. As the hydrogen from a storage tank reacts with the oxygen in the air through membrane water is formed and energy is produced. This energy is produced with only water as a waste product.

In this age of transforming technologies, high-energy demands, and environmental consequences, it is imperative that models are able to show the true capacity of today's renewable energy. There are many options available for energy production besides the burning of fossil fuels, what needs to be done now is to educate people of these alternative forms of energy production either through reading and classroom activities or by making demonstration sites available. The main message here to people is these alternative energies are not fifty or a hundred years away, they are available now and being used all over this country and the world.

Appendix E: Energy Education Contact List for Arcata Public Schools

Bloomfield School

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Jacoby Creek School

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