THE POWER OF THE SEA: USING OCEAN ENERGY TO MEET FLORIDA'S NEED FOR POWER

BY

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Like many across the United States, if you ask Floridians if they would give up air conditioning for the sake of saving energy they would respond with a resounding "no." So how are high demands for power met? In Florida, electricity is predominately generated by coal and gas fired power plants. As discussed in the Comment, these traditional power production facilities are known to emit pollutants that are harmful to human health and the environment. However, there is another option; Florida could meet its demands for power while simultaneously protecting human health and the environment simply by harvesting the energy of the sea.

This Comment explores how ocean energy can be used to provide coastal states with a feasible and reliable source of energy. The technologies needed to harvest wave energy have been proven by demonstration projects and these technologies are ready for full-scale development. Florida, a state with an extensive coastline, should consider ocean energy as a practical source of renewable energy and should use legislation to promote the development of wave farms.

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"*Not only will atomic power be released, but someday we will harness the rise and fall of the tides and imprison the rays of the sun.*"—*Thomas Edison*[1]

I. INTRODUCTION

A growing population combined with the ever-increasing number of electrical appliances in homes and businesses has caused demand for electricity to skyrocket. The once perceived "convenience" of electricity is now considered a necessity, and traditional power generation facilities struggle to meet these demands.[2] Americans are a power-hungry society, demanding conservation of natural resources and protection of the environment while simultaneously using an incredible supply of electricity. In 2000, the "[p]er-capita average consumption of electricity . . . was more than seven times as high as in 1949."[3] Despite our seemingly endless demand for power, society currently opposes the depletion of our nation's fossil fuels, an essential part of today's power production process. How can we satisfy this demand without depleting our fossil fuel supply? Renewable energy may be our answer.[4] On January 28, 2003, in his State of the Union Address, President Bush stated: "In this century, the greatest environmental

[1] Univ. of St. Thomas Recycling Program, Quotations on Energy/Alternatives, http://www.stthomas.edu/recycle/ENERGY.htm (last visited Apr. 15, 2007).

[2] *See* Jean Agras & Jennifer Tripp, *New Generation Resource Needs: Beyond the Simple Formula*, ELECTRIC LIGHTS & POWER, Jan.–Feb. 2007, at 60, *available at* http://uaelp.pennnet.com/display_article/284512/34/ARTCL/none/none/New-Generation-Reource-Needs (noting that "[m]any regions within the U.S. are currently experiencing excess capacity due to the heavy build out of natural gas-fired capacity additions since 2000, while others are already struggling to meet peak demand"); *see also* Paul M. Grant et al., *A Power Grid for the Hydrogen Economy: Cryogenic Superconducting Conduits Could Be Connected into a "SuperGrid" That Would Simultaneously Deliver Electrical Power and Hydrogen Fuel*, 295 SCI. AM. 76, 78 (2006), *available at* http://www.sciam.com/article.cfm?chanID=sa006&colID=1&articleID=00003872-159C-1498-959C83414B7F0000 (explaining that superconducting lines "would allow power plants in different climate regions to bolster those struggling to meet peak demand").

[3] U.S. Dep't of Energy, Energy in the United States: 1635–2000, http://www.eia.doe.gov/emeu/aer/eh/elec.html (last visited Apr. 15, 2007).

[4] Renewable energy includes "solar, wind, biomass, ocean (including tidal, wave, current, and thermal), geothermal, and hydroelectric energy resources." Energy Policy Act of 2005, Pub. L. No. 109-58, § 201(a), 119 Stat. 594, 650 (to be codified at 42 U.S.C. § 15,851).

progress will come about not through endless lawsuits or command-and-control regulation, but through technology and innovation."[5] This Comment analyzes wave power, a renewable energy source with tremendous power generation potential.

Although renewable energy encompasses a wide variety of alternatives, harvesting wave energy may serve as a viable alternative source of electric power for coastal states such as Florida. Electric conversion of wave energy can be accomplished through the use of mechanical devices that either directly or indirectly drive a generator. In turn, this power is transported to shore via submerged cables and then connected to a power grid. This supply, coupled with today's technological advancements, may provide an endless source of energy for Florida.

This Comment evaluates why wave energy is a viable source of energy production and what steps must be taken to stimulate its development. It begins with an examination of the energy available from the sea, the various technologies available to capture this energy, and their relationship to the sustainability of electric power in Florida. Next, it examines the environmental benefits of wave power versus existing fuels, giving emphasis to the local political atmosphere in Florida. The Comment then discusses the legislative action that must be taken to encourage the development of wave farms and, finally, why consideration must be given to public concerns.

II. THE WAVE OF THE FUTURE

Florida currently generates only one percent of its energy from renewable sources.[6] By utilizing the nation's second longest coastline,[7] Florida has the opportunity to lead the nation in its movement toward the use of renewable energy. To do so, state government must first take action by passing new legislation mandating that at least twenty-five percent of the state's energy usage be derived from renewable sources by no later than 2012. The state should take affirmative action by using new technology to harvest the world's most readily available resource—the energy of the sea.

The World Energy Council has estimated that the world's waves have the potential to produce two terawatts per year, the equivalent of twice the world's electricity production.[8] While not all of this power can be harvested, preliminary surveys indicate that wave energy has a global potential of over

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[5] George W. Bush, President of the United States, State of the Union Address (Jan. 28, 2003).

[6] FLA. DEP'T OF ENVTL. PROT., FLORIDA'S ENERGY PLAN 15 (2006), *available at* http://www.dep.state.fl.us/energy/fla_energy/files/energy_plan_final.pdf [hereinafter ENERGY PLAN].

[7] The Florida coastline is 1,350 miles. It is second only to Alaska, which has 6,640 miles of coastline. Nat'l Atlas, Profile of the People and Land of the United States, http://nationalatlas.gov/articles/mapping/a_general.html (last visited Apr. 15, 2007).

[8] *See* Greenpeace Southeast Asia, Clean Energy Revolution: Be a Part of It!, http://www.greenpeace.org/seasia/en/asia-energy-revolution/solutions (last visited Apr. 15, 2007) (noting that two terawatts, which equals two trillion watts, "is equivalent to the energy produced by 2,000 large oil, gas, coal and nuclear power stations").

450,000 megawatts (MW), representing a market of more than $550 billion worldwide.[9]

Because Florida has 1,350 miles of coastline,[10] harvesting the energy of the sea is a practical way for the state to expand the use of renewable energy. In Florida's 2003 *Assessment of Renewable Electric Generating Technologies*, limited consideration was given to the power that could be harvested from the ocean waves.[11] In view of the fact that wave energy is one of the largest available renewable sources on Earth, it is imperative that future assessments of Florida's renewable sources include a more extensive evaluation of its potential.

To encourage technological developments, Florida's Department of Environmental Protection "is currently administering approximately $5 million in grant funding to advance renewable and emerging alternative energy technologies for electricity generation."[12] Additionally, the Florida Renewable Energy Technologies and Energy Efficiency Act, which became effective July 1, 2006, creates a renewable Energy Technologies Grants Program to provide matching grants for "demonstration, commercialization, research, and development projects relating to renewable energy technologies."[13]

III. WAVE TECHNOLOGY

Through technological advancements, many companies convert kinetic wave energy into mechanical energy that is used to drive a generator. This energy is then sent to the power grid via submerged transmission lines.[14] Today, there are a variety of prototypes in operation across the world including the "PowerBuoy," the "Monitor," and the "Pelamis" sea snake.

Ocean Power Technologies (OPT) utilizes independent ocean buoys to generate electricity.[15] Studies conducted by OPT indicate that installation of PowerBuoys in a 100 square mile farm off the coast of California is likely to produce enough electricity for the entire state of California.[16] This translates into providing power to a population of 40 to 50 million people.[17]

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[9] *New Technology Alert: Electricity from Ocean Currents*, SOLAR TODAY NEWS NETWORK, Apr. 27, 2000, http://www.solartoday.net/news/article.asp?id=899&ssectionid=6 (last visited Apr. 15, 2007).

[10] Nat'l Atlas, *supra* note 7.

[11] FLA. PUB. SERV. COMM'N, AN ASSESSMENT OF RENEWABLE ELECTRIC GENERATING TECHNOLOGIES FOR FLORIDA AND THE DEP'T OF ENVTL. PROT. 37–38, 51–52 (2003), *available at* http://www.floridapsc.com/publications/pdf/electricgas/Renewable_Energy_Assessment.pdf.

[12] ENERGY PLAN, *supra* note 6, at 45.

[13] FLA. STAT. ANN. § 377.804 (2006).

[14] Alice Hohler, *More Than Just a Ripple*, REFOCUS, Jan.–Feb. 2006, at 54, *available at* http://www.oceanpowertechnologies.com/PDF/ReFocus_Draper.pdf.

[15] Ocean Power Technologies, Frequently Asked Questions, http://www.oceanpower technologies.com/faq.htm (last visited Apr. 15, 2007).

[16] VIDEO (Discovery Channel Canada 2005), *available at* http://www.exn.ca/video/ ?video=exn20051114-buoy.asx.

[17] *Id.*

Demi-Tek Incorporated's "Monitor" hybrid tide, wave, and wind electrical generation system is currently in service off of the coast of Asbury Park, New Jersey.[18] This design uses an array of buoys to convert wave activity into electricity.[19] The compact system, only 12' x 20' x 40', is reported to produce one MW of power.[20] The energy produced is then used to supply power to a public boardwalk and convention center.[21]

The largest system in operation today is Ocean Power Delivery Limited's (OPD) innovation. In May 2005, Portugal began construction of the world's first commercial wave farm off the north coast of Portugal, near Póvoa de Varzim.[22] The OPD wave conversion system called "Pelamis" or "sea snake" is a 120-meter segmented cylinder that utilizes wave motion to produce electricity.[23] The initial phase of the wave farm includes installation of three Pelamis devices, with a capacity of 2.25 MW.[24] This stage of the project "is expected to meet the average electric demand of more than 1,500 Portuguese households."[25] If this initial stage performs satisfactorily, thirty more Pelamis machines are intended to be ordered for the farm to produce an additional capacity of twenty MW.[26] The project cost per MW is only about $472,000, and the total cost of the project is approximately $10.5 million.[27]

Unlike buoys, "[t]he Pelamis is a semi-submerged, articulated structure composed of cylindrical sections linked by hinged joints."[28] The hydraulic motors located inside the hinged joints drive electrical generators to produce electricity.[29] A single cable feeds power from all the joints to a seabed junction.[30] A single seabed cable can connect several devices together and link the structure to shore.[31] OPD research shows that sites best suited for this technology are locations where the waves have an average wave power level of fifteen kilowatts (kW) per meter.[32] Florida's Atlantic coastline is an ideal location for Pelamis since the average wave power is nineteen kW per meter.[33]

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18 Ocean Wave Energy Co., By Others, http://www.owec.com/byOTHERS.html (last visited Apr. 15, 2007).

19 *Id.*

20 *Id.*

21 *Id.*

22 Press Release, Ocean Power Delivery Ltd., Order Signed to Build World's First Wave Farm in Portugal (May 19, 2005), http://oceanpd.com/docs/OPD%20Enersis%20Press%20Release.pdf (last visited Apr. 15, 2007).

23 Ocean Power Delivery Ltd., The Pelamis Wave Energy Converter, http://www.oceanpd.com/Pelamis/default.html (last visited Apr. 15, 2007) [hereinafter Pelamis WEC].

24 Ocean Power Delivery Ltd., Production of the P1A Machines, http://www.oceanpd.com/Development/default.html (last visited Apr. 15, 2007).

25 *Id.*

26 Press Release, *supra* note 22.

27 *Id.*

28 Pelamis WEC, *supra* note 23.

29 *Id.*

30 *Id.*

31 *Id.*

32 Ocean Power Delivery Ltd., The Resource, http://www.oceanpd.com/Resource/default.html (last visited Apr. 15, 2007).

33 *Id.*

Although many may anticipate that the initial investment cost for many wave energy systems is more expensive than that of fossil fuel plants, wave energy systems have low operating costs once built and are competitive with other technologies when used as a primary source of power.[34] After all, they have no fuel costs.

Another advantage of this technology is its high energy density, making it well-suited for large-scale developments capable of generating multiple gigawatts of power.[35] Waves are more powerful and predictable than wind, and thus are potentially more useful in coastal states. To put this in perspective, "[s]ea water is 832 times as dense as air, providing a 5 knot ocean current with more kinetic energy than a 350 km/h wind."[36] Additionally, in areas where researchers conducted detailed examinations, the discovery of additional suitable sites suggests that the available kinetic energy in waves may be considerably larger.[37] The costs associated with wave energy systems, such as Ocean Power Technologies's PowerBuoys, range from three to four cents per kilowatt hour (kWh).[38] This is competitive with the cost of four to six cents per kWh associated with traditional fossil fuel plants.[39]

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[34] *Innovative Environmental Technologies: Field Hearing Before the S. Comm. on Env't & Pub. Works*, 107th Cong. 11, 46 (2002) (statement of George Taylor, CEO and President, Ocean Power Technologies).

[35] *New Technology Alert: Electricity from Ocean Currents*, SOLAR TODAY NEWS NETWORK, Apr. 27, 2000, *available at* http://www.solarquest.com/news/article.asp?id=899 The costs of harvesting wave energy are often compared to the costs associated with wind farms. The developments for wind energy are now reaching optimal production technologies, while the developments for wave energy are 15 to 20 years behind that of wind. Press Release, Or. State Univ. News & Commc'n Serv., Oregon Moving to Center of Wave Energy Development (Feb. 1, 2005), *available at* http://oregonstate.edu/dept/ncs/newsarch/2005/Feb05/waveenergy.htm. Wave energy, however, is available more than 80% of the time, compared with 40% or less from wind energy. *See Innovative Environmental Technologies: Field Hearing Before the S. Comm. on Env't & Pub. Works*, 107th Cong. 11, 47 (2002) (statement of George Taylor, CEO and President, Ocean Power Technologies) (estimating the availability of wave energy at 80% to 90%); FLA. PUBLIC SERV. COMM'N & DEP'T OF ENVTL. PROT., AN ASSESSMENT OF RENEWABLE ELECTRIC GENERATING TECHNOLOGIES FOR FLORIDA 51 (2003), *available at* http://www.psc.state.fl.us/publications/pdf/electricgas/Renewable_Energy_Assessment.pdf [hereinafter FLORIDA PSC] (noting estimates of the capacity factors of wind turbines to vary between 5% and 40%); Lee Sherman, *Sea Power: OSU Engineers Are Working with Coastal Communities to Tap Offshore Energy*, TERRA, Spring 2006, at 5, *available at* http://oregonstate.edu/terra/2006spring/includes/2006spring.pdf (explaining how using more energy-dense sources leads "to more efficient scheduling for other energy sources on the grid"). This disparity in energy availability is due to the fact that energy production via wind farms is highly dependent on the wind velocity at the site. FLORIDA PSC, *supra.* Florida's average wind speed is only 12 to 14 miles per hour, translating into a 5% capacity factor and resulting in a cost of 57 cents per kilowatt hour. *Id.* Despite wind power's low ranking for Florida, it is feasible in many other states, as proven by the national range of 9 to 16 cents per kilowatt hour. Ocean Power Technologies, Technology Comparison, http://www.oceanpowertechnologies.com/compare.htm (last visited Apr. 15, 2007) [hereinafter Technology Comparison]. However, some research indicates that in the future the use of wind power may be a more viable option for Florida due to expected technology advancements. Press Release, *supra.*

[36] *New Technology Alert*, *supra* note 35.

[37] *Id.*

[38] Technology Comparison, *supra* note 35.

[39] Nuclearinfo.net, Everything You Want to Know About Nuclear Power,

Employment of these technologies off the Florida coast is likely to serve a key role in the environmental sustainability of the state.[40] If Floridians continue to live with today's comforts and the state continues to accommodate rapid growth without these technologies, future generations may have a poorer quality of life. Today's society, in the interest of fairness and justice, should take steps to embrace the use of new technology and continue pressing forward with innovative ideas. While tremendous potential exists for the use of wave energy worldwide, ocean power technology is superbly practical in Florida due to the state's extensive coastline. For decades the waves of Florida have supported state economics by attracting millions of tourists to the state each year.[41] These waves are able to provide Floridians a clean source of power at a very low cost. The examples above show that this technology is available and ready to be utilized. To embrace sustainability for Florida, the state cannot overlook the renewable resource of wave energy. The waves are persistently knocking at Florida's door—will someone answer?

IV. WHY WAVES?

While energy benefits are obvious, environmental benefits are an equally important reason to support and develop power production via wave energy. Certainly the number one reason for harvesting wave energy is that it is a truly clean source of power. Because offshore wave farms produce zero emissions, developing such farms could prove a big win for the environment.

Florida's projected electricity generating demand is expected to increase by about fifty-eight percent between 2002 and 2020.[42] A typical Florida home consumes about one megawatt hour (MWh) per month, while its electricity demand averages about 0.0014 MW (1.4 kW).[43] The 2000 census reported more than 6.3 million households in Florida,[44] and "[a]ccording to a

http://www.nuclearinfo.net/Nuclearpower/WebHomeComparisonOfEnergySources (last visited Apr. 15, 2007).

[40] "Sustainability can be defined simply as meeting contemporary needs without compromising the ability of future stakeholders to satisfy their needs." Univ. of Fla. Office of Sustainability, What Is Sustainability?, http://www.succeednow.org/sustain/whatis.html (last visited Apr. 15, 2007).

[41] In 2005, Florida had approximately 84.6 million visitors. Visit Florida, Research, http://media.visitflorida.org/about/research/ (last visited Apr. 15, 2007).

[42] ENERGY PLAN, *supra* note 6, at 13.

[43] FLORIDA PSC, *supra* note 35, at 1 n.1

> A megawatt (MW = 1000 kilowatts) is a measure of real power at any instant in time or, in other words, a measure of demand on the grid at any moment in time. Megawatt hours (MWhs) are a measure of the MWs demanded aggregated over some time interval and thus represents the amount of electric energy consumed.

Id.

[44] RAND Florida, Census 2000: State Summary Statistics, http://fl.rand.org/stats/census/census2000.html (under "States A–M" select "Florida" and under "Household" select "Household by Type, Total households," then select "Submit") (last visited Apr. 15, 2007).

2001 study by the United States Energy Information Administration, Florida ranks third nationally in total energy consumption."[45]

V. THE "EVILS" OF FOSSIL FUELS

Traditional power plants pollute the environment by spewing particulate matter, sulfur dioxide (SO_2), nitrogen oxides (NO_x), mercury (Hg), and carbon dioxide (CO_2), along with other contaminants, into the air we breathe. The environmental effects of these pollutants include the formation of acid rain, smog, and haze, and many of these pollutants contribute to global warming.[46] The public health effects of such pollutants include causation of asthma, heart attacks, respiratory damage, and premature death.[47] Studies show that "[t]he average number of life-years lost by individuals dying prematurely from exposure to particulate matter is 14 years."[48]

Acid rain is formed when SO_2 and NO_x react with water and oxygen to form acidic compounds.[49] These acidic compounds return to the earth in the form of gas, particles, rain, snow, or fog.[50] Smog is a haze that often appears over cities in summertime and impairs visibility.[51] Ground-level ozone is the main component of smog and is formed when NO_x reacts with other air-borne chemicals, especially in strong sunlight.[52] Additionally, scientists report that in the past century, the temperature of the Earth's surface has risen about one degree Fahrenheit.[53] Evidence suggests that this temperature rise is the result of greenhouse gases in the atmosphere, primarily CO_2, methane, and NO_x.[54]

One national organization campaigning for public education on global warming notes that "EPA's own consultants estimate that fine particle pollution from power plants shortens the lives of 1,416 Floridians each year" and "causes 155,908 lost work days, 1,367 hospitalizations and 28,321 asthma attacks every year, 1,219 of which are so severe they require emergency room visits."[55] Moreover, "[b]ased on EPA data, each year, 183 lung cancer

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45 ENERGY PLAN, *supra* note 6, at 13; Energy Info. Admin., State Energy Consumption, Price, and Expenditure Estimates (SEDS), http://www.eia.doe.gov/emeu/states/_seds.html (under "State Rankings, 2003" select "All Sectors and Total Consumption") (last visited Apr. 15, 2007).

46 U.S. Envtl. Prot. Agency, Clean Air Markets: Environmental Issues, http://www.epa.gov/airmarkets/envissues/index.html (last visited Apr. 15, 2007).

47 CONRAD G. SCHNEIDER, CLEAR THE AIR, DIRTY AIR, DIRTY POWER: MORTALITY AND HEALTH DAMAGE DUE TO AIR POLLUTION FROM POWER PLANTS 4 (Maria Padian ed., 2004), *available at* http://www.cleartheair.org/dirtypower/docs/dirtyAir.pdf.

48 *Id.* at 12.

49 U.S. Envtl. Prot. Agency, *supra* note 46.

50 *Id.*

51 *Id.*

52 *Id.*

53 *Id.*

54 *Id.* (stating generally that "[g]reenhouse gases trap heat that would normally escape back into the atmosphere, thus increasing the Earth's natural greenhouse effect and increasing temperature over time").

55 Clear the Air, Florida's Dirty Power Plants, http://www.cleartheair.org/regional/fl/ (last

deaths and 2,145 heart attacks in Florida are attributable to power plant pollution."[56] Consequently, due to the risks of mercury contamination, Florida has advised against consumption of fish from all of its rivers, lakes, and coastal miles.[57]

The U.S. Department of Energy has developed the Clean Coal Power Initiative program in the hopes of providing customers with power generation that is "reliable, low-cost, environmentally-sound, and efficient."[58] In 2005, as provided by this program, Curtis Stanton Energy, located near Orlando, Florida, was selected as the location to be used for the construction of a full-scale Integrated Gasification Combined Cycle (IGCC) demonstration plant.[59] The unit is expected to generate between 285 MW and 330 MW and to cost $557 million, which is equivalent to between $1.69 million and $1.95 million per MW.[60] The Department of Energy awarded a $235 million dollar grant to the Southern Company (the number-one utility emitter of NO_x, SO_2 and CO_2 in 1999)[61] in partnership with the Orlando Utilities Commission and Kellogg, Brown, and Root, to develop the IGCC plant.[62]

Although this project provides environmental improvements, the "clean coal" plant will not completely prevent dangerous emissions.[63] In 2005, Curtis Stanton's existing unit 1 belched 6440 tons of NO_x, 6059 tons of SO_2, 64 tons of particulate matter and 320 tons of CO into the air of central Florida.[64] Unit 2 emitted 2533 tons of NO_x, 2764 tons of SO_2, 77 tons of particulate matter, and 373 tons of CO.[65] While IGCC technology lowers the amount of emissions, the

visited Apr. 15, 2007).

[56] *Id.*

[57] *Id.* "Mercury is a toxic heavy metal, which, when ingested, can cause serious neurological damage, particularly to developing fetuses, infants, and children." *Id.* 41% of the total mercury emitted by all known United States sources is the result of power plant emissions. *Id.*

[58] Notice of Intent to Prepare an Environmental Impact Statement for the Orlando Gasification Project, 70 Fed. Reg. 46,825-02, 46,826 (Aug. 11, 2005); *see also* U.S. DEP'T OF ENERGY, FINANCIAL ASSISTANCE ANNOUNCEMENT OF FUNDING OPPORTUNITY: CLEAN COAL POWER INITIATIVE 3 (2004), *available at* http://e-center.doe.gov/iips/faopor.nsf/UNID/16E69F35C09AECC285256E3900734147/$file/04NT42061r3.doc (stating that "[u]nder CCPI, the Government and industry would collaborate to demonstrate advanced coal-based, power generation technologies that reduce barriers to continued and expanded coal use and that affirm technology readiness for widespread commercial deployment to provide clean, reliable, and affordable electricity").

[59] Notice of Intent to Prepare an Environmental Impact Statement for the Orlando Gasification Project, 70 Fed. Reg. at 46,826.

[60] *Id.*

[61] Press Release, Clear the Air, New Campaign Calls on Southern Company to Be Clean Air Leader, Not an Obstacle (Apr. 3, 2001), *available at* http://www.cleartheair.org/proactive/newsroom/release.vtml?id=19880.

[62] Press Release, U.S. Dep't of Energy, DOE Awards $235 Million to Southern Company to Build Clean Coal Plant (Feb. 22, 2006), *available at* http://www.energy.gov/news/3241.htm.

[63] *See* Notice of Intent to Prepare an Environmental Impact Statement for the Orlando Gasification Project, 70 Fed. Reg. at 46,827 (noting that the project would minimize but not fully remove sulfur dioxide, nitrogen oxides, mercury, and particulate emissions).

[64] FLA. DEP'T OF ENVTL. PROT., 2005 ANNUAL OPERATING REPORT FOR AIR POLLUTANT EMITTING FACILITY 5, 9–10 (2005), *available at* http://www.floridadep.org/air/forms/aor/dep62_210_900(5).pdf.

[65] *Id.* at 31, 35–37.

facility may still emit 5% SO_2, 1% NO_x, 10% Hg, 75% CO_2, and 0.1% particulates when compared to existing coal-fired plants that use coal containing up to 0.4% sulfur.[66] This facility will be constructed on an existing power plant site that houses two coal-fired units, each rated at approximately 465 MW, and a natural gas fired combined cycle unit rated at approximately 633 MW.[67]

VI. GLOBAL WARMING

Through the Kyoto Protocol, more than 160 countries committed to reducing greenhouse gases by 2012.[68] Carbon dioxide (CO_2) is one of the greenhouse gases known to contribute to global warming.[69] CO_2 emissions are not currently regulated at the federal level, and between 1990 and 2004 they increased twenty-seven percent.[70] In a parallel trend, from 1995 to 2000, the CO_2 emissions from the 500 most polluting power plants in the United States rose eight percent, representing a total increase of 175 million tons.[71] The new IGCC plant in Orlando is expected to reduce CO_2 emissions by only twenty-five percent.[72] This small reduction is simply not enough.

In 2003, the Environmental Protection Agency determined that the Clean Air Act[73] does not authorize CO_2 regulation in *Connecticut v. American Electric Power Co.*[74] In response to this lack of regulation, in 2005, various

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66 Notice of Intent to Prepare an Environmental Impact Statement for the Orlando Gasification Project, 70 Fed. Reg. at 46,827.

67 *Id.* at 46,826.

68 U.S. DEP'T OF ENERGY, IMPACTS OF THE KYOTO PROTOCOL ON U.S. ENERGY MARKETS AND ECONOMIC ACTIVITY at iii (1998), *available at* http://tonto.eia.doe.gov/FTPROOT/service/oiaf9803.pdf. The report notes:

> From December 1 though 11, 1997, more than 160 nations met in Kyoto, Japan, to negotiate binding limitations on greenhouse gases for the developed nations, pursuant to the objectives of the Framework Convention on Climate Change of 1992. The outcome of the meeting was the Kyoto Protocol, in which the developed nations agreed to limit their greenhouse gas emissions, relative to the levels emitted in 1990. The United States agreed to reduce emissions from 1990 levels by 7 percent during the period 2008 to 2012.

Id.

69 U.S. Envtl. Prot. Agency, *supra* note 46.

70 NATURAL RES. DEF. COUNCIL, BENCHMARKING AIR EMISSIONS OF THE 100 LARGEST ELECTRIC POWER PRODUCERS IN THE UNITED STATES—2004, at 2 (2006), *available at* http://www.nrdc.org/air/pollution/benchmarking/2004/benchmark2004.pdf (citing ENERGY INFO. ADMIN., EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2004, at xiii (2005), *available at* http://www.eia.doe.gov/oiaf/1605/gg05rpt/pdf/057304.pdf). This "[b]enchmarking report facilitates the comparison of emissions performance by combining generation data compiled by the [Energy Information Administration] with emissions data on sulfur dioxide (SO_2), oxides of nitrogen (NOx), mercury (Hg), and carbon dioxide (CO_2) compiled by EPA." NATURAL RES. DEF. COUNCIL, *supra*, at v.

71 REBECCA STANFIELD, DARKENING SKIES: TRENDS TOWARD INCREASING POWER PLANT EMISSIONS 1 (Apr. 4, 2002), *available at* http://floridapirg.org/reports/darkeningskies/darkeningskiespdf.pdf.

72 Notice of Intent to Prepare an Environmental Impact Statement for the Orlando Gasification Project, 70 Fed. Reg. 46,825, 46,827 (Aug. 11, 2005).

73 42 U.S.C. §§ 7401–7671q (2000).

74 Connecticut v. Am. Elec. Power Co., 406 F. Supp. 2d 265, 269–70 (S.D.N.Y. 2005) (citing

states and non-profit land trusts sued five electric utilities "for abatement of public nuisance of global warming."[75] The purpose of *American Electric Power Co.* was to encourage the courts to establish CO_2 limitations on the five largest emitters of carbon dioxide in the United States, one of which is the Southern Company.[76] Unfortunately, the district court held that the suit raised non-justiciable political questions beyond the limits of the court's jurisdiction.[77] The court found that "Congress has recognized that carbon dioxide emissions cause global warming and that global warming will have severe adverse impacts in the United States, but it has declined to impose any formal limits on such emissions."[78] The court recognized that Congress, due to concerns over potential economic burdens, "passed a series of bills that affirmatively barred the EPA from implementing the [Kyoto] Protocol."[79]

Not only are wave farms more economical than fossil fuels; their benign environmental effects are priceless. It is essential that Florida lead the nation by protecting the environmental health of the state as well as the public health of all its citizens by changing existing power production habits. Wave power is economically feasible, and awarding federal and state grants for accelerated commercial deployment of wave to energy facilities can encourage its development. When consideration is given to Florida's extensive coastline and its high demand for power, it is obvious that the benefits of harvesting wave energy far outweigh those associated with either traditional coal and gas power plants or those associated with "clean coal" technology.

VII. "NO TO COAL"

Despite the need for increased power production due to population growth, proposed construction of traditional coal and gas-fired power plants often meets with opposition from the customers they attempt to serve. The following examples illustrate the entrenched opposition to coal-burning energy sources.

A glimpse into the history of Gainesville Regional Utilities (GRU) exemplifies the problems that power production facilities face across the nation. During 2003, in Alachua County, Florida, GRU undertook preparations to meet its consumers' increasing demand for power.[80] GRU's proposed

Control of Emissions from New Highway Vehicles and Engines, 68 Fed. Reg. 52,922, 52,925 (Sept. 8, 2003)).

75 *Am. Elec. Power Co.*, 406 F. Supp. 2d at 265.

76 *Id.* at 268. The complaints named American Electric Power Company, Inc., the Southern Company, Tennessee Valley Authority, Xcel Energy Inc., and Cinergy Corporation as the five largest emitters of carbon dioxide in the United States. *Id.* at 267.

77 *Id* at 265.

78 *Id.* at 268–69.

79 *Id.* at 269.

80 DIAN DEEVEY & DAVID HARLOS, ALACHUA COUNTY ENVTL. PROT. ADVISORY COMM., REVIEW OF THE GAINESVILLE REGIONAL UTILITIES' PROPOSAL FOR A NEW COAL-FIRED POWER PLANT 1-1 (2005), *available at* http://www.alachuacounty.us/assets/uploads/images/EPD/Natural/EPAC_Review_of_Coal_Power_Plant.pdf [hereinafter ALACHUA EPAC]. Gainesville Regional Utilities is a

solution included the construction of a 220 MW coal-fired power plant.[81] Citizens in Alachua County and the Alachua County Environmental Protection Advisory Committee (EPAC) quickly opposed it, and the county authorized a review of the proposal.[82]

In September 2005, after reviewing "the potential adverse health effects of air pollution from GRU's existing and proposed generators," EPAC concluded that "[t]he most serious adverse air pollution effects are from fine particles emitted directly from the stacks and those produced in the atmosphere from sulfur and nitrogen gas emissions."[83] These primary and secondary particulates "are collectively called $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter)."[84] EPAC explained that $PM_{2.5}$ are well known to cause heart attacks, asthma attacks, episodes of difficult breathing among residents with emphysema or other chronic respiratory problems. Increased death rates from respiratory and cardiovascular disease, increased hospitalizations, and increased or more intense symptoms of respiratory or cardiovascular distress have all been associated with short-term exposures to elevated $PM_{2.5}$ well below the concentrations allowed by existing ambient air quality standards. Children, the elderly, asthmatics and those with other pre-existing diseases such as diabetes are more vulnerable to fine particulate pollution than other segments of the population.[85]

Alachua County residents who shared these environmental concerns joined together to create Citizens for Affordable and Renewable Energy (CARE).[86] CARE voiced its opposition to the power plant both by making presentations and by filling the audience at commission meetings with opponents in quiet protest.[87] In February 2006, CARE started a petition to allow residents to decide in the November 2006 election whether or not the plant will be built.[88]

Similarly, citizens formed a "Keep Madison Clean" coalition to oppose Jacksonville Electric Authority's proposal to construct an 800 MW coal-fired power plant in Madison County, Florida.[89] The coalition feared environmental

municipally-owned power generation facility. Gainesville Regional Utilities, About Gainesville Regional Utilities, http://www.gru.com/AboutGRU/default.jsp (last visited Apr. 15, 2007).

81 *Id.*

82 *Id.*

83 *Id.* at 1-5.

84 *Id.* The Clean Air Act currently requires all $PM_{2.5}$ nonatttainment areas and eight-hour ozone nonattainment areas to meet air quality standards by 2010. Clean Air Act, §§ 171–85B, 42 U.S.C. §§ 7501–11f (2000); 40 C.F.R §§ 52, 81 (2006).

85 ALACHUA EPAC, *supra* note 80, at 1-5.

86 Rob Brinkman, *Put Polluting Power Plant Choice to a Vote, Group Says*, GAINESVILLE IGUANA, Feb. 2006, *available at* http://www.afn.org/~iguana/archives/2006_02/20060201.html.

87 Rob Brinkman, *New $550M Coal Plant? Citizen Group Urges Cleaner Alternatives*, GAINESVILLE IGUANA, May–June 2005, *available at* http://www.afn.org/~iguana/archives/2005_05/20050501.html.

88 Jessica Riffel, *Petition Started to Protest New Coal Plant in Gainesville*, INDEP. FLA. ALLIGATOR ONLINE, Feb. 20, 2006, http://www.alligator.org/pt2/060220coal.php (last visited Apr. 15, 2007)

89 Press Release, Keep Madison Clean, Coal-Fired Power Plant Not Welcome in Madison County (Sept. 7, 2005), http://www.bigbendcat.org/MadisonCountyNo-To-Coal.htm (last visited

degradation and adverse health effects resulting from potential emissions generated by the plant.[90] Through the coalition, citizens articulated their desire to "be more progressive" and teach others to use alternate energy.[91] Medical specialists in asthma, pulmonary, and pediatric medicine and the American Lung Association issued public statements opposing coal-fired plants.[92] In September 2005, the Madison County Commission passed a resolution opposing the construction of the proposed plant.[93]

Likewise, on October 3, 2005, the Board of County Commissioners of nearby Wakulla County passed a resolution opposing the potential construction of a coal-fired power plant.[94] The Wakulla resolution conveys the county's opposition to construction of a power plant within either the environs of Wakulla or in nearby counties.[95]

VIII. "NO TO GAS & OIL"

Even "clean" fossil fuel is not without its opponents. Historically, Floridians have not only fought the construction of coal-burning power plants but have also battled proposed oil and gas exploration. Power plants using natural gas for energy production produce thirty-nine percent of Florida's electric generating capacity.[96] Not surprisingly, as a result of increased natural gas prices, Florida utilities continue to increase the rate for customers.[97] In the past, Florida's citizens have refused to permit oil and gas exploration off of the coast, and on February 1, 2006, Florida's United States senators introduced the Permanent Protection for Florida Act, which would create a no-drilling zone extending 260 miles off Tampa Bay and 150 miles off Pensacola and Florida's east coast.[98] Those who support off-shore drilling may do so because they seek freedom from foreign oil. However, the desire for freedom from reliance on foreign fossil fuels is arguably better achieved with wave energy than with offshore drilling from both an economic and an environmental perspective.

Apr. 15, 2007).

90 *Id.*

91 *Id.*

92 Wakulla County Comm'n, Resolution, http://www.bigbendcat.org/WakullaCountyNo-To-Coal.htm (last visited Apr. 15, 2007).

93 *Id.*

94 *Id.* (stating that pollutants from coal-fired power plants present a danger of damaging the Wakulla River ecosystem and noting that the Florida Medical Association adopted policies articulating specific heath hazards of environmental mercury).

95 *Id.*

96 ENERGY PLAN, *supra* note 6, at 15.

97 Gainesville Reg'l Utilities, Conservation Can Offset Rise in Electric Bills, http://www.gru.com/AboutGRU/NewsReleases/Archives/Articles/news-2005-12-30.jsp (last visited Apr. 15, 2007) (stating that Gainesville Regional Utilities planned to increase the customer rate in January 2006 as a direct result of increased natural gas prices).

98 S. 2239, 109th Cong. § 2 (2006).

IX. "JUST CONSERVE"

In a 2001 statement, Florida Governor Jeb Bush said that "the cheapest, easiest and fastest kilowatt we generate is the one we can save through efficiencies."[99] The costs associated with power generation can be significantly reduced through active conservation programs. However, in explaining why "conservation and energy efficiency programs are rarely greeted with enthusiasm by utility managers, owners, or even by city governments that own utilities" the Alachua County EPAC notes that utility owners' and managers' ability to gain enough revenue to cover fixed costs and to reap a profit is based on the volume of electricity sales.[100]

X. FEDERAL MANDATES

When investor-owned utilities are driven by profits, how can citizens demand continued movement in the direction of renewable energy? If utilities will not do it on their own, mandate it! On August 8, 2005,

> President Bush signed into law the first national energy plan in more than a decade. The President's national energy plan will encourage energy efficiency and conservation, promote alternative and renewable energy sources, reduce our dependence on foreign sources of energy, increase domestic production, modernize the electricity grid, and encourage the expansion of nuclear energy.[101]

The federal Energy Policy Act of 2005[102] requires the Energy Secretary to conduct an annual assessment of renewable energy resources.[103] This assessment will include an evaluation of renewable energy including that derived through harvesting wave energy.[104] The assessment must also consider changing market conditions as well as the development of new

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99 Jeb Bush, Governor of Florida, Address at the "Powering the Future Energy Conference" (Aug. 19, 2001), *in* FLA. ENERGY 2020 STUDY COMM'N, FLORIDA . . . ENERGYWISE!: A STRATEGY FOR FLORIDA'S ENERGY FUTURE 119 (2001), *available at* http://www.dep.state.fl.us/energy/fla_energy/files/05forum_2020Commission.pdf.

100 ALACHUA EPAC, *supra* note 80 at 1-4.

101 Press Release, The White House, Fact Sheet: President Bush Signs into Law a National Energy Plan (Aug. 8, 2005), *available at* http://www.whitehouse.gov/news/releases/2005/08/20050808-4.html.

102 Energy Policy Act of 2005, Pub. L. No. 109-58, § 201(a), 119 Stat. 594, 650 (to be codified at 42 U.S.C. § 15,851).

103 *Id.* Section 201 on "Assessment of Renewable Energy Resources" provides:

> a) Resource Assessment.—Not later than 6 months after the date of enactment of this Act, and each year thereafter, the Secretary shall review the available assessments of renewable energy resources within the United States, including solar, wind, biomass, ocean (including tidal, wave, current, and thermal), geothermal, and hydroelectric energy resources, and undertake new assessments as necessary, taking into account changes in market conditions, available technologies, and other relevant factors.

Id.

104 *Id.*

available technologies.[105] Additionally, the 2005 Energy Policy Act establishes a goal of twenty-five percent or more improvement in energy use efficiency by 2012 compared to the year 1990.[106] This encourages the development of new technologies so that the goal can be reached or exceeded.

Are goals enough? It is doubtful. The goals of the 2005 Energy Policy Act should be mandated. Furthermore, the act should require each state to conduct annual assessments and establish its own measurable mandates.

It is time to correct the legislative mistakes made over the past ten years. In 1992, President George Bush signed the United Nations Framework Convention on Climate Change,[107] "which brought together a coalition of countries to work toward a coordinated approach to the international issue of global warming."[108] In 1997, President Clinton signed the Kyoto Protocol, but "the Senate . . . expressed misgivings over the prospect that the potential economic burdens of carbon dioxide reductions would be shouldered exclusively by developed nations, such as the United States."[109] Today we are left with the mere goals described in the 2005 Energy Policy Act. These goals must become mandates.

XI. STATE LEGISLATION

By January 2003, eleven states had Renewables Portfolio standards in place, but only two states had established purchase mandates.[110] These thirteen states have taken steps in the right direction, but none have the defined goal or mandate of twenty-five percent improvement by the year 2012 as iterated in the 2005 Energy Policy Act.[111] Regrettably, as of March 2006, Florida had not established any clearly defined goal or mandate to mirror the federal act.

The Florida Public Service Commission and the Department of Environmental Protection have noted that, "since the 1970's, the State of Florida has enacted at least twelve laws and numerous rules intended to promote the growth and development of renewable energy."[112] In announcing

105 *Id.*

106 *Id.* § 123(b). Section 364 was amended to read as follows:

> Each State energy conservation plan with respect to which assistance is made available under this part on or after the date of enactment of the Energy Policy Act of 2005 shall contain a goal, consisting of an improvement of 25 percent or more in the efficiency of use of energy in the State concerned in calendar year 2012 as compared to calendar year 1990, and may contain interim goals.

Id.

107 United Nations Convention on Climate Change, Dec. 6, 1992, 1771 U.N.T.S. 107.

108 Connecticut v. Am. Elec. Power Co., 406 F. Supp. 2d 265, 269 (S.D.N.Y. 2005).

109 *Id.;* S. Res. 98, 105th Cong. § x (1997) (resolving by vote of 95–0 to urge the President not to sign any agreement that would result in serious harm to the economy or that did not include provisions regarding the emissions of developing nations).

110 FLA. PUB. SERV. COMM'N, *supra* note 11, at 76 app.B.

111 *Id.*

112 FLA. PUB. SERV. COMM'N, *supra* note 11, at 65.

the unveiling of one of these laws, the Department of Environmental Protection promoted the 2006 Florida Energy Act as action that "encourages and supports market-based development of reliable and cost-effective energy alternatives."[113] Furthermore, "[i]nstead of mandates and taxes, the Governor's strategy uses targeted incentives and government purchasing power to stimulate the free market and shape new technologies."[114] This act certainly presents incentives for the use and development of new technologies. The question that begs asking, however, is, "where is the meat?" Without clearly defined goals or legislative mandates, private industries use their own discretion to decide if it is in the company's interest to pursue alternative energy sources. In most cases, profit-driven corporations will consider their own interests prior to taking action to advance the interests of the state. Without legislative guidance, it is difficult to "sell" conservation and the pursuit of renewable energy to big business.

Governor Jeb Bush signed the Florida Renewable Energy Technologies and Energy Efficiency Act[115] into law on June 19, 2006. This act created the nine-member Florida Energy Commission.[116] The commission will review the state energy policy and, "based on the guiding principles of reliability, efficiency, affordability, and diversity . . . recommend to the Legislature any additional necessary changes or improvements" by December 31, 2007.[117] Because Florida currently generates only one percent of its energy from renewable sources,[118] the council should recommend legislation that clearly defines Florida's desire to use renewable energy. This can be accomplished by either mandates or goals, but affirmative action must be taken to establish an expectation that at least twenty-five percent of Florida energy usage will be derived from renewable sources no later than the year 2012. This action must encourage the development of innovative technology that utilizes the natural resources of the state, such as wave energy farms. Governor Jeb Bush has previously stated, "By establishing Florida as the center for this 'next generation' energy technology, we are encouraging new corporate investment, creating new jobs and protecting the state's air quality."[119] It is now time for Florida's state government to take affirmative action by passing new legislation.

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113 Press Release, Fla. Dep't of Envtl. Prot. Press Office, Governor Bush Unveils 2006 Florida Energy Act (Feb. 2, 2006), *available at* http://www.dep.state.fl.us/secretary/news/2006/02/0202_03.htm.

114 *Id.*

115 Florida Renewable Energy Technologies and Energy Efficiency Act, FLA. STAT. §§ 377.801–377.806 (2006); Press Release, Fla. Dep't of Envtl. Prot., Governor Signs Historic Energy Legislation, Launches Tampa's First Ethanol Production Facility (June 19, 2006), *available at* http://www.dep.state.fl.us/secretary/news/2006/06/0619_02.htm.

116 FLA. STAT. § 377.901 (2006).

117 *Id.* § 377.901(5), (6)(b).

118 ENERGY PLAN, *supra* note 6, at 15.

119 Press Release, Florida Dep't of Envtl. Prot., Governor Bush Unveils Hydrogen Energy Technologies Act and Breaks Ground on Florida's First Hydrogen Energy Station (Feb. 18, 2005), *available at* http://www.dep.state.fl.us/secretary/news/2005/02/0218_01.htm (Governor Jeb Bush discussing the Hydrogen Energy Technology Act, specifically in regard to emerging energy technology).

XII. PURCHASING WAVE POWER

The federal government, through the Public Utility Regulatory Policies Act (PURPA),[120] is involved with state rate policies for energy producing facilities.[121] PURPA encourages alternative energy sources by exempting them from many federal and state utility regulations.[122] PURPA also requires that power from small renewable sources be purchased at the avoided cost for the utility.[123] Application of PURPA to wave energy farms means that the electricity produced by such facilities can be purchased by larger utilities at a rate equivalent to the avoided cost.

Gainesville Utilities Department v. Florida Power Corp.[124] addressed the issue of which utility will benefit from emergency interconnects between small electric utilities and large power corporations. In that case, GRU sought an interconnection with Florida Power Corp. (Florida Power) for emergency purposes.[125] After hearings, the Federal Power Commission entered an order requiring the interconnection to be made.[126] The commission directed GRU to pay the entire cost of the interconnection and established specific rates to be paid by each utility for actual energy transfers across the interconnection.[127]

Florida Power appealed the order on the basis that only the small utility would benefit from such an interconnection and should therefore be required to pay an annual fee to the large utility.[128] Although the Fifth Circuit Court of Appeals denied enforcement of the commission's order, the Supreme Court held that the order was valid and must be enforced.[129] The Court stated that there was substantial evidence to support the commission's finding that the large utility would benefit from the interconnection with the small energy

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120 Public Utility Regulatory Policies Act of 1978, Pub. L. 95-617, 92 Stat. 3119 (codified as amended in scattered sections of 15, 16, 30, 42, & 43U.S.C.)

121 16 U.S.C. § 2601 (2000); *see also* AMY ABEL & JON SHIMABUKURO, CONGRESSIONAL RESEARCH SERV., REPORT RS20146: ELECTRICITY RESTRUCTURING BILLS: A COMPARISON OF PURPA PROVISIONS 2 (1999), *available at* http://www.ncseonline.org/nle/crsreports/energy/eng-50.cfm (noting that "PURPA established several major modifications in the economic regulation of electric power facilities and substantially injected the federal government as a regulator into the domain of the economic electric power regulation formerly held by the states").

122 *See* ABEL & SHIMABUKURO, *supra* note 121, at 2 (noting that "[t]he original intent of § 210 of PURPA was to encourage alternative sources of electricity beyond traditional generation facilities, without these facilities being subject to all existing federal and state regulations").

123 16 U.S.C. § 824a–3(b) (2000).

> PURPA shifted the price basis for wholesale electricity from the seller's cost to the purchaser's cost. PURPA indicates that [qualifying facilities'] power is to be purchased at the 'incremental cost' of alternative energy to the utility. This rate, referred to as the avoided cost, is the likely costs for both energy and facilities that would have been incurred by the purchasing utility if that utility had to provide its own generating capacity.

ABEL & SHIMABUKURO, *supra* note 121.

124 402 U.S. 515 (1971).

125 *Id.* at 521.

126 *Id.* at 522.

127 *Id.*

128 *Id.*

129 *Id.* at 525–26, 528–29.

facility in the form of increased reliability of service to certain customers, availability of additional reserve capacity during certain periods, and savings from coordinated planning as to efficient use of generating equipment.[130]

While PURPA requires energy produced from small power facilities to be purchased at its "full avoided cost," case law has established that large power industries receive a benefit from small energy facilities. As such, large industries cannot prevent small facilities from entering into the energy marketplace. By utilizing these regulations in conjunction with case law precedent, small wave-to-energy facilities are guaranteed a customer base in Florida.

XIII. PERMITTING AUTHORITY

A. State Permits

Harvesting the energy from ocean waves is beneficial to the public because it provides a supply of clean power to the state. One of the obstacles facing ocean energy planners is environmental permitting. Site certification can provide proposed facilities with a streamlined application process in order to achieve compliance with multiple regulatory agencies. The State of Florida's Siting Coordination Office (SCO) coordinates the permitting for any electrical power plant that generates seventy-five MW or more in capacity.[131] The SCO works in conjunction with the Office of General Counsel to issue site certifications and perform the administrative and legal tasks of the coordination process.[132] The Governor and cabinet, however, issue the actual license.[133]

State statutes define the terms "permit" and "certification."[134] Permits authorize construction or operation of a facility that may cause harm to the public health or environment.[135] Governed by statutory and regulatory standards and criteria, permits are "media specific, valid for a fixed duration, and issued by an Agency Head."[136] A facility may be required to obtain state, regional, and local permits.[137]

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130 *Id.* at 527.

131 The SCO is located within the Department of Environmental Protection. Fla. Dep't of Envtl. Prot., Siting Coordination, http://www.dep.state.fl.us/siting/default.htm (last visited Apr. 15, 2007). The Florida Electrical Power Plant Siting Act governs selection and use of sites for electrical generation facilities. FLA. STAT. §§ 403.501–403.518 (2006). The act does "not apply to any electrical power plant . . . of less than 75 megawatts in capacity . . . unless the applicant has elected to apply for certification of such plant . . . under this act.". *Id.* § 403.506.

132 Fla. Dep't of Envtl. Prot., *supra* note 131. *See generally* FLA. STAT. § 403.504 (2006) (enumerating the Department of Environmental Protection's powers and duties in relation to the Florida Electrical Power Plant Siting Act); FLA. ADMIN. CODE ANN. r. 62-17.011–760 (1999) (containing electrical power plant siting regulations implementing the act).

133 Fla. Dep't of Envtl. Prot., *supra* note 131.

134 Fla. Dep't of Envtl. Prot., Siting Coordination, Frequently Asked Questions, http://www.dep.state.fl.us/siting/Highlights/FAQs.htm (last visited Apr. 14, 2007).

135 *Id.*

136 *Id.*

137 *Id.*

Certifications are essentially facility-wide, "all-in-one" licenses or "umbrella" permits covering almost every aspect of the facility.[138] With the exception of necessary local zoning and building approvals, state certifications preempt the issuance of any other regional or local license or permit required to construct and operate the facility.[139] Certifications are "granted for the life of the facility," and "are intended to protect the public health and environment, but they must also balance this protection with the benefits to the public of a ready and reliable source of energy."[140]

The SCO is responsible for coordinating interagency reviews and certification of power production facilities.[141] With capacities of less than seventy-five MW, most proposed wave farms are not required to apply for siting certification, but facility planners may voluntarily choose to obtain a siting certification.[142] There are many advantages of one-stop permitting. For instance, local government must file a determination with the SCO within eighty days after the application is filed.[143] Placing time restraints on the governmental agencies that have interests in the project provides assurance that the project will move forward at a reasonable pace.

According to the webpage of the Florida Department of Environmental Protection, an Administrative Law Judge must hold a "certification hearing" on every application, regardless of whether any matters remain in dispute, within 300 days after a complete application is filed.[144] Within forty-five days of the hearing, a notice of the hearing must be published.[145] Prior to the hearing, interrogatories may be answered and depositions may be taken.[146] The hearings may last as short as a few hours and as long as a couple of weeks.[147] During the hearing, the judge receives testimony and evidence, and agency staff may appear as witnesses.[148] If members of the public testify, it is typically in the evening during a specified time.[149]

B. Federal Permits

Any proposed wave farm in federal waters off Florida's coast must comply with state and local regulations prior to obtaining an appropriate federal permit from the Army Corps of Engineers. The outer continental shelf is subject to federal jurisdiction under the Outer Continental Shelf

138 *Id.*; Fla. Dep't of Envtl. Prot., *supra* note 134.

139 Fla. Dep't of Envtl. Prot., *supra* note 134.

140 *Id.*

141 Fla. Dep't of Envtl. Prot., *supra* note 131.

142 FLA. STAT. § 403.506 (2006).

143 FLA. STAT. § 403.50665(2) (2006).

144 Fla. Dep't of Envtl. Prot., Power Plant Siting Overview, http://www.floridadep.org/siting/Programs/Power_Plant_Siting_Overview.htm (last visited Apr. 15, 2007).

145 *Id.*

146 *Id.*

147 *Id.*

148 *Id.*

149 *Id.*

Lands Act (OCSLA).[150] In Florida, the outer continental shelf[151] is located nine nautical miles off Florida's west coast and three nautical miles off of the east coast.[152] Most wave energy technologies have an optimal performance in waters that are 100 to 164 feet deep.[153] The distance these systems will need to be placed from Florida's coastline will thus vary depending on the ocean topography around the state. If wave energy developers site a system on the outer continental shelf, the Rivers and Harbors Appropriation Act[154] requires the system to obtain a federal permit from the Army Corps of Engineers. Nonetheless, federal permitting does not exclude states from exercising additional authority over the activities that fall on the outer continental shelf off its coast.[155]

The Coastal Zone Management Act (CZMA)[156] requires activities permitted by federal agencies to be "consistent to the maximum extent practicable with the enforceable policies of approved State management programs," including the coastal management programs of affected states.[157] The federal government and state governments simultaneously manage natural resources on the outer continental shelf and in state waters,

150 43 U.S.C. §§ 1331–56(a) (2000).

151 According to the Minerals Management Service, the Outer Continental Shelf is "the submerged lands, subsoil, and seabed, lying between the seaward extent of the States' jurisdiction and the seaward extent of Federal jurisdiction." Minerals Mgmt. Serv., Outer Continental Shelf—Definition, http://www.mms.gov/aboutmms/ocsdef.htm (last visited Apr. 15, 2007).

> Federal jurisdiction is defined under accepted principles of international law. The seaward limit is defined as the farthest of 200 nautical miles seaward of the baseline from which the breadth of the territorial sea is measured or, if the continental shelf can be shown to exceed 200 nautical miles, a distance not greater than a line 100 nautical miles from the 2,500-meter isobath or a line 350 nautical miles from the baseline.

Id.

152 One nautical mile equals 1.1508 statutory miles. Nat'l Aeronautics & Space Admin., NASA Facts: Life on Earth: Archive, http://www.nasa.gov/facts/Earth/earth_facts_archives.html (last visited Apr. 15, 2007); *see also* 43 U.S.C. § 1331(a) (2004) (defining outer continental shelf); Fla. Dep't of Envtl. Prot., Outer Continental Shelf, http://www.dep.state.fl.us/secretary/oip/ocs.htm (last visited Apr. 15, 2007) (stating that the OCS is "10.36 statutory miles off Florida's west coast and 3 nautical miles off the east coast").

153 Ocean Power Technologies, Frequently Asked Questions, http://www.oceanpower technologies.com/faq.htm (last visited April 15, 2007); *see also* Ocean Power Delivery Limited, The Pelamis Wave Energy Converter, http://www.oceanpd.com/Pelamis/default.html (last visited April 15, 2007) ("Ideally the Pelamis would be moored in waters approximately 50–60m in depth (often 5–10km from the shore). This would allow access to the great potential of the larger swell waves but it would avoid the costs involved in a longer submarine cable; if the machine was located further out to sea.").

154 Rivers and Harbors Appropriations Act of 1899, 33 U.S.C. §§ 401–467n (2000).

155 *See* Carolyn R. Langford et al., *The Mouse that Roared: Can Louisiana's Coastal Zone Management Consistency Authority Play a Role in Coastal Restoration and Protection?*, 20 TUL. ENVTL. L.J. 97, 99 (2006) ("The federal consistency provisions of the CZMA [Coastal Zone Management Act] give states the power to ensure that federally conducted or approved activities, including Outer Continental Shelf (OCS) activities, comply with the states' federally approved coastal management program (CMP).").

156 Coastal Zone Management Act of 1972, 16 U.S.C. §§ 1451–64 (2000).

157 *Id.* § 1456(c)(1)(A).

respectively.[158] Through the Florida Coastal Management Program, Florida coordinates the reviews of activities proposed for the outer continental shelf.[159] Additionally, Florida's Office of Intergovernmental Programs (OIP) serves as the state's point of contact for all matters concerning the outer continental shelf.[160]

OCSLA requires compliance with the National Environmental Policy Act (NEPA).[161] NEPA documents required by OCSLA include Environmental Impact Statements and Environmental Assessments.[162]

XIV. AESTHETICS

One of the driving forces behind opposition to harvesting the renewable energy of the ocean is public concern for aesthetics. Many communities have opposed power projects because they anticipate that the projects will have a negative visual impact.[163] To accommodate such concern, "wave energy system planners can choose sites that preserve scenic shorefronts."[164] Furthermore, society is accustomed to the presence of buoys in ocean waters due to their use in navigation, and the general population will likely not recognize the difference between an energy buoy and a typical navigational buoy. According to the Ocean Power Technologies website, the PowerBuoy "has the distinct advantage of having only a minimal visual profile."[165] Since most of the PowerBuoy is hidden below water, "[o]nly a small portion of the unit is visible at close range."[166] In addition, the PowerBuoy is usually placed one to five miles out to sea and is usually not visible from the shoreline.[167]

Recently there has been much debate over the construction of a proposed wind farm known as Cape Wind, near Cape Cod, Massachusetts. A prominent resident of Martha's Vineyard for thirty years encapsulated the community's objection to the proposal: "I'm not against wind turbines. I'm against 130 of them over 400 feet tall right smack in the middle of one of the most beautiful places in America."[168] The public interest review required by federal permitting regulations for installations on the outer continental shelf includes consideration of aesthetics, but this is unlikely to dominate the

158 Fla. Dep't of Envtl. Prot., *supra* note 144.

159 *Id.*

160 *Id.*

161 National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–70e (2000); Outer Continental Shelf Lands Act, 43 U.S.C. 1344(b)(3) (2000).

162 42 U.S.C. § 4332 (2000).

163 Ocean Power Technologies, Visual Impact, http://www.oceanpowertechnologies.com/visual.htm (last visited Apr. 15, 2007).

164 Florida PSC, *supra* note 35, at 38.

165 Ocean Power Technologies, *supra* note 163.

166 *Id.*

167 *Id.*

168 Dorothy W. Bisbee, *NEPA Review of Offshore Wind Farms: Ensuring Emission Reduction Benefits Outweigh Visual Impacts*, 31 B.C. ENVTL. AFF. L. REV. 349, 368–69 (2004).

review of the permit application.[169] Because opponents are aware that an aesthetics argument alone will not stop the construction of Cape Wind, they have attempted to use other avenues to bring an end to the project.

For instance, the authority for issuance of a federal permit for Cape Wind was recently questioned in the case of *Alliance to Protect Nantucket Sound, Inc. v. United States Department of the Army* (*Alliance*).[170] In *Alliance*, Cape Wind Associates submitted an application for a navigability permit under Section 10 of the Rivers and Harbors Act.[171] This application was for the construction and operation of an offshore data tower in an area of Nantucket Sound located on the outer continental shelf.[172] Section 10 delegates authority to the Army Corps of Engineers (the Corps) to issue permits for projects that impact the navigability of waters of the United States.[173] In August 2002, the Corps authorized Cape Wind to construct and maintain the data tower, subject to conditions.[174] The Corps also submitted an Environmental Assessment and Finding of No Significant Impact, as required by NEPA.[175]

One of the arguments made by the Alliance to Protect Nantucket Sound was that the Corps lacked authority to issue a Section 10 permit for the data tower.[176] The court noted that federal jurisdiction extends to

> *all* artificial islands, and *all* installations and other devices permanently or temporarily attached to the seabed, *which may be erected thereon for the purpose of exploring for, developing, or producing resources therefrom*, or any such installation or other device (other than a ship or vessel) for the purpose of transporting such resources.[177]

The court determined that Congress clearly expressed its intent in a conference report that the clause applies to all devices attached to the seabed, not only devices used to extract mineral resources, and that the Corps had jurisdiction to issue a Section 10 permit for Cape Wind's data tower.[178] The Court of Appeals for the First Circuit affirmed the judgment of the lower court in favor of the Corps.[179] This ruling makes clear the fact that Section 10 permitting will apply to wave farms.

It is also important to note that, as quoted in *Alliance*, a "[Corps] permit does not convey any property rights . . . or any exclusive privileges. Furthermore, a [Corps] permit does not authorize any injury to property or

169 33 C.F.R. §§ 320.1, 320.4(a)(1) (2006).

170 398 F.3d 105 (1st Cir. 2005).

171 Rivers and Harbors Appropriations Act of 1899, 33 U.S.C. §§ 401–467n (2000); *Alliance*, 398 F.3d at 107.

172 *Alliance*, 398 F.3d. at 107.

173 33 U.S.C. §§ 1, 403 (2000).

174 *Alliance*, 398 F.3d. at 107.

175 *Id.* at 108.

176 *Id.*

177 *Id.* (quoting 43 U.S.C. § 1333(a) (2000)).

178 398 F.3d at 110–11.

179 *Id.* at 115–16.

invasion of rights or any infringement of Federal, state, or local laws or regulations."[180] In terms of state laws, Corps regulations note that permit applications for activities affecting coastal zones of states with approved coastal zone management programs must comply with those plans.[181]

XV. FISHING

Other arguments presented by the Alliance to Protect Nantucket Sound involve concerns that the wind farm may cause adverse effects on local fisherman who utilize the area.[182] Conversely, Oregon State University (OSU) in its development of energy buoys has found different results for wave energy projects, and likewise, Ocean Power Technologies (OPT) has determined that its wave energy system is beneficial to marine life.

Researchers at OSU have developed "direct drive ocean buoys" that "will sit neutrally buoyant in the water, and will be almost impossible to see from land with the naked eye."[183] The research team foresees powering the entire state of Oregon with a wave park, comprised of an array of buoys, placed in an estimated ten square mile area.[184] Although the design wards off public concern for aesthetics, the research team is prepared to face opposition from local crab fishermen, whose harvests have broken many records in recent years and who worry that "an upturn in energy resources" may "cause a downturn in crab harvest."[185]

In order to encourage cooperation between the fishing industry and the wave park project planners, OSU asked local fishermen for their input during early project planning. Many fishermen, while voicing concerns about the project, were also receptive to the prospect of producing clean, renewable energy.[186] By bringing the fishing industry into the project early, local fisherman were able to contribute their ocean expertise to the engineering of the buoys. Simultaneously, project planners are seeking to minimize negative impacts on the local crabbing industry.[187] This harmonious relationship demonstrates how cross-industry cooperation can result in a benefit to all of a state's citizens. After all, clean, renewable energy contributes to the protection of the ocean and thus protects the livelihoods of its fishermen.

Site development for OPT's PowerBuoy includes preparation of a comprehensive Environmental Assessment before commencement of any

180 *Id.* at 111 (quoting 33 C.F.R. § 320.4(g)(6) (2006)).

181 33 C.F.R. § 320.4(h) (2006).

182 *See* Alliance to Protect Nantucket Sound, FAQs: Impacts & Effects: What Would the Impacts of This Project Be on Fish and Fishing?, http://www.saveoursound.org/node/116 (last visited Apr. 15, 2007) (asserting that no fishing or boating groups support the project because of its anticipated effects on the safety of navigation and fishing).

183 OR. STATE UNIV., COLLEGE OF ENGINEERING 2005 ANNUAL REPORT 5 (2005), *available at* http://engr.oregonstate.edu/news/ar/docs/2005_OSUCOE_AR.pdf.

184 *Id.*

185 Sherman, *supra* note 35, at 7.

186 *Id.* at 7–8.

187 *Id.* at 8.

construction.[188] OPT asserts that "[g]reat care is put in the planning and design phases to ensure there are no negative environmental effects."[189] Additionally, the placement of the buoys does not prohibit fishermen or swimmers from using the surrounding waters.[190] In general, OPT has found that its buoys act as artificial reefs that attract more marine life to the area.[191]

XVI. IMPORTANCE OF WINNING PUBLIC SUPPORT

In its wave park project, OSU has found success by winning public support early in its project planning. As a general rule, public perception of a project is based upon the trust of the players involved.[192] To win public support, it is necessary to listen to and learn from all of the stakeholders who have an interest in the project. Failure to gain public support may result in the failure of alternative energy facilities to be constructed.

After the Kyoto Summit, the United Kingdom (UK) government pledged to address global warming by generating at least ten percent of its electrical power from renewable sources by 2010.[193] One of the renewable projects proposed to be constructed in North Wiltshire was a 5.5 MW biomass-to-energy facility by Ambient Energy.[194] The project faced a difficult challenge, however, because "[t]he public in the UK are increasingly distrustful of government policy makers, industry and other public bodies, while environmental non-governmental groups are seen as more trustworthy."[195] Locals formed an action group to oppose the facility, and the North Wiltshire District Council rejected the application.[196] Although Ambient Energy appealed the decision, the appeal was dismissed.[197]

Misunderstanding between developers and the public caused the demise of the North Wiltshire project. Project stakeholders considered the project to be "environmentally advantageous to all and blamed the opposition of engaging in typical NIMBY [Not-In-My-Back-Yard] behavior" to defeat it, but at the same time, "the general public interpreted the

188 Ocean Power Technologies, *supra* note 15.

189 *Id.*

190 *Id.*

191 *Id.* (stating that "[i]n some parts of the world, conventional buoys are deployed to serve as 'Fish Attracting Devices'").

192 *See* Bishnu Raj Upreti & Dan van der Horst, *National Renewable Energy Policy and Local Opposition in the UK: The Failed Development of a Biomass Electricity Plant*, 26 BIOMASS & BIOENERGY 61, 66–68 (2004), *available at* http://burningissues.org/pdfs/ccr_biomass%20&%20UK.pdf.

193 *Id.* at 61–62.

194 *Id.* at 63.

195 *Id.* at 62.

196 *Id.* at 64–65. The North Wiltshire District Council stated: "The Biomass Power Station is a major development proposal which would, if allowed, seriously undermine the openness of the rural landscape, resulting in a loss of countryside creating an inappropriate form of major development in the Rural Buffer, contrary to the Wiltshire Plan Review and Policy." *Id.*

197 Upreti & van der Horst, *supra* note 192, at 66.

development as solely serving the economic benefits of the developer."[198] The lessons learned from this project emphasize the importance of winning public support.

As previously examined, public stakeholders in Nantucket oppose the construction of the Cape Wind project off of the coast of Massachusetts. [199] However, unlike the troubles facing Cape Wind, other renewable energy projects in the northeast have found ways to encourage public support. Specifically, a 140 MW wind energy project proposed off the south shore of Long Island, New York has the backing of state, local, and national environmental groups.[200] Early in the planning phase, the Long Island Offshore Wind Initiative sought public input so that it would be able to expeditiously address any concerns that might be raised.[201] It was pleased to find that the project had the general support of both regional groups and local communities.[202]

The lessons learned thus far in the development of renewable energy facilities can easily be applied to any wave energy farm to be constructed off of the coast of Florida. To prevent a massive grassroots opposition, it is imperative to identify the stakeholders early, and any concerns they have must be thoughtfully addressed. Without local support, any wave-to-energy project runs the risk of failure.

XVII. CONCLUSION

Due to its extensive coastline, harvesting wave energy is a viable source of renewable energy for the state of Florida. Technology and innovation have developed a variety of mechanisms that can be used to harvest the most abundant energy in the world, the energy of the sea. It is imperative that Florida take immediate action to prevent the continued degradation of human health and environment caused by emissions from traditional fossil fueled power plants. Implementing power production from a truly clean energy source will bring Florida forward as a leader in the United States and will set a positive example for the world.

Societal demands for power will continue to increase. Thus, it is essential that Florida mandate that future power generation be derived from clean sources. Although federal goals are in place, without state mandates it is unlikely that Florida will work toward these goals. As a first step, the Florida Energy Council will be created in accordance with the 2006 Florida

198 *Id.* at 67.

199 Andrew Miga, *Cape Cod Wind Farm Backers Target Congress*, ASSOCIATED PRESS, Apr. 20, 2006, *available at* http://www.boston.com/news/local/massachusetts/articles/2006/04/20/cape_cod_wind_farm_backers_target_congress (reporting that an alliance of 55 energy, labor and environmental groups planned to express opposition to the renewable project by sending a joint letter to members of Congress).

200 Press Release, Renewable Energy Long Island, *Enviros Support Offshore Wind Park* (Apr. 26, 2005), *available at* http://www.lioffshorewindenergy.org/index.php?module=article&view=9&lay_quiet=1&9fe95c5d98a1dafa8354b93dbfec1434=37f97aa640a0404a6464aa18c8fc9849.

201 *Id.*

202 *Id.*

Renewable Energy Act. Without delay, this council must recommend to Florida's governor and legislature that affirmative actions be taken to establish renewable energy mandates for the Sunshine State. Additionally, wave power is economically feasible, and the permitting processes are well established. Awarding state construction grants will encourage the development of wave energy farms in Florida. Historically, the use of fossil fuels for energy production caused immense environmental degradation. We must now seek redemption by harvesting the energy of the sea.