THE FLORIDA WATER-ENERGY NEXUS: PLANNING FOR CLIMATE CHANGE IN FLORIDA'S WATER AND ENERGY LAW

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ABSTRACT

Florida is running low on water, a fact that would have been inconceivable fifty years ago. Moreover, the impact of global climate change may further exacerbate water shortages over the coming years. Florida's freshwater resources necessitate coordinated management and responses by regulatory agencies. Electric power generation is a regular and increasing source of water consumption. However, three agencies that have regulatory influence over power generation and water consumption, the Public Service Commission, Water Management Districts, and the Department of Environmental Protection, have little institutional coordination. This Article examines the relationship between power generation, water consumption, and global climate change. It then makes five suggestions on how to integrate water and energy research and planning among these agencies.

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INTRODUCTION

Florida is starting to run low on water,[1] a fact that would have been inconceivable fifty years ago. [2] In Florida's early years of statehood, Floridians viewed fresh water as an element of nature to be tamed.[3] Developers and state officials saw wetlands and marshy areas as obstacles to the development booms of the 1920s and 1940s.[4] The notion of Florida running out of water was entirely alien to the concept of what Florida was—a wetland.[5] However, the state now engages in wetland restoration and water management to ensure that Florida does not lose its natural character and to keep water flowing to millions of Floridians.[6]

Florida grew from 2.7 million people in 1950 to 18.5 million people 2011.[7] With the population growth came a staggering increase in water use. In 1950, the state began tracking annual water withdrawals every five years.[8] That year, consumers withdrew 1,454 million gallons a day (Mgal/d), while in 2005 that figure increased to 6868 Mgal/d, a 470% increase in freshwater withdrawals.[9] Since the 1980s, however, Florida has actually reduced the amount of water it withdraws because of programs designed to

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[1] *See* CYNTHIA BARNETT, MIRAGE 2 (2007).
[2] *See id.*; *Florida Faces Vanishing Water Supply*, NPR (June 15, 2007), http://www.npr.org/templates/story/story.php?storyId=11097869.
[3] BARNETT, *supra* note 2 at 14-15.
[4] *Id.* at 22-25. The population boom from 1940 to 1960 led to draining thousands of acres of wetlands. *Id.* at 24.
[5] *Id.* at 13-19.
[6] *Florida QuickFacts*, U.S. CENSUS BUREAU, http://quickfacts.census.gov/qfd/states/12000.html (last visited Dec. 5, 2010).
[7] *1950 Census of Population and Housing*, US CENSUS BUREAU, http://www.census.gov/prod/www/abs/decennial/1950.html (last visited Dec. 5, 2010); U.S. CENSUS BUREAU, *supra* note 6.
[8] *Water Use in Florida, 2005 and Trends 1950-2005*, U.S. GEOLOGICAL SURVEY, http://pubs.usgs.gov/fs/2008/3080/#Water_Withdrawal_Trends,%201950-2005 (last visited Dec. 5, 2010).
[9] *Id.*

better manage the state's water resources, conservation initiatives, water restrictions, and other mechanisms.[10]

While this reduction bodes well for Florida, the population continues to increase at a current rate of approximately 17% per decade.[11] If the population continues to grow at this rate, it will double by the mid-21st century.[12] In addition to the increased water demands for the population, there will need to be increased food production, living areas, and power production.[13]

To put Florida's problem in a more theoretical frame, the state has been experiencing firsthand the problem of the exponential increase in consumption of a finite resource. Professor Albert A. Bartlett illustrated this problem with his bottle analogy.[14] While this concept is relevant to most natural resource management issues, it is particularly pertinent to water management. Consider the following hypothetical, which is derived from Professor Bartlett's work.

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[10] *Id.*
[11] U.S. CENSUS BUREAU, *supra* note 6.
[12] Starting with the current estimated population of 18.5 million and presuming a constant population growth of 16% every 9 years (as has been the case from 2000-2009), Florida's population will increase to approximately 37.4 million by 2050. *Id.*
[13] *See* FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, *Overview of Programs*, 15 (Aug. 2009), http://www.dca.state.fl.us/ downloads/ProgramOverview.pdf [hereinafter DCA OVERVIEW] (noting the increased need for water supplies); U.S. DEPARTMENT OF ENERGY, ENERGY EFFICIENCY & RENEWABLE ENERGY, *Florida Energy Summary Fact Sheet*, http://apps1.eere.energy.gov/states/energy_summary_print.cfm?state=FL (last visited Dec. 5, 2010) [hereinafter DOE FLORIDA FACTSHEET](noting the relation between population growth and future energy demand, also noting goals for reduction in per capita energy consumption).
[14] The hypothetical of the bottle is based on Professor Albert A. Bartlett's hypothetical of bacterial growth in a bottle. Albert A. Bartlett, *Forgotten Fundamentals of the Energy Crisis*, NEGATIVE POPULATION GROWTH, § II-III, http://www.npg.org/specialreports/bartlett_ section2.htm (last visited Dec. 5, 2010).

Imagine you have just bought a new plant that grows very quickly and, more pertinently, it is very thirsty. In fact, it doubles its water consumption every minute. As you sit down at 11:00 p.m., you set the plants roots into a bottle of water. However, based on information about the plant's water consumption, you know for a fact that the plant will consume all the water in the bottle by midnight. After stepping away, you return at 11:30 p.m., surprised to see that none of the water appears to be gone. You sit down to take some very precise measurements and realize that thus far, the plant has only consumed 3.7×10^{-9} % of the water in the bottle. How, then, will it use all of the water in the bottle by the end of the hour?

To better understand this plant, you start from midnight and count back. You realize that if the bottle will be empty at midnight. If the plant doubles its rate of water consumption every minute, that means the bottle will be 50% drained at 11:59 p.m., and in that final minute the plant will consume the remaining water. At 11:58 p.m., the plant will have only consumed 25% of the water, at 11:57 p.m., only 12.5% of the water, at 11:56 p.m., only 6.25%, and at five minutes before midnight, only 3.125% of the water will have been consumed. With only five minutes till midnight the loss of water will still be barely perceptible.

Then you start to think about how you will manage to get this plant through the night considering how much water it requires. Even if you could find seven more bottles, you realize that at 12:01 a.m., the plant will have

consumed an entire additional bottle of water, at 12:02 a.m., two more bottles, and then at 12:03 a.m., four more bottles. To keep it going until 12:04 a.m., you'll have to find an additional eight bottles of water. You now realize what a significant problem you are faced with—one which appeared a speculative problem at a mere five minutes till midnight.

With this hypothetical in mind, the issues that water managers face in Florida become apparent. Assuming an increase in population of 17% per decade, Florida will be doubling its population every fifty or so years.[15] A single doubling in demand could precipitously affect the water resources in Florida depending on how "close to midnight" it is, or how close the state is to exceeding the bounds of its water resources.

One of the primary industries that water availability affects is electric power generation.[16] Many energy production methods rely on water for cooling and without water to cool the plant, they cannot operate.[17] Power plants affect water resources and Florida's increasing population in multiple ways. First, they account for consumptive use of both fresh and saltwater

[15] The equation would be: $F = Pe^{RT}$. Where F is the future population, P is the present population, *e* is a mathematical constant used for calculating continually compounding growth, R is annual percent increase, and T is the number of years. For any given P, it will increase to 2.23P every fifty years if there is a constant, compounding 16% growth per decade. See JOHN H. VANDERMEER AND DEBORAH E. GOLDBERG, POPULATION ECOLOGY FIRST PRINCIPLES 3-5 (2003).

[16] *See* U.S. DEPARTMENT OF ENERGY, *Energy Demands on Water Resources, Report to Congress on the Interdependency of Energy and Water*, 9 (Dec. 2006), http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf [hereinafter ENERGY DEMANDS ON WATER].

[17] *See* Wayne C. Micheletti & John M. Burns, *Emerging Issues in Power Plant Cooling Systems*, 2 http://www.netl.doe.gov/publications/proceedings/02/EUW/Micheletti_JMB.PDF; NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, STATE OF THE CLIMATE DROUGHT SEPTEMBER 2007 (Oct. 2007) http://www.ncdc.noaa.gov/sotc/?report=drought&year=2007&month=sep (last visited Dec. 5, 2010).

resources in Florida.[18] Second, power plants have long operational periods, demanding regular sources water over extended periods of time.[19] Finally, power plants fulfill the demand for electricity which is becoming increasingly essential to keep lives and businesses functioning normally in Florida as air-conditioning, computer equipment, and industrial refrigeration are essential for many types of industry in Florida.[20]

Another burden on Florida's water sources is altered precipitation patterns. Florida will see altered precipitation patterns and uncertain water resources because of global climate change and must plan for future changes in water availability.[21] Specifically, the state should develop a coordinated planning strategy among the Public Service Commission (PSC), the Department of Environmental Protection (DEP), and the Florida Water Management Districts (WMDs) to begin to plan for the potential effects of climate change.

The goal of this Article is to develop a proposal for coordinated planning efforts for water and energy resources among the agencies responsible for Florida's water resource management and power plant siting.

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[18] *See Frequently Asked Questions About St. Lucie Plant Operations*, FLORIDA POWER & LIGHT, http://www.fpl.com/environment/nuclear/st_lucie_faq.shtml#TopOfPage (last visited Dec. 5, 2010) (noting that the St. Lucie nuclear power plant pumps cooling water from the Atlantic Ocean); Frequently Asked Questions About Turkey Point Plant, FLORIDA POWER & LIGHT, http://www.fpl.com/environment/nuclear/turkey_point_faq.shtml (last visited Dec. 5, 2010) (noting the Turkey Point plant uses a closed loop freshwater canal system for cooling).

[19] For instance the Big Bend power station began service in 1970. *Big Bend Power Station*, TAMPA ELECTRIC, http://www.tampaelectric.com/news/powerstation/bigbend/ (last visited Dec. 5, 2010).

[20] *See* U.S. ENERGY INFORMATION ADMINISTRATION, FLORIDA, (Dec. 2, 2010), http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=FL.

[21] U.S. GLOBAL CHANGE RESEARCH PROGRAM, OVERVIEW: SOUTHEAST, http://www.globalchange.gov/publications/reports/scientific-assessments/first-national-assessment/471 (last visited Dec. 5, 2010) [hereinafter GLOBAL CHANGE SOUTHEAST OVERVIEW].

Part II of this Paper presents a view of global climate change and its potential effects on Florida's water resources. Part III develops the relationship between water resources and energy production. Part IV presents the current regulatory structure for water consumption and power plant siting in Florida. Part IV also illustrates how land use planning addresses the effects of development on water resources as an example of how Florida may create cooperative water-energy planning. Part V proposes several specific areas of agency coordination, including timeframe coordination, cooperative research, adapted land use mechanisms for water management, and assured supply laws. The Paper ultimately concludes that agency coordination should be established now, prior to the onset of further effects of climate change.

I. GLOBAL CLIMATE CHANGE AND WATER IN THE SOUTHEAST

Climate change will have global consequences, some that are relatively predictable and some more uncertain.[22] How watersheds will change is one of the uncertainties.[23] By the end of the century we can count on average global temperatures increasing by approximately five to seven degrees Fahrenheit.[24] This change has already begun and it will continue for some

[22] U.S. GLOBAL CHANGE RESEARCH PROGRAM, *Our Changing Planet The U.S. Global Change Research Program for Fiscal Year 2010*, 29-35 (Oct. 2010), http://downloads.globalchange.gov/ocp/ocp2010/ocp 2010.pdf [hereinafter GLOBAL CHANGE 2010].
[23] *Id.* at 37-38.
[24] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 2007, ch. 10 Executive Summary (S. Solomon et al. eds., 2007) http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch10s10-es-1-mean-

time regardless of human activities to prevent it—it took a long time to get this point and it will take a long time to redress the problems.[25] Subsequently, climate change will alter the water cycle and will thus have a significant impact on our societies, which count on water flowing in roughly the same pattern in perpetuity. [26] These effects of climate change are already occurring and will take a very long time to redress if it is even possible.

A. The Effect of Global Climate Change on Watersheds

The impacts of climate change on watersheds across the globe will alter the way our social and legal structures deal with water. The concept of "stationarity" framed the development of America's water law and water resource planning—meaning that throughout all of American legal history water patterns were essentially unchanging.[27] As cultural and legal structures formed over centuries, water cycles had seasonal, annual, and multi-year variations that fit "within an unchanging envelope of variability."[28] Society put systems in place—be it aqueducts, sewers, or water law—that were able to handle variations within this envelope.[29] However outside of this envelope, these cultural and legal structures are often unable to

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temperature.html [hereinafter IPCC WGI]; Richard A. Posner, *Disaster Insurance*, HOOVER INSTITUTION (Apr. 1, 2007) http://www.hoover. org/publications/hoover-digest/article/5970.

[25] *Key Findings*, U.S. GLOBAL CHANGE RESEARCH PROGRAM, http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/key-findings (last visited Dec. 5, 2010).

[26] *See* GLOBAL CHANGE 2010, *supra* note 22 at 37-38.

[27] Robert W. Adler, Climate Change and the Hegemony of State Water Law, 29 Stan. Environmental L.J. 1, 8 (2010).

[28] P.C.D. Milly et al., *Stationarity is Dead: Whither Water Management?*, 319 SCIENCE 573, 573 (2008).

[29] *See id.*

maintain the status quo.[30] Climate change will likely push our society outside of this envelope and these social structures will have to change to deal with the alteration.

First, and most directly, climate change will have a significant impact on the cycle of evaporation and precipitation.[31] Not only will the rate of evaporation change, but wind patterns may change local precipitation patterns.[32] Moreover, increased atmospheric heat means water will remain in the atmosphere longer.[33] The increased temperature will also allow cloud formations and evaporated water to travel farther than has historically been the case.[34] Changes like these are already evident. For example, annual precipitation has increased in most of North America, but has decreased in the Southwest United States.[35]

There will also be secondary effects of climate change on water resources. First, changes in the location of fresh water will require either large relocation of population centers or transport of freshwater to current cities.[36] Precipitation changes will also result in altered irrigation for farmlands, which will contribute additional stress to already overburdened

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[30] *See id.*
[31] Adler, *supra* note 27, at 10-11.
[32] *Id.*
[33] *See* LAWRENCE LIVERMORE NATIONAL LABORATORY, *Increase in Atmospheric Moisture Tied to Human Activities* (Sept. 18, 2007), https://www-pls.llnl.gov/?url=science_and_technology-earth_sciences-moisture.
[34] *See* International Satellite Cloud Climatology Project, *Cloud Climatology*, http://isccp.giss.nasa.gov/role.html (last updated June 3, 2009).
[35] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 2007, § 14.2 (M.L. Parry, et al. eds. 2007) http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch14s14-2.html [hereinafter IPCC WGII].
[36] *See id.* at §7.4.

irrigation sources.[37] Additionally, precipitation changes and the accompanying alterations in human demand for water will likely be serious stressors to aquatic ecosystems.[38]

Another effect of rising global temperatures is an increase in power consumption. For instance, climate change will cause an increased need for air-conditioning.[39] Some estimates place power-use related to air conditioning in America at almost 20% of all power used.[40] The effects on power consumption would vary regionally.[41] In Florida, for example, an increase of two degrees Celsius would cause an 11.6% increase in per capita residential power-use due to air-conditioning.[42] But that same temperature increase in Washington state would *reduce* per capita energy consumption by 7.2% because of reduced demand for heat.[43] Thus, climate change will alter both sides of the water-energy relationship.

Climate change will continue to progress for some time regardless of efforts to reduce greenhouse gasses (GHGs).[44] The anthropogenic increase in atmospheric carbon began with the industrial revolution.[45] Industrialized

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[37] *See* Robin Kundis Craig, *Adapting Water Law To Public Necessity: Reframing Climate Change Adaptation As Emergency Response And Preparedness*, 11 VT. J. ENVTL. L. 709, 725 (2010).
[38] *See id.* at 724.
[39] U.S. GLOBAL CHANGE RESEARCH PROGRAM, *Global Climate Change Impacts in the United States*, 55 (2009), http://downloads.globalchange.gov/usimpacts/pdfs/energy.pdf.
[40] Dan Watson, *How air-conditioning is baking our world*, GUARDIAN.CO.UK, (Oct. 8, 2010), http://www.guardian.co.uk/environment/2010/oct/08/ air-conditioning-baking-world.
[41] U.S. CLIMATE CHANGE SCIENCE PROGRAM, *Effects of Climate Change on Energy Production and Use in the United States*, 20 (Feb. 2008), http://www.climatescience.gov/Library/sap/sap4-5/final-report/sap4-5-final-all.pdf.
[42] *Id.* at 19.
[43] *Id.*
[44] *See* IPCC WGI, *supra* note 25, at § 10.3.
[45] U.S. ENVIRONMENTAL PROTECTION AGENCY, *Don't "Waste" Your Chance to do Your Share, How to Reduce Your Climate Footprint*, 2 (June 2005), http://www.epa.gov/osw/partnerships/wastewise/pubs/howto-climate.pdf.

nations do not yet have the resources to use exclusively non-fossil fuel based energy production methods,[46] so atmospheric carbon will continue to increase for at least some time.[47] Additionally, sea level rise, which is caused by climate change, will continue and the ocean will stay elevated long after atmospheric carbon levels and temperatures fall due to the thermal inertia of water.[48] The causes of climate change have been compounding for many years and it will take many years to return the climate to a pre-industrial state. Alterations in GHG production can only hope to reduce the extent of climate change in the short-term. Therefore, planning to adapt to the coming changes is essential.[49]

B. Climate Change and Florida's Watersheds

Florida's government has acknowledged that climate change will have a significant impact on the state. In 2007, Governor Charlie Christ signed three executive orders designed to reduce GHGs[50] in which he recognized that GHGs are changing earth's climate.[51] One of climate change's largest impacts on Florida will be sea level raise. Florida has over 1300 miles of coastline, and climate change could substantially alter the character of those

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[46] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 2007, Summary for Policy Makers § B (B. Metz et al., 2007), http://www.ipcc.ch/publications_and_data/ar4/wg3/en/spmsspm-b.html [hereinafter IPCC WGIII].
[47] *Id.*
[48] NOAA OFFICE OF CLIMATE OBSERVATION, ROLE OF THE OCEAN IN CLIMATE, http://www.oco.noaa.gov/index.jsp?show_page=page_roc.jsp&nav=universal (last updated Oct. 24, 2008).
[49] *See* IPCC WGIII, *supra* note 46, at Summary for Policymakers § C.
[50] *Governor Crist Signs Executive Orders to Reduce Greenhouse Gases*, FLORIDA GOVERNOR CHARLIE CRIST (July 13, 2007), http://www.dep.state.fl.us/secretary/news/2007/cc/0713_1.htm.
[51] Charlie Christ, Exec. Order 07-126, Establishing Climate Change Leadership by Example: Immediate Actions to Reduce Greenhouse Gas Emissions from Florida State Government (July 13, 2007), *available at* http://www.fsec.ucf.edu/en/media/enews/2007/pdf/07-126-actions.pdf.

coasts.[52] Sea level rise is caused primarily by the thermal expansion of the world's oceans and continental glacier ice breaking off into the oceans.[53] As the temperature of the earth increases because of global warming, so too does the volume of water and the amount of sea ice.[54] Sea level rise will have obvious and direct effects on Florida's economy. For example, the loss of beaches and barrier islands[55] due to sea level rise would severely impact Florida's tourism and real estate markets.[56] However, there may be less obvious and more pernicious impacts of sea level rise.

Saltwater has been intruding into Florida's aquifer system for some time.[57]As Floridians consume water out of the aquifers, saltwater infiltrates to take up the space.[58] Saltwater intrusion, in turn, reduces the amount of fresh water available to millions of Floridians for drinking and municipal use.[59] Saltwater intrusion can also harm industry—particularly agriculture.[60]

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[52] *Florida's Coast: What's at Stake*, ENVIRONMENTAL DEFENSE FUND, http://apps.edf.org/article.cfm?contentid=5361 (last updated Sept. 5, 2007).
[53] Roger G. Barry, *How Might Sea Level be Affected by Changes in Land Ice?* (Jan. 8, 2009), http://www.arctic.noaa. gov/essay_barry.html.
[54] While thermal expansion may seem to be a small effect, when it occurs through all the oceans it can result in a substantial increase in the volume of the world's oceans. *Id.*
[55] Mark Schrope, *Unarrested Development*, NATURE.COM (Apr. 6, 2010), http://www.nature.com/climate/2010/1004/ full/climate.2010.27.html.
[56] "According to a 2007 study, if a rise of 58 centimetres were realized by 2050, it would cost Florida $92 billion per year owing to losses in tourism and real estate . . . ." *Id.*
[57] *Florida Everglades*, U.S. GEOLOGICAL SURVEY, http://sofia.usgs.gov/publications/circular/1182/ (last updated Oct. 11, 2002) ("[T]he major engineering effort [to restore the Everglades] in the 1950s and 1960s halted the destructive fires and saltwater intrusion of preceding decades . . . ."). However, saltwater intrusion has continued to be a concern long after the Everglades restoration projects of the 1950s and 1960s. *See* David V. Fitterman & Maria Deszcz-Pan, *Geophysicial Mapping of Saltwater Intrusion in Everglades National Park*, http://sofia.usgs.gov/publications/ papers/geophysmap/Ecohydraulics_99v4.pdf.
[58] *Protecting Our Water Resources*, NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT, http://www.nwfwmd. state.fl.us/about/protectwaterresources.html (last visited Dec. 5, 2010).
[59] Ronald A. Christaldi, *Sharing The Cup: A Proposal For The Allocation Of Florida's Water Resources*, 23 FLA. ST. U. L. REV. 1063, 1088 (1996).

Saltwater has already forced farmers to change their source of water for their crops, increasing strains on other parts of Florida's water supply system and costs to the farmers.[61] Saltwater intrusion's impact on agriculture will likely only be made worse by sea level rise and is only one element of global climate change.

Current climactic events that have a significant impact on crop yields may be further magnified by climate change.[62] For example, Southeast corn production experiences up to a $200 million variability in yields from El Niño years to La Niña years.[63] Climate change will likely exacerbate the El Niño and La Niña cycles and, accordingly, the impact on crops.[64] Additionally, increased sea levels will result in saltwater infiltration into rivers, streams, and wetlands that are near or adjacent to the ocean, which will negatively impact Florida's fishing industry.[65] Salinity at the mouth of the Apalachicola River has long been an issue of concern.[66] Americans get 10% of their

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[60] *See, e.g.*, *Carroll Brothers Nursery*, FLORIDA-AGRICULTURE.COM http://www.florida-agriculture.com/news/agen_carrollbrothers.htm (last visited Dec. 5, 2010) (discussing saltwater intrusion necessitating a flower farm shifting from well water to reused water due to saltwater intrusion).
[61] *See id.*
[62] James W. Hansen et al., *ENSO Influences on Agriculture in the Southeastern United States*, 11 J. Climate 404 (1998) *available at* http://journals.ametsoc.org/doi/full/10.1175/1520-0442%281998%29011%3C0404%3AEIOAIT%3E2.0.CO%3B2 (last visited Dec. 5, 2010); *Global Warming Frequently Asked Questions*, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, http://www.ncdc.noaa.gov/oa/climate/globalwarming.html (last updated Aug. 20, 2010).
[63] Hansen et al., *supra* note 61.
[64] *Global Warming Frequently Asked Questions*, *supra* note 61.
[65] U.S. ENVIRONMENTAL PROTECTION AGENCY, *Climate Change, Wildlife, and Wildlands: Everglades and South Florida*, 6, http://www.epa.gov/climatechange/wycd/downloads/CS_Ever.pdf (November 11, 2011).
[66] *See* D. Twichell et al., *Geologic Controls on the Recent Evolution of Oyster Reefs in Apalachicola Bay and St. George Sound, Florida*, 88 ESTUARINE, COSTAL AND SHELF SCIENCE 385, 385 (2010) *available at* http://www.gly.fsu.edu/~donoghue/pdf/twichell-etal-apal-bay-seismic-2010.pdf.

oysters from Apalachicola[67] and if the salinity level of these areas is affected it can lead to reduced oyster harvests.[68]

In addition to the increased issues with ocean water, precipitation will change.[69] The two primary climate prediction models conflict as to whether there will be more or less precipitation in Florida.[70] Both the Canadian and the Hadley models agree that Florida will see temperature increases altering the state's precipitation patterns.[71] In the Canadian model, Florida, and the Southeast generally, will see a reduction in precipitation.[72] However, the Hadley model indicates that central and northeastern Florida will see up to an approximate 20% increase in precipitation.[73] A decrease in precipitation in Florida creates obvious problems for public supplies of water,[74] the ecology of the state,[75] and, as we shall see, energy production.[76] On the other hand, if the Hadley model proves accurate, the greater precipitation may be a boon for Floridians and the ecology of the state.[77] However, more precipitation and altered water patterns would still create many problems that water and energy planners would have to address.[78] Increased

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[67] Jeff Klinkenberg, *Apalachicola, an Oyster Capital, Braces for Oil*, ST. PETERSBURG TIMES, July 1, 2010, http://www.tampabay.com/news/humaninterest/apalachicola-an-oyster-capital-braces-for-oil/1106181.
[68] *See* Twichell et al., *supra* note 65.
[69] GLOBAL CHANGE SOUTHEAST OVERVIEW, *supra* note 22.
[70] *Id.*
[71] *Id.*
[72] *Id.*
[73] *Id.*
[74] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, *A Sustainable Water Supply,* (Aug. 2001), http://www.swfwmd.state.fl.us/about/isspapers/watersupply.html.
[75] *Id.*
[76] *See infra* section III.A.
[77] *See* A SUSTAINABLE WATER SUPPLY, *supra* note74.
[78] *See Id.*

precipitation would still create many ecological problems as wetlands, lakes, and rivers would be overwhelmed with more water than they historically receive.[79] Additionally, increased precipitation will increase flooding problems, which can introduce many types of toxins into the environment that would otherwise remain outside of the water column.[80] Considering the potential impacts of these changes, Florida has already begun to plan for climate change.[81] However, there should be a special focus on the water-energy nexus.

II. THE INTERSECTION OF WATER AND ENERGY: THE NEXUS

Nearly all kinds of conventional energy production rely on a regular supply of water.[82] The connection between water and energy begins with fuel extraction, includes production, and goes all the way to transportation and storage. First, resource extraction of oil, gas, coal, and uranium all use water in various ways.[83] Next, shipping these fuels to the power plants relies on rivers and waterways and increases the risk of pollution to those waterways.[84] Finally, electric power generation uses water to operate steam turbines, for scrubbing and cleaning activities, and most significantly, for

[79] *See* SOUTH FLORIDA WATER MANAGEMENT DISTRICT, *Climate Change & Water Management in South Florida*, 15-17 (Nov. 12, 2009), http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/climate_change_and_water_management_in_sflorida_12nov2009.pdf.
[80] *See id.* at 17.
[81] *See, e.g.*, *id.*
[82] *See* Betsy Woodhouse, *Energy Demands on Water Resources: The Federal Perspective*, SOUTHWEST HYDROLOGY (Sept.-Oct. 2007), at 18 *available at* http://www.swhydro.arizona.edu/archive/V6_N5/feature2.pdf.
[83] *Id.*
[84] *Id.*

cooling.[85] On the other side of the nexus, water resources have an impact on electricity use. Extraction, transport, treatment, and other activities related to water use all consume energy.[86] Therefore, the interconnectedness between water and power production should be studied and considered by water and energy planners.

A. Energy Production's Reliance on Water and Water Production's Reliance on Energy

Conventional steam and combined cycle power plants account for nearly 80% of Florida's net power capacity.[87] Both of these, which are thermoelectric methods of power generation, use water.[88] Some water is used to turn turbines, while some is used to cool the plant.[89] Thermoelectric power generation on average results in a consumption rate of 0.14 gallons of water per kilowatt hour (G/kWh) and accounts for nearly twenty million gallons of water consumed in Florida annually.[90] Total water use related to power generation in Florida accounted for only 2% of water use in Florida in 2005. However, by 2025 it is projected to grow to 6%.[91] While that figure is small compared to the two primary water uses, public supply and

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[85] *Id.*
[86] Ronnie Cohen, *The Water-Energy Nexus*, SOUTHWEST HYDROLOGY (Sept.-Oct. 2007), at 17 *available at* http://www.swhydro.arizona.edu/archive/V6_N5/feature1.pdf.
[87] PUBLIC SERVICE COMMISSION, 2009 STATISTICS OF THE FLORIDA ELECTRIC UTILITY INDUSTRY, 22 (Sept. 2010), http://www.floridapsc.com/utilities/electricgas/statistics/statistics-2009.pdf.
[88] U.S. GEOLOGICAL SURVEY, NATIONAL HANDBOOK OF RECOMMENDED METHODS FOR WATER DATA ACQUISITION, § 11.J.1, http://pubs.usgs.gov/chapter11/chapter11J.html (last visited Dec. 5, 2010).
[89] *Id.*
[90] P. Torcellini et al., *Consumptive Water Use for U.S. Power Production*, 11 (Dec. 2003), http://www.nrel.gov/docs/fy04osti/33905.pdf.
[91] Janet Llewellyn, Director of Water Resource Management for the Florida Department of Environmental Protection, Presentation at Florida State University College of Law's 2010 Florida Water Law Class (Sept. 29, 2010).

agricultural use, in a state where water resources are becoming more scarce, this is still an area of concern, particularly when considered alongside the projected trend of increased water-use.

Recent national energy policy has shifted toward nuclear energy.[92] The Obama administration plans to triple funding for nuclear power development, resulting in enough capital to develop six to seven new nuclear power plants nationally.[93] Increased nuclear power production will significantly affect water policy because nuclear energy uses 25% more water to produce the same amount of electricity as a coal-fired power plant.[94] Many nuclear power plants, including most in Florida, use sea water for cooling,[95] which has less of an impact on water management analysis for freshwater supplies. However, nuclear power plants create other problems related to water resources, such as heat pollution which affects coastal biology.[96] Florida is in the process of making decisions about nuclear power now. Notably, there are current applications to add two reactors at the Turkey Point Power Plant

[92] Barack Obama & Joe Biden, *New Energy for America*, http://www.barackobama.com/pdf/factsheet_energy_speech_080308.pdf.
[93] Mark Clayton, *Obama's Nuclear Power Policy: A Study in Contradictions?*, CSMONITOR.COM, Feb. 4, 2010, http://www.csmonitor.com/USA/2010/0204/Obama-s-nuclear-power-policy-a-study-in-contradictions.
[94] Andy Aden, *Water Usage for Current and Future Ethanol Production*, SOUTHWEST HYDROLOGY Sept.-Oct. 2007, at 23 *available at* http://www.swhydro.arizona.edu/archive/V6_N5/SWHVol6Issue5.pdf.
[95] *See Nuclear Power Serves You*, FPL, http://www.fpl.com/environment/nuclear/nuclear_power_serves_you.shtml (last visited Dec. 5, 2010); U.S. ENERGY INFORMATION ADMINISTRATION, FLORIDA NUCLEAR PROFILE (Sept. 2010) http://www.eia.gov/cneaf/nuclear/state_profiles/florida/fl.html.
[96] *See* Victor B. Flatt, *Adapting Energy And Environmental Policy For Climate Change*, 11 VT. J. ENVTL. L. 655, 656-57 (2010).

in South Florida.[97] The state should make these decisions with full consideration of potential water impacts.

On the other side of the equation, water withdrawal can constitute a significant burden on power production.[98] Current methods of water extraction in Florida are not energy intensive because most of Florida's freshwater supplies come from the aquifers and surface waters.[99] Energy used for water extraction in Florida is different from other areas of the country, such as the arid West, where activities related to water-use account for twenty to 30% of the power used.[100] Water and power production creates a re-enforcing cycle, whereby the more water a state needs, the more energy the state requires to produce and process it, thus requiring more water, and so on.[101] While this effect is certainly not the primary mover in water and energy demand increases, it illustrates the close relationship of the two. Moreover, if there is an increased demand on either side (if water processing starts to require more energy, or if power production begins to require more water), the impact of this effect can become magnified.

As the climate warms and the available amount of freshwater in Florida decreases, organizations have begun to look to alternative methods

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[97] Turkey Point Makeover Gives Boost to Local Economy, MIAMI.CBSLOCAL.COM, January 18, 2012, http://miami.cbslocal.com/2012/01/18/turkey-point-makeover-gives-boost-to-local-economy/.
[98] *See* Cohen, supra note 85, at 16
[99] *See* Southwest Florida Water Management District, West-Central Florida's Aquifers, 2, http://aquacomm.fcla.edu/1541/1/Aquifer.pdf (noting that some aquifers are under pressure resulting in water that will rise above the aquifer).
[100] Cohen, *supra* note 85, at 16.
[101] *See id.*

of procuring drinkable water,[102] some of which can increase energy demands.[103] Desalination is one way of ensuring freshwater supplies will be available. It also guarantees that freshwater will become more energy intensive.[104] Florida has already taken the first steps in desalination with the Tampa Bay Seawater Desalination Plant.[105] Problems have plagued the plant so far, including opening five years later than expected, being forty million dollars over budget, persistent clogging with the membranes, and not meeting processing goals.[106] However, even presuming that the plant was working at peak capacity, it would still result in a significant increase in energy consumption per gallon of drinkable water.[107] Electricity accounts for half of the plant's annual budget and it would be even higher if the plant were not adjacent to a power plant.[108] It is estimated that in some desalination plants, it takes approximately 4400 to 5500 kWhs to process one acre-foot of sea water into drinkable freshwater.[109] To put that in

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[102] Robin Kundis Craig, *Water Supply, Desalination, Climate Change, And Energy Policy*, 22 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 225, 247-48 (2010).
[103] *Id.* at 247;Press Release, National Academy of Sciences, Desalination Can Boost U.S. Water Supplies, But Environmental Research Needed to Understand Environmental Impacts, Lower Costs (Apr. 24, 2008), http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12184.
[104] *See* Brian Skoloff, *Much of US Could See a Water Shortage*, WESTERFUNK.NET (Oct. 26, 2007) http://www.westerfunk.net/archives/environment/Much%20of%20U.S.%20Could%20See%20a%20Water%20Shortage/.
[105] Desalination Plant Facts, TAMPA BAY WATER, http://www.tampabaywater.org/facilities/desalination_plant/desalination_plant_facts.aspx (last visited Dec. 5, 2010).
[106] Craig Pittman, *Tampa Bay Water desal plant isn't running often enough for Swiftmud,* ST. PETERSBURG TIMES, Aug. 25, 2010, http://www.tampabay.com/news/environment/water/tampa-bay-water-desal-plant-isnt-running-often-enough-for-swiftmud/1117191; Craig Pittman, *More problems for Tampa Bay Water desalination plant*, ST. PETERSBURG TIMES, Mar. 17, 2009, http://www.tampabay.com/news/environment/water/article984409.ece.
[107] Pat Hatfield, *As plans for Coquina Coast desal plant go forward, lessons come from Tampa Bay*, WEST VOLUSIA BEACON, Mar. 4, 2010, http://www.beacononlinenews.com/news/daily/2454.
[108] *Id.*
[109] Cohen, *supra* note 85, at 17. However this figure does drop when brackish water, instead of seawater is being processed. *See* Craig, *Water Supply, Desalination, Climate Change, and Energy Supply*, supra note 101, at 248. For

perspective, the average American household uses about 11,000 kWhs and 146,000 gallons, about half an acre-foot, of water annually.[110] Thus, a household would increase its energy consumption by roughly 25% by using desalinated water.

The relationship between water and energy is becoming more evident as water resources dwindle and the demand for power increases.[111] The nation is addressing energy demand in multiple ways that have an impact on water, such as the increased development of nuclear power plants.[112] Additionally, automakers are increasing efforts to develop electric cars that charge from the utility grid.[113] While these reduce, and in some cases even eliminate tailpipe emissions, they increase electric demand.[114] In turn, the increased demand creates increased demand on water resources where the power is generated.[115]

The connections between water and energy discussed above are some of the most direct connections. Other important issues also exist, such as

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Florida this may ultimately become a method to utilize water from aquifers where seawater encroachment has occurred.

[110] *Frequently Asked Questions – Electricity*, U.S. ENERGY INFORMATION ADMINISTRATION, http://www.eia.doe.gov/ask/electricity_faqs.asp#electricity_use_home (last updated June 18, 2010) (indicating the annual and monthly household electric consumption in 2008). One acre foot of water is 326,000 gallons of water. *Rain and precipitation*, USGS WATER SCIENCE FOR SCHOOLS, http://ga.water.usgs.gov/edu/earthrain.html (last visited Dec. 5, 2010). And a typical American household uses approximately 146,000 gallons of water per year. *Indoor Water Use in the United States*, US EPA, http://www.epa.gov/WaterSense/pubs/indoor.html (last updated Nov. 18, 2010).

[111] *See* Craig, *Water Supply, Desalination*, *supra* note 102, at 247-48; Cohen, *supra* note 86, at 16-17.

[112] Obama & Biden, *supra* note 91.

[113] *See, e.g.*, *2012 Chevy Volt*, CHEVROLET, http://www.chevrolet.com/volt-electric-car/ (last visited Feb. 12, 2012) (the Chevrolet volt can drive up to thirty-five from a plug-in electric charge).

[114] *Utilities Conflicted Over Electric Cars*, GM-VOLT.COM (Nov. 24, 2010), http://gm-volt.com/2010/11/24/utilities-conflicted-over-electric-cars/ (noting that "coming tidal wave of electric vehicles is both a blessing and a curse for electric utility companies").

[115] The increased demand will create a greater public need for electric production, resulting in more power plants and greater water withdrawal.

water quality problems related to coal shale fracturing techniques for natural gas extraction,[116] water quality problems related to barge transport of energy production fuels,[117] and even the large amount of evaporation related to hydroelectric dams.[118] As the population increases, demand for more power will also increase. As a result, the connection between water and energy production should be addressed now rather than later.

B. Practicability of Renewables

Some renewable sources of energy promise to relieve the burden on water supplies.[119] However, the prospect of using these power production methods on a large scale in Florida is currently bleak.[120] Renewables only account for 8% of national energy production,[121] which is almost as much as nuclear energy production.[122] Between 2008 and 2009 there was a 5% increase in renewable production.[123] Some renewable energy sources do not have significant implications for water resources, such as solar photovoltaic

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[116] While much research remains, there are initial concerns about contamination of underground water resources due to natural gas drilling. *See In Pa. the fate of "fracking" depends on what river you live near*, NEWSWORKS (July 27, 2010), http://www.newsworks.org/index.php/health-science/item/5457-in-pa-the-fate-of-e2809cfrackinge2809d-depends-on-what-river-you-live-near; Matthew Daly, *EPA issues subpoena on fracking*, OBSERVER-REPORTER.COM (Nov. 10, 2010) www.observer-reporter.com, http://www.observer-reporter.com/OR/Story/11-10-2010-NaturalGas-Drilling.

[117] Woodhouse, *supra* note 82, at 18.

[118] *Id.*

[119] ENERGY DEMANDS ON WATER, *supra* note 16 at 41.

[120] *See*, *Renewable Energy in Florida*, NATIONAL RESOURCE DEFENSE COUNCIL http://www.nrdc.org/energy/renewables/florida.asp (last visited Dec. 5, 2010) (indicating wind is not currently a viable renewable option); PUBLIC SERVICE COMMISSION & THE DEPARTMENT OF ENVIRONMENTAL PROTECTION, AN ASSESSMENT OF RENEWABLE ELECTRIC GENERATING TECHNOLOGIES FOR FLORIDA, 31(Jan. 2003) http://www.psc.state.fl.us/publications/pdf/electricgas/Renewable_Energy_Assessment.pdf [hereinafter ASSESSMENT OF RENEWABLES IN FLORIDA] (indicating wide scale solar power is not a viable option).

[121] *Renewable Energy Consumption and Electricity Preliminary Statistics,* U.S. ENERGY INFORMATION ADMINISTRATION (Aug. 2010) ftp://ftp.eia.doe.gov/renewables/pretrends09.pdf.

[122] *Id.* (indicating that nuclear power accounts for 9% of national energy consumption).

[123] *Id.*

(PV) and wind power.[124] However, other types of renewables consume water, such as biomass, concentrated solar, and geothermal.[125]

While it is intuitive to think Florida, the Sunshine State, would be a natural fit for PV energy production, the amount of solar resources in the state are only moderate.[126] Solar power would be most effective in the summer months to mitigate air-condition related peak loads.[127] Because summer peaks are highest on sunny days when air-conditioning is used most, those days would also correspond to the times when solar energy production would be at its peak.[128] However, during peaks in winter months there would be no correlation to sunshine, thus solar would not help mitigate peak energy consumption in the same way.[129] Ultimately, for large-scale power production, PV is one of the costliest methods of generating power and Florida is ill suited to use solar for large-scale power production.[130]

Wind power, likewise, is a renewable energy source that would have little direct impact on water resources.[131] However, nearly all of Florida's commercially viable locations for wind farms are offshore.[132] Wind power technology has significantly advanced, reducing the cost of wind energy; it was 80 cents per kWh in 1979 and had dropped in some areas to as low as

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[124] ENERGY DEMANDS ON WATER, *supra* note 16 at 10.
[125] *Id.* at 18.
[126] ASSESSMENT OF RENEWABLES IN FLORIDA, *supra* note 119, at 31
[127] *Id.* at 33.
[128] *Id.*
[129] *See id.*
[130] *See id.*
[131] ENERGY DEMANDS ON WATER, *supra* note 16 at 10.
[132] *See Renewable Energy in Florida*, supra note 119.

4-6 cents per kWh in 2000.[133] However, Florida's land based wind speed averages between 12 and 14 miles per hour, which results in a cost of 57 cents per kWh.[134] That price is over ten times higher than the cost of electricity from traditional power production methods.[135] Offshore wind farms would have somewhat better wind resources because of more reliable and stronger winds; however, these farms would likely face a host of regulatory challenges, making them currently unfeasible.[136]

Ocean based hydrokinetic power production may be a power generation method for Florida that does not negatively affect Florida's freshwater resources.[137] For instance, some technologies can convert wave or deep sea currents into electric power.[138] Currently, there is interest from the Department of Energy in developing these sources of power.[139] However, these technologies are still far from offering an alternative to conventional power generation methods.[140]

Ultimately, Florida will not be able to supply enough low-water renewable energy to avoid needing a coordinated approach between water and energy policy. With intermittent solar resources and small land and

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[133] ASSESSMENT OF RENEWABLES IN FLORIDA, *supra* note 119, at 51.
[134] *Id.*
[135] *Id.* at 42.
[136] *See* Michael Shulz, *Questions Blowing in the Wind: The Development of Offshore Wind as a Renewable Source of Energy*, 38 N. ENG. L.R. 415 (2004).
[137] *See*, *Hydrokinetic Electric Power Generation*, CENTER FOR CLIMATE CHANGE AND ENERGY SOLUTIONS, http://www.pewclimate.org/technology/factsheet/Hydrokinetic (last visited Dec. 5, 2010).
[138] *Id.*
[139] *See*, *Marine and hydrokinetic energy can play a "substantial role" in clean energy options*, RENEWABLE ENERGY FOCUS, (Jan. 12, 2010), http://www.renewableenergyfocus.com/view/6346/marine-and-hydrokinetic-energy-can-play-a-substantial-role-in-clean-energy-options/.
[140] *Id.*

ocean-based wind resources, Florida will have to continue to rely upon thermoelectric methods of power generation. Because these conventional methods of power generation will continue to depend upon water to cool and clean the power plants[141] Florida should plan on energy production continuing to affect Florida's water supply.

III. FLORIDA'S LEGAL STRUCTURE FOR WATER USE AND POWER PLANT SITING

In Florida, two separate entities issue licenses for water use and power plant development[142] despite that these resources are intimately related and will grow to be more related as climate change and dwindling water resources impact Florida. Each agency has a set of criteria that it must consider prior to issuing permits.[143] However, there is no set, forward-looking procedure to coordinate water resource management between these two agencies .

A. Consumptive Use Permitting

The Florida Water Resource Act (FWRA) governs permit requirements for water withdrawal for consumptive use in Florida.[144] Power plants require a Consumptive Use Permit (CUP) for water to use for cleaning, cooling, and

[141] Woodhouse, *supra* note 81, at 18.
[142] *Florida Water Management District Permitting Portal*, FLORIDA WATER MANAGEMENT DISTRICTS, http://flwaterpermits.com/ (last visited Dec. 5, 2010); *Power Plants Siting Act*, FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION http://www.dep.state.fl.us/siting/power_plants.htm (last updated Oct. 25, 2010).
[143] *See* Fla. Stat. 373.223(1) (2010) (addressing consumptive use criteria); Fla. Stat. § 403.519(b) (2010) (addressing public need for power plant siting).
[144] *See* Fla. Stat. § 373.219.

other power plant activities.[145] CUPs are issued if the proposed water withdrawal meets three conditions: the use "is a reasonable-beneficial use,"; it "will not interfere with any presently existing legal use of water"; and it "is consistent with the public interest."[146] The FWRA further breaks down the public interest element into a several-factor analysis that considers factors such as the environmental impact and the capital investment in the water-related infrastructure.[147]

Florida charged its five Water Management Districts (WMDs) with issuing CUPs.[148] The districts are divided according to the geographical lines of the watersheds in Florida, not political boundaries.[149] Each WMD is responsible for creating the permitting structure for its jurisdiction.[150] Permits vary based on how much water is available within the district. For example, the Southwest Florida WMD, which has relatively low water resources, requires a Small General Water Use Permit for uses less than 100,000 gallons per day (gpd).[151] However, some particularly wet areas of the Northwest Florida WMD do not require a permit for any consumptive use

[145] Woodhouse, supra note 82, at 18.
[146] Fla. Stat. 373.223(1).
[147] Fla. Stat. § 373.223(3).
[148] *Florida Water Management District Permitting Portal*, *supra* note 142.
[149] *See Water Management Districts,* FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION, http://www.dep.state.fl.us/secretary/watman/ (last updated June 18, 2008).
[150] *Id.*
[151] *Water Use Permit*, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, http://www.swfwmd.state.fl.us/permits/wup/#wup_renew_modify (last visited Dec. 5, 2010).

less than 1.4 million gpd, where it is not from a well greater than ten inches in diameter, and is not for public supply or bottled water use.[152]

CUPs are not principally focused on planning for the future; the determination is based on whether the use applied for meets the statutory criteria.[153] The WMDs incorporate some levels of planning for future water resources in the form of minimum flow and level requirements.[154] However, the WMDs only began to establish minimum flows after a successful citizen suit in 1993.[155]

The State uses CUPs to manage water resources in the respective watersheds; however, there has been criticism focused on the over-granting of CUPs.[156] The problems associated with excessive permitting are most evident within those coastal counties where saltwater intrusion and water scarcity are occurring.[157] Increasing competition for water resources will likely exacerbate these issues as populations continue to grow and, especially, as water resources begin to dwindle.

The WMDs and the DEP bear the responsibility for protecting and overseeing the water resources in Florida.[158] However, these agencies do not

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[152] *Consumptive Uses of Water*, NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT, http://www.nwfwmd.state.fl.us/permits/permits-wateruse.html (last visited Dec. 5, 2010) (addressing permitting in Permit Area C).
[153] *See* Christine A. Klein et al., *Modernizing Water Law: The Example of Florida*, 61 F. L. REV. 1, 50-51 (2009).
[154] *Id.* at 43-44.
[155] Concerned Citizens of Putnam County for Responsive Gov't v. St. Johns River Water Mgmt. Dist., 622 So. 2d 520, 521, 523–24 (Fla. 5th DCA 1993).
[156] Christaldi, *supra* note 59, at 1084.
[157] *Id.*
[158] Susan Roeder Marting, *Addressing environmental permit issues prior to closing*, FLORIDA BAR JOURNAL (DEC. 2005) http://findarticles.com/p/articles/mi_hb6367/is_11_79/ai_n29225491/?tag=content;col1.

have authority over power plant siting.[159] Given the extensive interconnections between water and energy, these agencies could more effectively plan for the future of Florida's water resources if they had more direct interaction with power plant siting decisions. Additionally, coordination between these agencies would provide better insight into Florida water use.

B. Florida Electrical Power Plant Siting Act

The Florida Public Service Commission (PSC) is the primary regulator of public utilities in Florida; its responsibilities include power plant siting.[160] The PSC authorizes the siting of power plants based on the Florida Electrical Power Plant Siting Act (FEPPSA), which mandates the PSC to evaluate the need of a new power plant based on a set of criteria that does not include planning for water resources.[161] Specifically, the PSC will consider whether the plant will: (1) "[p]rovide needed base-load capacity;" (2) enhance production "by improving the balance of power plant fuel diversity and reducing Florida's dependence on fuel oil and natural gas;" and (3) "provide the most cost-effective source of power, taking into account the need to improve the balance of fuel diversity, reduce Florida's dependence on fuel oil and natural gas, reduce air emission compliance costs, and contribute to the long-term stability and reliability of the electric grid."[162]

[159] *See* Fla. Stat. § 403.519 (2010).
[160] *Id.*
[161] *Id.*
[162] Fla. Stat. § 403.519(b).

The PSC can consider water when evaluating the above elements. For instance, it would likely play a role in evaluating cost-effectiveness. However, evaluating the effect on water resources is not required. More to the point, water management, ecological implications, and the effects of climate change on water may be considered however, that consideration is not mandated.

The Florida Legislature explicitly recognized that siting electric power plants has a significant impact on the natural resources of the state.[163] Moreover, the stated policy of Florida is that:

> [W]hile recognizing the pressing need for increased power generation facilities, the state shall ensure through available and reasonable methods that the location and operation of electrical power plants will produce minimal adverse effects on human health, the environment, the ecology of the land and its wildlife, and the ecology of state waters and their aquatic life and will not unduly conflict with the goals established by the applicable local comprehensive plans.[164]

One of the reasons the FEPPSA was passed was to ensure that power plant siting would have minimal adverse impacts on the environment.[165] However, the act prescribes no specific method of ensuring that the effects will be minimal. Moreover, the language of the act is focused on land use planning rather than on the consumptive use of water, because

[163] Fla. Stat. § 403.502.
[164] *Id.*
[165] Nassau Power Corp. v. Beard, 601 So. 2d 1175, 1176 (Fla. 1992); Tampa Elec. Co. v. Garcia, 767 So. 2d 428, 433-34 (Fla. 2000).

it specifies that there be no conflict with applicable local comprehensive plans, which are a fundamental element of land use planning.[166]

The PSC has an interest in Florida water resources beyond the general welfare of the state and the regulation of power plant siting. The PSC regulates all utilities, which include water and wastewater utilities.[167] Because the PSC's interests extend into multiple areas that are directly affected by the amount of water available in the state, coordinating water planning with other agencies would serve its interests. Moreover, the state would benefit from siting power plants so that they have less of an impact on state-wide water resources. Ultimately, the PSC would benefit from coordination with WMDs.

C. Land Use Planning and Water Management Coordination

For some time now, Florida has recognized the connection between land use planning and water management.[168] It is clear that urban growth can significantly impact local water resources.[169] One of the most direct impacts is caused by increases in impermeable surfaces.[170] Precipitation falling on these surfaces cannot filter into the soil; therefore, it is runoff and becomes a part of a city's wastewater problem, which requires treatment

[166] *See* Fla. Stat. § 403.502.
[167] Water & Wastewater Regulation, FLORIDA PUBLIC SERVICE COMMISSION, http://www.psc.state.fl.us/utilities/waterwastewater/ (last visited Dec. 5, 2010).
[168] Klein, *supra* note 153, at 47.
[169] *Id.*
[170] *Id.*

and processing.[171] More importantly, that water will not follow the natural process of entering the soil and subsequently replenishing the aquifers.[172] Additionally, because of the large wetland areas in Florida, many land use decisions have impacts on the health of wetlands which are an integral part of the water ecosystems in Florida.[173]

The clearest examples of coordination between land use planning and water resource management are in arid western states.[174] Approximately two-thirds of western states coordinate land use and water resources.[175] One method of coordination - assured water supply laws - mandates that a developer secure an adequate supply of water for development prior to agency approval.[176] Assured supply laws give agencies considerably more information about impacts on water resources. For example:

> If the developer needs to demonstrate it has secured 7,500 acre feet of water to satisfy an assured supply requirement, but the developer can show that xeriscaping yards in the subdivision will reduce that demand to 6,500 acre feet, or project opponents can show the subdivision's real impact is to consume far more than 7,500 acre feet because it is poorly designed, causes wetland loss, and increases impervious surfaces, suddenly the local zoning commission has before it considerable land-water interaction evidence that would not

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[171] *See* FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION & FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS, 27 (Nov. 2002) http://www.dca.state.fl.us/fdcp/dcp/publications/ Files/springsmanual.pdf.
[172] *See id.*
[173] BOB DENNIS, PLANNING FOR WETLANDS PROTECTION THROUGH A FEDERAL, STATE AND LOCAL PARTNERSHIP, FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS , 1-2 (May 18, 1998) http://www.dca.state.fl.us/fdcp/dcp/publications/ Files/wetlandspub.pdf.
[174] Lincoln L. Davies, *Just A Big, "Hot Fuss"? Assessing The Value Of Connecting Suburban Sprawl, Land Use, And Water Rights Through Assured Supply Laws*, 34 ECOLOGY L.Q. 1217, 1227(2007).
[175] Ellen Hanak & Margaret K. Browne, *Linking Housing Growth to Water Supply: New Planning Frontiers in the American West*, 72 J. AM. PLAN. ASS'N 154, 154 n.1 (2006) (noting that eleven of the seventeen western states have some form of water supply requirement for development); *Id.*
[176] Davies, *Hot Fuss, supra* note 174.

necessarily have been taken into account in the pre-assured supply world.[177]

The three goals of assured supply laws are protecting consumers, implementing holistic planning, and protecting the environment.[178] Initially, assured supply laws were viewed as the latest and greatest element to ensuring sufficient water supply for the future.[179] However, if the laws are poorly designed, they can promote the ills they seek to remedy by furthering problems such as urban sprawl.[180] For instance, if the assured supply laws result in increased costs, developers will build further away from the urban core to reduce real estate cost and keep housing prices competitive, but also increasing sprawl.[181] Ultimately, assured supply laws can contribute to efficient land use and water resource management; however, the success of the laws is contingent upon the minutia of the plan and specific area.[182]

Florida has implemented a different model for water resource planning for land use.[183] Florida requires the state comprehensive land use plan to "[s]et forth and integrate state policy for Florida's future growth as it relates to land development, air quality, transportation, and *water resources*."[184] In addition to the state comprehensive plan, the Florida Department of

[177] *Id.* at 1236 (citations omitted).
[178] *Id.* at 1229.
[179] *Id.* at 1292.
[180] *Id.*
[181] *Id.* at 1234.
[182] *Id.* at 1292.
[183] Kevin M. O'Brien & Barbara Markham, *Tale Of Two Coasts: How Two States Link Water And Land Use Planning*, NAT. RESOURCES & ENV'T, Fall 1996, at 5-7.
[184] Fla. Stat. § 186.009(2)(d) (2010) (emphasis added).

Community Affairs[185] prepares the State Land Development Plan, and the DEP prepares the Florida Water Plan, both of which address water supply planning.[186] Florida's eleven regional planning councils also address water resource planning because the regional plans are required to be consistent with the comprehensive plan.[187] Finally, water planning is considered on the local level as well because all of Florida's cities must prepare comprehensive plans,[188] which must include provisions for "general sanitary sewer, solid waste, drainage, potable water, and natural groundwater aquifer recharge element correlated to principles and guidelines for future land use . . . ."[189] Thus, land use planning in Florida, from the state comprehensive plan all the way down to local comprehensive plans, must take into account water resources and the impact of future development on these resources. The WMDs also play a role in local land use planning because they are mandated to assist local governments in developing the elements of the local comprehensive plan that relate to water resources.[190]

While the WMDs assist local governments, they also have their own responsibilities regarding land use and water resource management. The

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[185] As of October 1, 2011 the Department of Community Affairs has been merged into the Florida Department of Economic Opportunity. Frequently Asked Questions, Florida Department of Economic Opportunity, http://www.floridajobs.org/frequently-asked-questions-directory/frequently-asked-questions/category/95b6d798-fea4-4d0c-8780-0d58825a5cad.

[186] O'Brien & Markham, supra note 183, at 6.

[187] Fla. Stat. § 186.508 (2010). For a map of the regional planning districts, see Florida Regional Planning Councils, http://www.ncfrpc.org/state.html (last updated Dec. 2, 2010).

[188] "Florida's Growth Management Act . . . requires all of Florida's 67 counties and 410 municipalities to adopt Local Government Comprehensive Plans that guide future growth and development." *Growth Management and Comprehensive Planning*, *supra* note 166.

[189] Fla. Stat. § 163.3177(6)(c) (2010).

[190] Fla. Stat. § 373.711.

public interest element of analysis for granting CUPs must consider "the projected populations, as contained in the future land use elements of the comprehensive plans adopted . . . by the local governments . . . [which] will be considered together with other evidence presented on future needs of those areas."[191] Furthermore, the WMDs are required to have a comprehensive water management plan that accounts for water resources twenty years into the future.[192] The plan must include elements such as minimum flows and levels, and technical data compiled.[193]

The WMDs' responsibilities are strongly tied to planning for future land use; however, ultimately, WMDs' issuance of CUPs is not planning.[194] Permitting and planning are fundamentally different resource management techniques.[195] Permitting, in the consumptive water use context, is primarily focused on addressing whether the consumptive use will cause current adverse effects on water resources.[196] Planning, on the other hand, is future-looking; it focuses on when and where development will occur.[197] As then-Senior Assistant General Counsel for the St. Johns River Water Management District put it, "[p]lanning should ask 'what,' 'where,' and 'when,' whereas permitting should ask 'how.' "[198]

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[191] Fla. Stat. § 373.223.
[192] FLA. ADMIN. CODE 62-40.520 (2005).
[193] Fla. Stat. § 373.036(2)(b); Fla. Stat. § 373.711.
[194] Mary Jane Angelo, *Integrating Water Management And Land Use Planning: Uncovering The Missing Link In The Protection Of Florida's Water Resources?*, 12 U. FLA. J.L. & PUB. POL'Y 223, 232-35 (2001).
[195] *Id.* at 232-33.
[196] *Id.*
[197] *Id.* at 232-33.
[198] *Id.* at 233

While Florida has made many attempts to link land use planning with water resource management through various legislative and administrative efforts,[199] criticism persists that these links are not sufficient to substitute for a robust water planning system.[200] Even so, Florida has devoted no equivalent effort to linking water and energy use.

IV. PROPOSAL: INTEGRATION OF WATER AND ENERGY RESEARCH AND PLANNING

Florida would benefit from a coordinated approach to water management among the WMDs, DEP, and the PSC because a well-structured plan would enable the state to optimally manage its declining water resources while still providing sufficient energy. Furthermore, the uncertainty of climate change means that planners will likely have to develop plans that are adaptable to changing conditions. Lacking a coordinated plan could entail problems with, for example, Duke Energy Corporation's hydroelectric facilities along the Catawba River.[201] Duke is seeking a new fifty-year license for its eleven reservoirs and thirteen hydroelectric facilities along the Catawba River, which flows between North and South Carolina.[202] However, the South Carolina Attorney General filed suit to intervene to block Duke because, he asserts, Duke's water flow estimations are incorrect, and

[199] *Id.* at 234-35.
[200] *Id.* at 248; O'Brien & Markham, *supra* note 183, at 6-7.
[201] Susan Stabley, *S.C. to fight Duke's Catawba River license*, CHARLOTTE BUSINESS JOURNAL (MAY 8, 2009) http://www.bizjournals.com/charlotte/stories/2009/05/04/daily64.html.
[202] *Id.*

because the river will be "'extraordinarily taxed' beyond Duke's environmental calculations."[203] While conflict exists not between two state agencies, but between the state and Duke in its application to the Federal Energy Regulatory Commission, this conflict nevertheless illustrates how uncoordinated planning, when faced with changing water supplies, can lead to conflict that implicates energy production.

Ultimately, conflicts of this nature could cause problems in Florida. First, these problems can lead to increased utility rates and the possibility of interruption in service.[204] Second, private industry and jobs in Florida would be harmed because of the potential regulatory and price uncertainty that would accompany conflicting plans from the various agencies.[205] And finally, the agency goals themselves would be frustrated because, once a power plant is in place, a long-term requirement exists for water and regular service from the plant, and these long term commitments may conflict with the long-term plans of the respective agencies.[206]

The connection between water and energy is an increasingly-discussed issue in legal and public policy circles, and both states and the federal government are beginning to realize that regulators cannot efficiently manage these two resources without first addressing their

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[203] *Id.*
[204] *See* Mitch Weiss, *Drought could force nuke-plant shutdowns*, USATODAY.COM (Jan. 24, 2008) http://www.usatoday.com/weather/drought/2008-01-24-drought-power_N.htm.
[205] *See id.*
[206] *See supra* Parts IV.A, IV.B.

interconnectedness.[207] Much of the research and commentary focuses on the water-energy connection in the Southwest.[208] However, in late 2006 the Department of Energy reported to Congress on this connection and concluded that "[c]ollaboration on energy and water resource planning is needed among federal, regional, and state agencies as well as with industry and other stakeholders."[209] Since the early 2000s, regulators and the energy industry have seen conflicts between proposed power plant locations and water resource plans.[210] One such conflict in Maryland resulted from an application for a permit to use wastewater to cool a nuclear power plant.[211] The county commission denied the wastewater application because it feared the decrease in need would result in regulators denying the county's future application for new water.[212] The only other source of water was the Potomac River;[213] thus, if the power plant is to be built, the regulatory conflict will lead to it consuming 2.4 to 4 million gpd of freshwater rather than wastewater.[214]

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[207] *See* ENERGY DEMANDS ON WATER, *supra* note 16, at 49.; Cohen, *supra* note 85, at 16-17 (focusing on the "Water-Energy Nexus").
[208] Cohen, *supra* note 85, at 16-17 (focusing on the "Water-Energy Nexus").
[209] ENERGY DEMANDS ON WATER, *supra* note 16, at 49.
[210] *South Dakota governor calls for Missouri River meeting*, U.S. WATER NEWS ONLINE (Aug. 2003) http://www.uswaternews.com/archives/arcpolicy/3soudak8.html.
[211] *Maryland County denies cooling water to proposed power plant*, U.S. WATER NEWS ONLINE (Oct. 2007) http://www.uswaternews.com/archives/arcsupply/7marycoun10.html.
[212] *Id.*
[213] *Id.*
[214] *Id.*

As the population in Florida continues to grow, demand for both water and energy increases.[215] However, beyond the issue of continued population growth, climate change will confront Florida with an uncertain water future-there will either be more or less rain. However, either way, water patterns in Florida will change, which will have to be accounted for in the allocation and distribution of water.

This Paper proposes a coordinated scientific investigative and planning program in which the WMDs, the DEP, and the PSC would take part with the ultimate goal of coming together for a unified picture of water and energy resources. This assessment could then be used to form a plan to address increased demands on both water and energy, which would prepare the state for challenges related to climate change.

A. Timeframe of Water Resource Planning

All natural resource management addresses resources and needs within certain timeframes. The present issue asks how much water and power Florida's population will require over the next twenty, forty, or even hundred years. Projections are limited by several factors; first and most important is the ability to accurately model for future population growth, technological advances, and overall need.[216] Second is the expected lifetime

[215] *See* DCA OVERVIEW, *supra* note 13, at 15 (noting the increased need for water supplies); DOE FLORIDA FACTSHEET, *supra* note 13 (noting the relation between population growth and future energy demand, also noting goals for reduction in per capita energy consumption).
[216] *See* FLORIDA PUBLIC SERVICE COMMISSION, ANNUAL REPORT ON ACTIVITIES PURSUANT TO THE FLORIDA ENERGY EFFICIENCY AND CONSERVATION ACT, 1-2 (Feb. 2010) http://www.psc.state.fl.us/publications/pdf/electricgas/FEECA2010.pdf.

of the infrastructure that the agency is approving, which must be taken into account.[217] For instance, the timeframe for aquifer and wetland restoration varies based on the local water resources available, and CUPs are issued for periods of up to twenty years.[218] On the other hand, power plants have limited lifetimes which are determined by the age of the technology and, in some cases, regulatory frameworks.[219] For example, the Nuclear Regulatory Commission licenses nuclear power plants for forty years, at the end of which the plant may apply a new permit.[220]

The relevant agencies would have a substantially more informed permitting process if each one evaluated the timelines of water management and energy production projects together. For instance, if a WMD was anticipating a water shortage from a particular body of water within the next thirty years, then that projected shortage should induce the PSC to be less willing to approve a power plant at that location knowing that the WMD may ultimately resist future CUPs for the power plant. Or in more exigent circumstances, climate change may cause an area to become much more arid during the first CUP period, which would threaten the water body and the power plant's operation, which is similar to the issues facing the Duke

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[217] *See* STEVE THOMAS, THE ECONOMICS OF NUCLEAR POWER: ANALYSIS OF RECENT STUDIES, PUBLIC SERVICES INTERNATIONAL RESEARCH UNIT, 16-17 (July, 2005) http://www.psiru.org/reports/2005-09-E-Nuclear.pdf.
[218] *See, e.g.*, *Consumptive Water Use Permits*, SOUTH FLORIDA WATER MANAGEMENT DISTRICT, http://www.sfwmd.gov/portal/page/portal/xweb%20-%20release%202/water%20use%20permits (last visited Dec. 5, 2010).
[219] *Decommissioning a Nuclear Power Plant*, U.S. NUCLEAR REGULATORY COMMISSION, http://www.nrc.gov/reading-rm/basic-ref/students/decommissioning.html (last visited Dec. 5, 2010).
[220] *Id.*

facilities on the Catawba River.[221] Currently, the power plant bears the risk that the WMD will not grant the CUP or that the water will not be there.[222] While communication on anticipated timelines will not produce more water, it will help inform water and energy decisions, meaning that all interested parties will be more prepared to cope with future changes in the resources.

B. Cooperative Scientific Research and Reporting

The DEP, the WMDs, and the PSC all have specialized knowledge regarding the respective areas they regulate. However, each institution has particular goals that the state has put in place. The DEP and the WMDs are focused on ensuring that Floridians have a supply of water, as well as ensuring that water use does as little damage to the environment as possible.[223] The PSC, in turn, is committed to ensuring that sufficient electricity is available to Floridians at reasonable rates.[224] While these are divergent goals, they converge at many points, as is illustrated above. Regular exchange of expert opinions between the respective agencies would foster more knowledgeable decisions and planning processes amongst both agencies.

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[221] Stabley, *supra* note 199.
[222] *See* THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT, BASIS OF REVIEW FOR WATER USE PERMIT APPLICATIONS WITHIN THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT, 2-3 (Mar. 18, 2010) http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/bor_wu.pdf (noting that "[a]pplicants for projects that are to be developed in phases should consider their water needs for all phases of the proposed project. However, the District evaluates permit applications based on the demonstrated need of water for the project only through the recommended duration of the permit . . . ").
[223] *See Water Management Districts*, *supra* note 148.
[224] *See Mission Statement and Goals*, FLORIDA PUBLIC SERVICE COMMISSION, http://www.psc.state.fl.us/about/mission.aspx (last visited Dec. 5, 2010).

Increasing the interaction between these agencies might ultimately result in less agency expense to do initial studies for future planning. Much of the raw data that these agencies must address is the same because each has regulatory duties that are affected by water resources.[225] Even if the specific focus of the inquiries may be slightly different, the agencies would benefit from sharing the information. Coordinated study plans and goals would likely result in a more complete picture of water supply and energy needs for each agency; they would also utilize combined resources to achieve desirable end results. The U.S. Department of Energy has specifically noted:

> Mechanisms, such as regional natural resources planning groups, are needed to foster collaboration between stakeholders and regional and state water and energy planning, management, and regulatory groups and agencies. These types of collaborative efforts are needed to ensure proper evaluation and valuation of water resources for all needs, including energy development and generation.[226]

Moreover, such coordination may result in less expense for private industries that have an interest in water and energy resources, because there would be a single repository of data upon which these agencies would base their decisions. Ultimately, it would require less expense of private resources to become familiar with the data, and there would be fewer areas of potential conflict. Ultimately, the unified information would produce a greater likelihood of anticipating agency action.

[225] *See supra* Parts IV.A, IV.B.
[226] ENERGY DEMANDS ON WATER RESOURCES, *supra* note 16, at 49.

If all agencies with a hand in managing the same resources were involved in the investigatory process, conflict will likely diminish. Moreover, all of these agencies will be looking at the same data and will be more familiar with the likely activity of the other agencies, resulting in better planning.

C. Applying Florida's Existing Land Use Planning Linkage to Water Policy to Energy Development

Florida has already established mechanisms to coordinate land use planning and water resource management,[227] and some of these can be adapted for combined water-energy planning. Many of the land use mechanisms focus on the development of state and local comprehensive plans.[228] This is a planning (rather than a permitting) exercise,[229] which may not fit well with the FEPPSA and CUPs, because these are both permitting programs.[230] However, power companies engage in power plant site planning, which provides a planning program to which agencies can adapt land use mechanisms.[231]

While PSC is responsible for permitting power plants, the power plant developers engage in their own mandated planning process.[232] Utilities submit ten-year plans to the PSC based on historical and future energy

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[227] O'Brien & Markham, *supra* note 182, at 5-7.
[228] *Id.*
[229] *See* Angelo, *supra* note 192, at 232.
[230] *See supra* Parts IV.A, IV.B.
[231] Lisa O. O'Neill, *Florida Electrical Power Plant Siting Act: Perpetuating Power Industry Supremacy in The Certification Process*, 36 U. FLA. L. REV. 817, 836 (1984).
[232] *Id.*; *see Ten-Year Site Plans*, FLORIDA PUBLIC SERVICE COMMISSION, http://www.psc.state.fl.us/utilities/electricgas/10yrsiteplans.aspx (last visited Dec. 5, 2010).

consumption rates, projecting if and where future power plants will be required.[233] However, these plans do not substantively address future water consumption and available resources related to the plants.[234] Florida Power & Light (FPL), for example, does mention water resources several times in its 2010 site plan, but the references are very basic – even cursory descriptions of the water use by the plants. The plan does not include an overall impact on the local water resources.[235]

Power plant developers are mandated to produce the plans, and the PSC is mandated to review and classify the plans as suitable or unsuitable based on multiple criteria.[236] Thus, the PSC already has planning authority; moreover, one of the criteria for review is the views of "local, state, and federal agencies, including the views of the appropriate water management district as to the availability of water and its recommendation as to the use by the proposed plant of salt water or fresh water for cooling purposes."[237] However, the concerns of the WMDs appear to play a relatively minor role in the overall process of site approval.[238] The power plant developers are not

[233] O'Neill, *supra* note 230; *see*, e.g., FLORIDA RELIABILITY COORDINATING COUNCIL, INC., 2010 REGIONAL LOAD & RESOURCE PLAN (July 2010) http://www.psc.state.fl.us/utilities/electricgas/docs/2010_FRCC_Plan.pdf.
[234] *See, e.g.*, FPL, TEN YEAR PLANT SITE PLAN 2010-2019 (Apr. 2010) http://www.fpl.com/about/ten_year/pdf/plan.pdf.
[235] *See id.* at 123, 130, 137, 143, 147.
[236] Fla. Stat. § 186.801.
[237] *Id.*
[238] *See* FLORIDA PUBLIC SERVICE COMMISSION DIVISION OF ECONOMIC REGULATION, A REVIEW OF FLORIDA ELETRIC UTILITY 2005 TEN-YEAR SITE PLANS (Dec. 2005) http://www.floridapsc.com/publications/pdf/electricgas/tysp2005.pdf (noting the most WMDs have no adverse comments regarding the suitability of proposed sites, but noting some concerns); FLORIDA PUBLIC SERVICE COMMISSION, REVIEW OF 2007 TEN-YEAR SITE PLANS FOR FLORIDA'S ELECTRIC UTILITIES (Dec. 2007) http://www.floridapsc.com/publications/pdf/electricgas/tysp2007.pdf (noting no concerns from the WMDs).

mandated to address water resource issues; [239] moreover, they do not readily have access to data, nor a program to assess the impact of future power plants on water resources in the state, basin, or even local level.

Current land use planning mechanisms addressing water concerns can supply a model for improving the coordination of energy and water planning mechanisms. Water resources benefit from having water managers – the WMDs – contribute input directly to land use planning.[240] This model can be applied to a water-energy planning context by mandating that the WMDs create a water-energy plan accessible to the public, and by mandating that power plant developers review the plan and provide a comment section addressing the implications of their proposed power plant siting. Having power plant developers review and comment on the WMD's water-energy plan and develop their site development plan accordingly would front-load review of water resource concerns, rather than back-load it by having WMDs comment only after the plans have been reviewed by the PSC.[241] Furthermore, the review process would highlight the long-term concerns of water planners, giving developers a better understanding of the water resources available for future power plants.

D. Lessons from the West: Assured Water Supply Requirements

In addition to direct agency coordination, power plant developers should also take an active role in planning for future water availability for

[239] *See* Fla. Stat. § 186.801.
[240] *See supra* Part IV.C.
[241] *See* Fla. Stat. § 186.801(2).

plants that they plan to construct. To this end, the developers should play a greater role in the planning process through assured water supply requirements.[242] While the ten-year planning mandate discussed above[243] can be modified for a water-energy planning system based on land use mechanisms, it could not be adapted to assured water supply requirements. Assured supply requirements apply to actual developments, not a long-range plan of potential development.[244] Assured supply requirements focus on permitting, rather than planning, but they do take a long-view of water supply.[245] Thus, a permitting program would be better suited for implementation of an assured water supply program. For the WMDs, the appropriate program would be CUPs; for the PSC, it would be certificates of need determinations.[246]

The mechanics of assured water supply requirements for land use development are fairly simple. The laws require the developer to prove that it has an adequate water supply before the agency will approve the development.[247] However, as simple as this mandate may appear, many complexities follow from it.[248] Some of these complexities arise as a result of various definitions and interpretations of the statutory terms employed, such

[242] *See* Davies*, Hot Fuss, supra* note 173, at 1249.
[243] Fla. Stat. § 186.801 (Year).
[244] Davies*, Hot Fuss, supra* note 173, at 1249
[245] *Id.* at 1248.
[246] Fla. Stat. § 403.519 (Year); *see, e.g.,* FLORIDA PUBLIC SERVICE COMMISSION, CERTIFICATE OF NEED DETERMINATION FOR NEW PLANTS IN FLORIDA (May, 2005) http://www.gru.com/Pdf/futurePower/PSCNeedCertification.pdf
[247] Lincoln L. Davies, *Assured Water Supply Laws in the Sustainability Context*, 4 GOLDEN GATE U. ENVTL. L.J. 167, 173 (2010).
[248] *Id.* at 174.

as "assured" and "adequate."[249] Moreover, there are problems related to what constitutes proof under these schemes.[250] For instance, there are open questions as to whether a water provider's guarantee that the water will be available is sufficient, or whether the developer must engage in a more in-depth scientific analysis and provide future water use projections.[251] While these laws face difficulty and vary in their success based on the minutia of their implementation, they can ultimately succeed in achieving their goals of protecting consumers, achieving holistic planning, and protecting the environment.[252] The same benefits can be brought to the development of energy resources in Florida.

Because FEPPSA and the FWRA both require the PSC to be wholly responsible for power plant siting,[253] the PSC is the agency best suited to ensure that water assurance requirements are met. However, the WMDs responsible for authorizing CUPs[254] would be the agency responsible for authorizing the actual water withdrawal for the power plant. Implementing assured supply laws would require WMDs to look beyond the relatively basic statutory criteria of public need currently set out for CUPs,[255] and require them to have a mechanism through which they can address future water

[249] Compare Cal. Gov't Code § 66473.7(a)(2) and Wash. Rev. Code § 19.27.097(1); *See* Davies*, Hot Fuss, supra* note 174, at 1279-91.
[250] Davies, *Assured Water Supply*, *supra* note 245 at 174.
[251] *Id.*
[252] Davies*, Hot Fuss, supra* note 174, at 1230-46.
[253] Fla. Stat. § 403.519 (stating that the PSC has the exclusive authority to determination of need for a new power plant); Fla. Stat. § 373.217(3) (stating that the FWRA does not supersede the FEPPSA).
[254] Fla. Stat. 373.223(1).
[255] The consumptive use must be of "reasonable-beneficial use" as statutorily defined; "not interfere with any presently existing legal use water"; and "consistent with the public interest." Fla. Stat. § 373.223(1).

resources at specific locations. Moreover, directly involving water resource managers in a forward-looking authorization process would likely help Florida to avoid situations such as the Maryland nuclear power plant or the Catawba River power facilities.[256]

E. Climate Change and Implementing Coordination

As climate change progresses, water supplies in Florida will inevitably change.[257] Depending on whether the Hadley model or the Canadian model is correct, Florida will either see an increase or decrease in precipitation.[258] Along with this alteration in climate will come more drastic weather patterns, likely including stronger storms and stronger droughts.[259] As was illustrated by the Catawba River power facilities, droughts can have devastating effects on a power plant's ability to operate. Without the water, the plants must reduce production or shut down.[260] To make up for the closed power plants, other, typically more expensive methods of power generation, lead to spikes in power prices and potentially to power rationing and losses.[261]

Climate change is a slow process, thus coordinated planning between water resource management and power plant siting would have time to

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[256] *See supra* Part V.
[257] *See supra* Part II.B.
[258] GLOBAL CHANGE SOUTHEAST OVERVIEW, *supra* note 22.
[259] *National Climate Change*, U.S. GLOBAL CHANGE RESEARCH PROGRAM, http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/full-report/national-climate-change (last visited Dec. 5, 2010).
[260] *State of the Climate, Drought August 2007*, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (Sept., 2007) http://www.ncdc.noaa.gov/sotc/index.php?report=drought&year=2007&month=aug (noting that in 2007, "Brown's Ferry Number 2 nuclear power plant shut down due to the Tennessee River being too weak and too warm for cooling the reactor").
[261] *See* Jeff Keeling, *Slow Burn: TVA to Downsize 3 Coal-Fired Plants in Tenn., Ky., and Ala.*, JOHNSONCITYPRESS.COM, http://www.johnsoncitypress.com/News/article.php?ID=80350 (last visited Dec. 5, 2010).

adapt to alterations in climate. Measures such as coordinated time frames and combined research would lead to a more complete picture for the parties involved in power and water decisions. More extreme droughts and storms are expected to come from alterations in the climate.[262] If extreme droughts, like those in 2007 that affected power plants,[263] begin to occur in Florida, the power industry and Floridians will likely feel a direct effect from climate change and the water-energy issues. Therefore, the state should begin planning for these potential effects on both energy and water.

Furthermore, sea level rise, which is caused by climate change, is already a concern for power plants in Florida and around the world.[264] In Florida, for example, FPL has proposed to build two additional nuclear power reactors at the Turkey Point Power Plant in southern Florida.[265] However, there is already vocal opposition asserting that FPL did not sufficiently consider the impact of sea level rise on operations and safety at the facility.[266] In other parts of the world, the same concerns are being echoed.[267] In India, for example, the India Institute of Technology, Madras, conducted a study which focused on the Kalpakkam nuclear power plant,

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[262] *See National Climate Change*, *supra* note 257.
[263] *State of the Climate, Drought August 2007*, *supra* note 258.
[264] *Growing Opposition to FPL's Proposed New Turkey Point Nuclear Reactors*, NATIONAL PARKS CONSERVATION ASSOCIATION (Nov. 19, 2010) http://www.npca.org/media_center/press_releases/regions/growing_opposition_to_fpls.html; *Sea level rise will hit Kalpakkam power station, says study,* THE TIMES OF INDIA (Nov. 25, 2010) http://timesofindia.indiatimes.com/city/chennai/Sea-level-rise-will-hit-Kalpakkam-power-station-says-study/articleshow/6984339.cms (last visited Dec. 5, 2010).
[265] *FPL's Turkey Point Proposal*, FPL, http://www.fpl.com/environment/plant/turkey_point.shtml (last visited Dec. 5, 2010); *Growing Opposition*, *supra* note 262.
[266] *Growing Opposition*, *supra* note 262.
[267] *Sea level rise will hit Kalpakkam power station*, *supra* note 262.

which concluded that without long-range planning, India would be faced with extensive costs of mitigating rising sea levels or potentially replacing power plants.[268] Climate change problems, as they relate to power plant siting, are becoming more apparent in Florida and around the world.

Combined timeline approaches and cooperative studies would give energy companies, agencies, and the public a better understanding of the potential future effects of climate change and how it will affect power development in Florida. If agencies and developers have a broader picture of the current and future states of water resources and energy development, that information can be used to create an informed planning system that incorporates mechanisms that Florida already employs in land use planning as well as more novel schemes, such as assured supply requirements.

CONCLUSION

Floridians, who once saw water as a problematic part of nature to be tamed, are now facing the consequences of earlier water management decision. The state must now plan for population increases and the uncertainty of climate change.[269] As such, the parties responsible for planning and managing water and power should work in a more integrated fashion to ensure the most efficient allocation of resources. States and the federal government are increasingly recognizing the critical intersection of

[268] *Id.*
[269] *See supra* Part II.

water and energy policy and that a lack of energy-water coordination can have substantial effects on water resources and on the availability of electricity. The time to set up the cooperative structures between the WMDs, the DEP, and the PSC is now, so agencies can form a clearer picture of the water-energy relationships and so they can cooperatively plan for the future.