

*Review*

## **A Blueprint for Florida's Clean Energy Future - Case Study of a Regional Government's Environmental Strategy**

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*Received: 2 February 2009 / Accepted: 27 March 2009 / Published: 1 April 2009*

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**Abstract:** On 13 July 2007, Governor Charlie Crist of Florida signed executive orders to establish greenhouse gas emission targets that required an 80 percent reduction below 1990 levels by the year 2050. Florida is a very high-risk state with regard to climate change. Its 1,350-mile-long coastline, location in "Hurricane Alley," reliance on coral reefs and other vulnerable natural resources for its economy, and the predictions that state population could double in the next 30 years all contribute to this designation of "high-risk. As a consequence of the potential economic and ecological impacts of climate change to Florida, a series of Action Teams were created to plan for adaptation to impending environmental changes. As the 26<sup>th</sup> largest emitter of carbon dioxide on a global scale, Florida needs to act aggressively to create a clean energy footprint as part of its statewide initiatives but with global impacts. This case study examines the process and expected outcomes undertaken by a regional government that anticipates the need for stringent adaptation.

**Keywords:** Climate change; Florida; adaptation; regional government; environmental policy.

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### **1. Introduction**

Right on the heels of a monumental Supreme Court decision mandating the US Environmental Protection Agency to regulate carbon dioxide and other greenhouse gases, the Florida cabinet convened a special Climate Change Conversation on 3 April 2007 [1]. Surrounded on three sides by rising sea levels and also directly in the pathway of major hurricanes, Florida has a lot at stake with impending global warming [2]. Chief Financial Officer Alex Sink and Chief of Agriculture Charles

Bronson spearheaded the first-ever Florida Climate Change Conversation (see [www.floridaclimateaction.com](http://www.floridaclimateaction.com)). Given its current trajectory, climate change will significantly affect the economy, environment, and agriculture of Florida, as well as the health and welfare of its citizens. Governor Charlie Crist was an enthusiastic participant in the initial dialogue, listening and asking questions throughout this historic four-hour session.

Three Florida climate change scientists launched the day's conversation: Dr. Margaret Lowman introduced climate change from a scientific perspective and de-mystified the myriad data-bases that doubtless confuse most non-scientists who tackle this complex subject; Dr. Stephen Mulkey from University of Florida reviewed some of the daunting and relatively gloomy predictions for Florida's future; and Dr. Stephen Leatherman, Director of the International Hurricane Research Center at Florida International University, explained the impacts of sea level rise to coastal Florida, including destruction of properties from storm surges and the folly of beach re-nourishment as coastal erosion accelerates. Insurance expert Tim Wagner (Nebraska Department of Insurance) reminded the Florida cabinet that half its population lives within one mile of the coastline, creating enormous challenges for insurance companies. Ken Locklin of the Clean Energy Group spoke about innovative business investments in alternative energy technologies that represent immediate economic opportunities. And Keith Allen, British Consul General based in Miami, shared his United Kingdom perspective that the "cost of inaction will be large... and the cost of action will be less". On that note, the cabinet of the state of Florida undertook a commitment to obtain best practices from around the world, to facilitate Florida's adaptation to climate change and its inevitable consequences. The scientific literature in 2007 corroborated Governor Crist's actions with several sobering new data sets relating to the impacts of climate on ecosystems [3,4,5]. Clearly, warming temperatures are impacting Earth, and the rates of change appear alarmingly rapid.

Despite the fairly gloomy prospects for a state with extensive coastline and proclivity for hurricanes, the good news is that Florida can take measures to adapt, starting with the creation of scientific and economic blueprints. Similar to getting a home insurance policy, a prudent statewide climate change "insurance policy" is under scrutiny by a combination of policy-makers working with scientists. This coupling of economics and ecology are long overdue [6]. The theme of science and economics continued to interface at the second Florida Climate Change Conversation in May 2007, where State CFO Sink discussed the potential costs of global warming. Experts also spoke on issues ranging from the ecological benefits of mangroves as "property insurance," to coral bleaching in the Florida Keys, to the possibility that sea level rise could turn the real estate market inside-out. Will homes with smaller footprints and green design features outprice mega-homes in the year 2015, due to rising costs of energy? Will lakefront homes become more popular than Gulf views because of storm surge, red tide, and eroding beaches?

## 2. Results and Discussion

A medical doctor accumulates a wellness history for each patient, and long-term care records allow better diagnosis during times of illness. Similarly, scientists collect baseline data on weather, vegetation, and biodiversity to diagnose possible environmental degradation. Economists use indicators to measure financial health - interest rates, unemployment, inflation and the Dow Jones

Index, to name a few. Ecologists use biological indicators to assess change – patterns such as earlier flowering dates in Boston, shifts in geographic ranges of species, increased droughts, and higher storm surges are clues that confirm shifts in global climate patterns. The Heinz Center for Science, Economics, and the Environment has established a national ecosystem assessment system, to monitor ecological changes and health [7]. To date, many vulnerable regions of Florida (e.g. the southwest coast) have not linked sound science to policy-making decisions about Florida's sea level rise or other aspects of climate predictions. Governor Crist's statewide climate change agenda has facilitated discussions that will foster accelerated action throughout the state. The application of statewide monitoring (using "best practices" such as the Heinz Center) [7] are currently under discussion.

Amidst the apparent gloom-and-doom of current environmental predictions, two words are bandied about by regional governments that may provide positive outcomes to climate change – adaptation and mitigation. A blueprint for Florida's clean-energy future has been prioritized, given the instability of oil production and the fact that carbon emissions are clearly linked to rising global temperatures. Such a blueprint requires an accurate assessment of the state's current environmental health, both ecological and economic. The creation of a Climate Change Action team, and additional task forces to create a blueprint for Adaptation and other relevant topics, will provide Florida government with baseline for sound policies of adaptation and mitigation ([www.flclimatechange.us](http://www.flclimatechange.us)).

Established in May 2008, the Florida Adaptation Technical Working Group (TWG) was comprised of scientists, planners, engineers, economists, regional government, and citizens. TWG defined a framework for future climate change adaptation, based on these topics:

- 1). Advancing climate change science data and analysis;
- 2). Comprehensive planning at local, state, and regional levels;
- 3). Protection of ecosystems and biodiversity including coastal and estuarine habitats, ocean chemistry, plant-animal interactions, and ecosystem nutrient cycles;
- 4). Water resource management, especially with the inevitability of sea level rise and salt water intrusion;
- 5). Built environment, infrastructure and community protection which incorporates transportation as one major element;
- 6). Economic development;
- 7). Insurance (property and casualty);
- 8). Emergency preparedness and response (especially with regard to extreme events);
- 9). Human health concerns;
- 10). Social effects with regard to providing food, water and security to all citizens;
- 11). Organizing state government for the long haul to have sufficient scope, powers and resources;
- 12). State funding and financing;
- 13). Coordination with other regulatory and standards entities; and
- 14). Education outreach that makes Florida exemplary in its programs to educate the public.

Collectively, this comprehensive list is intended to drive future policy-making both regionally and statewide for Florida ([www.climatestrategies.us](http://www.climatestrategies.us)). The visionary aspects of Florida's climate change

adaptation plans are intended to prepare it for environmental changes, and safeguard citizens through implementation of best practices.

It is well documented that Earth's average surface temperature increased approximately one degree Fahrenheit during the last century, and that sea level rose 6-8 inches. The reduction of green house gases will require a significant change in human behavior, but action plans can be implemented with existing technology. The classic Science paper about energy wedges [4] creates one of the key solution-based strategies for both state-level or national energy policies. In their report, Socolow and Pacala explain that humankind currently has the technical, scientific, and industrial knowledge to abate global warming for the next half-century. They admit that no single option offers an ideal solution. But they optimistically explain how we could scale up certain existing technologies, perhaps averting potential catastrophe for the next generation that could result if we maintain (or increase) current levels of carbon dioxide emissions. They claim that we need to significantly ramp up research and development within the next 5 decades to develop revolutionary new technologies essential for the second half of this century. Their 50-year solution outlines the notion of "stabilization wedges", which represent pieces of a global energy pie that can collectively be executed to reduce current emissions with existing technologies. They admit their strategy will only slow down the current climate trajectory, after which time we must have new technologies operational by or before 2054. As the "sunshine state," Florida is viewed as admittedly slow to embrace clean energy alternatives such as solar energy. The widespread publicity of the energy wedges concept throughout both scientific and political circles served to accelerate the planning of statewide energy strategies.

The government of Florida is concerned that, over the past 30 years, carbon emissions grew by 1.5% each year. Human activities currently release seven billion tons of carbon per year into Earth's atmosphere, and at current rates of industrialization, this amount will more than double over the next 50 years. During William Shakespeare's lifetime, the air that he breathed contained approximately 280 ppm (parts per million) carbon dioxide, as compared to nearly 400 ppm in 2008. No one is certain what level will exceed the threshold that allows humans to survive on this planet. But the majority of scientists are optimistic that staying below 500 ppm may avert the severest impacts of rapid climate change, and Florida government concurs with this.

To implement a series of energy wedges within the next 50 years to stall the increasing levels of carbon dioxide in our atmosphere requires immediate action, particularly in the United States where a disproportional amount of energy is utilized [6] as well as in Florida, which anticipates increased numbers of retirees moving into the state as baby boomers approach retirement. Fifty years also represents an important threshold or tipping point – the longevity of a career, the lifetime of a power plant, and the estimated timeframe within which future technologies must be developed and utilized. But can Florida leadership agree on such an ambitious strategy?

Using best practices, some scientists are convinced that Earth can stabilize carbon dioxide in its atmosphere at 500 ppm within the next 50 years. At current levels of increase, humans will double today's emissions of seven billion tons of carbon per year to 14 GtC/y in 2050. (Note: 1 GtC/y = one billion tons of carbon per year). To curb this predicted increase, seven "stabilization wedges" (whereby one wedge represents one billion tons carbon per year) of energy savings must be deployed to reduce global emissions by the required seven billion tons to avert catastrophic global warming. The energy wedges proposal provides three economic options to reduce atmospheric carbon: 1). energy

efficiency; 2). removing carbon from existing electricity and fuel production, and 3. biological storage of carbon in natural sinks. No single solution is identified as ideal, but a combination of different existing technologies - if scaled up and used in conjunction with one another - may provide adequate measures to curb carbon emissions between now and 2050. Specific actions include improved fuel economy, reduced reliance on cars, more efficient buildings, improved efficiency of power plants, substitution of natural gas for coal, terrestrial storage of carbon captured in power plants, nuclear and photovoltaic electricity and wind power replacing coal power, renewable hydrogen, expanded use of biofuels, improved forest management, and conservation tillage to minimize loss of carbon from soils [4].

The good news is that current technologies already exist to reduce our current emissions of greenhouse gases into the air. The bad news is that it may be next to impossible to willingly engage communities to implement some of these carbon savings. Scientists, economists and political leaders have some daunting decision-making in the very near future, to assure that we do not exceed the capacity of Earth to recover from excessive alterations to her atmosphere. Under Governor Crist's leadership, Florida now embraces these sustainability challenges.

### 3. Conclusions

One important component for state governments in America is to design policies in partnership with national goals and priorities. Florida, with its expanse of coastline and extensive reliance on natural resources for tourism, agriculture, and forestry, is a beneficiary of any national assessments that involve such natural resources. One such continental-scale ecosystem assessment was completed by the H. John Heinz III Center for Science, Economy and Environment in Washington DC entitled "The State of the Nation's Ecosystems – 2008." ([www.heinzcenterassessment.com](http://www.heinzcenterassessment.com)). The Heinz team measured coasts/oceans, farmland, forests, fresh water, grasslands/shrublands, and urban/suburban regions, and subsequently developed a set of indicators to evaluate national ecosystem health, including climate change. In this way, scientists become "doctors of the landscape" to monitor the nation's ecological health. Using the Heinz Center model, Florida hopes to create a similar snapshot of its current natural capital and develop indicators to monitor future changes (see also Center for Science in the Earth System 2007) [1,7]. A science-based sustainability blueprint for Florida will require the following.

#### *3.1. Centralized Data Base or Web Site of Florida's Natural Capital Including Species, Ecosystems and Important Ecological Services*

Data bases should be both centralized and simplified, so that users such as regional governments can base their planning efforts on the most up-to-date land use information. For example, coastal counties need accurate information on mangrove distribution, sea level rise, and water quality. Incentives for conserving mangroves, forest canopy, and planting native species to reduce water consumption are obvious economic practices that could be implemented from the data base.

Many baseline measurements of Florida's natural capital already exist, but are dispersed throughout state agencies, institutions, and science labs. A single, user-friendly website for climate change-related

data would assist regional government. One statewide data base called CLIP (Critical Lands/Waters Identification Project, [www.clip.com](http://www.clip.com)) is beginning to compile ecosystem data in this fashion.

### *3.2. Indicators to Assess the Health of Florida's Natural Capital*

Environmental indicators can serve as “canaries in the coal mine” to signal decline of natural systems. For example, depletion of salt marshes may indicate rising sea level. Assessments of traffic noise along interstates could indicate intensity of vehicle use. Permanent plots of coral reefs can provide indicators of bleaching events. The Heinz Center analyzed nitrogen in water bodies as part of its national ecosystem assessment process to indicate decline of water quality and to predict the expansion of dead zones [7].

### *3.3. Economic Indicators to Assess the Health of Our Businesses*

While a state science team can assess natural capital, an economic team could work simultaneously on economic indicators. Businesses that capitalize on clean energy, agricultural crops that sequester carbon, and even creative new industries such as virtual conferencing (to reduce business travel) may be earmarked as indicators of Florida's economic health. Think-tanks for renewable energy and other new industries adapted to warming temperatures should be prioritized. Senator Michael Bennett (Florida Senate District 21) received a standing ovation from scientists and policy-makers at a statewide Climate Change Conference in Tampa (May 12, 2007) when he said: “Let's try to leave a legacy of how we want Florida to look four or five generations from now.... If we don't start thinking outside of the box, we're going to be in the same box five years from now.”

### *3.4. Creation of Clean-Energy Portfolio for Florida*

Like the national climate change prognosis, Florida will require its own statewide portfolio of energy wedges, with incentives to develop renewable energies as well as to mitigate the current trajectory of warming temperatures. Taking from the best practices of Pacala and Socolow's [4] national-scale model of energy wedges, Florida hopes to create an energy portfolio with less reliance on fossil fuels, and with more incentives for its own workforce. The next few years are critical, as states such as Florida face the confines of government and democratic process, but remain cognizant of a rapid timeline of global change whose predictions threaten its physical shorelines, natural resources, economics, and quality of life for all residents.

## **Acknowledgements**

The author is grateful for her colleagues from the ALLP (Aldo Leopold Leadership Program) for discussions that led to many ideas concerning public science outreach; to Florida colleagues Drs. Stephen Mulkey and Steven Leatherman for discussions of state scientific data; and to the Action Team committees headed up by Michael Sole of the Department of Environmental Protection in Tallahassee, Florida.

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