



Florida's Energy & Climate Change Action Plan

October 15, 2008

Governor's Action Team on Energy & Climate Change

Table of Contents

Letter from Chairman Michael Sole to Governor Charlie Crist	2
Members of the Governor’s Action Team on Energy and Climate Change	4
Members of Technical Working Groups	5
Acknowledgments	8
Executive Summary	10
The Science of Climate Change and Its Importance and Opportunities for Florida	31
History and Status of State Actions	40
Chapter 1 – Background and Overview	1-1
Chapter 2 – Inventory and Projections of Florida GHG Emissions	2-1
Chapter 3 – Energy Supply and Demand.....	3-1
Chapter 4 – Cap-and-Trade	4-1
Chapter 5 – Transportation and Land Use	5-1
Chapter 6 – Agriculture, Forestry, and Waste Management	6-1
Chapter 7 – Government Policy and Coordination.....	7-1
Chapter 8 – Adaptation Strategies.....	8-1
Technical Appendices	
A. Energy Supply and Demand – Policy Recommendations.....	A-1
B. Cap-and-Trade – Policy Recommendations	B-1
C. Transportation and Land Use – Policy Recommendations	C-1
D. Agriculture, Forestry, and Waste Management – Policy Recommendations	D-1
E. Government Policy and Coordination – Policy Recommendations.....	E-1
F. Adaptation Strategies – Policy Recommendations	F-1
G. Acronyms and Abbreviations	G-1
Administrative Appendices	
H. Executive Orders	H-1
I. Phase 1 Report.....	I-1

October 15, 2008

Dear Governor Crist:

Since you issued Executive Order 07-128 on July 13, 2007, the Governor's Action Team on Energy and Climate Change has worked diligently to develop this comprehensive Energy and Climate Change Action Plan for the State of Florida.

This transmittal is the second and final report of the Governor's Action Team on Energy and Climate Change. The Action Team submitted its Phase 1 report in 2007 containing 35 findings and 30 recommendations. This Phase 2 report details our collective 2008 work and provides 50 separate policy recommendations that will reduce harmful greenhouse gas emissions and provide a framework for climate change adaptation strategies to guide Florida over the coming years and decades. Further, the Phase 2 report provides a separate set of comments toward the current work to develop Florida's cap-and-trade regulatory program, one of the provisions contained in the 2008 Legislature's landmark energy and climate change bill that you signed.

The principal charge provided to the Action Team has been to develop a plan that will fully achieve or surpass the targets for statewide greenhouse gas reductions specified in Executive Order 07-127. If all of the recommendations in this plan were to be implemented, it is estimated that:

- Florida's greenhouse gas emission reductions would *surpass* your Executive Order 07-127 emission reduction targets for 2017 and 2025, by 11 percent and 34 percent, respectively;
- Florida's energy security would increase by reducing our dependence on fossil fuels resulting in a total fuel savings of 53.5 billion gallons of petroleum, 200.2 million short tons of coal, and 6.394 billion cubic feet of natural gas during the period of 2009 through 2025; and,
- Florida's economy would see a net benefit through investments in energy efficiency, low-carbon energy sources, and other greenhouse gas reduction strategies resulting in an estimated total net cost savings of more than \$28 billion from 2009 to 2025.

I could not possibly offer enough thanks to the 28 appointed members of the Governor's Action Team on Energy and Climate Change. At their own expense, they participated in this unprecedented effort as a collegial yet dynamic panel, lending their expertise and judicious thought. In the Phase 2 process, we also engaged more than 120 technical experts with resource knowledge in six separate Technical Working Groups. I am truly grateful for their technical

wisdom and dedication to serving in these key roles and for ensuring the Action Team had the latest and most complete science and data available. Also, the Center for Climate Strategies was instrumental in developing this report, serving as the independent facilitator, providing technical resources, and helping us ensure a public participation stakeholder process.

This second and final report of the Governor's Action Team on Energy and Climate Change is an exciting marker in Florida's journey on these issues, but it does not mark the end of the work Florida has ahead. It is essential that the recently created Florida Energy and Climate Commission continually track, update, and review these recommendations and analyses as additional data and information become available.

On behalf of the Governor's Action Team on Energy and Climate Change, I want to thank you for the opportunity to serve Florida in this critical and historic endeavor.



Michael W. Sole, Chairman

GOVERNOR'S ACTION TEAM ON ENERGY AND CLIMATE CHANGE

Chairman Michael W. Sole, Secretary, Florida Department of Environmental Protection

Vice-Chairman The Honorable Rick Baker, Mayor, City of St. Petersburg

The Honorable Jeffrey "Jeff" Atwater, Senator, Florida Senate, District 25

The Honorable Al Lawson, Senator, Florida Senate, District 6

The Honorable Dan Gelber, Representative, Florida House of Representatives, District 106

The Honorable Stan Mayfield, Representative, Florida House of Representatives, District 80

Thomas "Tommy" Boroughs, Partner, Holland & Knight

Michael Branch, Manager Forest Sustainability, Smurfit Stone

Matthew Carter, Chairman, Florida Public Service Commission

Camille E. Coley, J.D., Executive Assistant Vice President, Research, Florida Atlantic University

James M. Fenton, Ph.D., Director, Florida Solar Energy Center, University of Central Florida

Manley K. Fuller, III, President, Florida Wildlife Federation

David Guest, Managing Attorney, Earthjustice Florida

Debbie Harrison, Director, South Florida Program, World Wildlife Fund

Tim Hernandez, Principal, New Urban Communities Corporation

Robert "Buzz" Hoover, President, Gate Biofuels, LLC and Vice President – Petroleum Supply, Gate Petroleum Company

Lonnie Ingram, Ph.D., Distinguished Professor of Microbiology and Cell Science, College of Agriculture, University of Florida

Mark Kaplan, Vice President, Mosaic Fertilizer, LLC

Gerald "Jerry" Karnas, Florida Climate Project Director, Environmental Defense Fund

R. David McConnell, Area Vice President, Florida Waste Management

Kathy Baughman McLeod, Deputy Chief of Staff, Office of Florida's Chief Financial Officer

Jerry Montgomery, Senior Vice President, Conservation and Environmental Sustainability, Walt Disney Parks and Resorts

Armando Olivera, President, Florida Power & Light

Charles Pattison, President, 1000 Friends of Florida

Kathleen Shanahan, Chief Executive Officer, WRScompass

Jack Shreve, Senior Counsel to Governor Charlie Crist

Kathy E. Viehe, Assistant General Manager of Customer Support Services, Gainesville Regional Utilities

GOVERNOR'S ACTION TEAM ON ENERGY AND CLIMATE CHANGE

Technical Working Group Members

Adaptation

Matthew Alvarez, Chair, Florida Section, American Water Works Association
Ricardo Alvarez, Director, Laboratory for Structural Mitigation, International Hurricane Research Center, Florida Atlantic University
Gary Appelson, Policy Coordinator, Caribbean Conservation Corporation
Kathy Baughman McLeod*, Deputy Chief of Staff, Office of Florida's Chief Financial Officer
Steve Boutelle, Marine Operations Manager, Lee County Division of Natural Resources
Julie Brashears Wraithmell, Wildlife Policy Coordinator, Audubon of Florida
Camille E. Coley, J.D.*, Assistant Vice President for Research, Florida Atlantic University
Richard T. Crotty, Mayor, Orange County, Florida
Diane Ferguson, Legislative Staff Attorney, Florida Association of Counties
Debbie Harrison*, Director of South Florida Program, World Wildlife Fund
Paul Johnson, President, Reef Relief
Meg Lowman, Director of Environmental Initiatives, Professor of Biology and Environmental Studies, New College of Florida
Kevin McCarty, Commissioner, Office of Insurance Regulation
Jim Murley, Director, Center for Urban and Environmental Solutions, Florida Atlantic University
John Ogden, Director, Florida Institute of Oceanography
Richard Owen, Deputy Executive Director, Division of Resource Regulation, Southwest Florida Water Management District
Tom Pelham, Secretary, Florida Department of Community Affairs
Thom Rumberger, Partner, Rumberger, Kirk, & Caldwell
Harvey Ruvin, Clerk of the Courts, Miami-Dade County
Jerry Sansom, Executive Director, Organized Fisherman of Florida
Doug Shaw, Director of Conservation Science, The Nature Conservancy
Hilary Swain, Executive Director and Senior Research Biologist, Archbold Biological Station

Agriculture, Forestry and Waste Management

Jim Alberts, President and CEO, Farm Credit of Northwest Florida
Jeffrey "Jeff" Atwater*, Senator, Florida Senate, District 6
Michael Branch*, Manager Forest Sustainability, Smurfit-Stone
Marc Bruner, Chief Administrative Officer, Solid Waste Authority of Palm Beach County
Jimmy G. Cheek, Senior Vice President, Agriculture and Natural Resources, Institute of Food and Agricultural Science, University of Florida
Manley Fuller, President, Florida Wildlife Federation
Doria Gordon, Senior Ecologist, The Nature Conservancy
Eugene Jones, Executive Director, Southern Waste Information Exchange
Jay Levenstein, Deputy Commissioner, Florida Department of Agriculture & Consumer Services
R. David McConnell*, Area Vice President of Florida Waste Management, Inc.
Jim Oskowis, General Manager, City of Tallahassee Water Utility
Gary Peter, Associate Professor, School of Forest Resources and Conservation, University of Florida
Dan Roach, Forest Environmental Systems Manager, Rayonier, Inc.
Kevin Robertson, Fire Ecology Research Scientist, Tall Timbers Research Station
Dwight Stansel, Owner, Dwight Stansel Farm and Nursery
Andrew Thomas Walmsley, Environmental Services Coordinator, Florida Farm Bureau Federation
Celeste White, Institute of Food and Agricultural Sciences, University of Florida
Nick Wiley, Assistant Executive Director, Florida Fish & Wildlife Conservation Commission

Cap- and-Trade

John Cahill, Attorney, Chadbourne & Park LLP
Laura Crouch, Manager of Environmental Policy & Regulatory Affairs, Tampa Electric Company
Tim Devlin, Director of Economic Regulation, Florida Public Service Commission
Judi Greenwald, Director of Innovative Solutions, Pew Center for Global Climate Change
Julie Harrington, Director, Center for Economic Forecasting & Analysis, Florida State University
Debbie Harrison*, Director, South Florida Program, World Wildlife Fund
John Hewa, General Manager, Talquin Electric Cooperative Inc.
Michael Hewett, Manager of Environmental Services, Publix Supermarkets, Inc.
Robert "Buzz" Hoover*, President, Gate Biofuels, LLC and Vice President, Petroleum Supply, Gate Petroleum Company
Gerald "Jerry" Karnas*, Florida Climate Project Director, Environmental Defense Fund
Robert Kaufman, Manager of Federal Regulatory Policy, Georgia-Pacific LLC
Michael Kennedy, Principal Environmental Specialist, Florida Progress Energy
Greg Munson, General Counsel, WRScompass
Terry Murphy, Senior Policy Advisor, Miami-Dade County Commission
Armando Olivera*, President, Florida Power & Light
Robert Reedy, Director Solar Energy Division, Florida Solar Energy Research Center
Kathleen Shanahan*, CEO, WRScompass, Inc.
Jim Vick, Vice President of Environmental Services, Gulf Power
Kathy E. Viehe*, Assistant General Manager, Customer Support Services, Gainesville Regional Utilities

Energy Supply and Demand

Charlie Beck, Office of the Public Counsel, the Florida Legislature
Angie Beehler, Senior Director of Energy Regulation, Wal-Mart
Holly Binns, Field Director, Environment Florida
David Byrne, Director of Energy Service, City of Tallahassee Utilities
Linda Campbell, Vice President and Executive Director, Standards and Compliance, Florida Reliability Coordinating Council
Matthew Carter*, Chairman, Florida Public Service Commission
Ben Crisp, Director of Systems Planning and Regulatory Performance, Progress Energy Florida
Eric Draper, Deputy Director for Policy, Audubon of Florida
Phillip Fairey, Deputy Director, Florida Solar Energy Center, University of Central Florida
Jack Glenn, Technical Services Director, Florida Home Builders Association
David Guest*, Managing Attorney, Earthjustice Florida
Thomas Hernandez, Vice President of Operations, Tampa Electric Company
Leon Jacobs, Energy Policy Consultant, Natural Resources Defense Council
Pierce Jones, Director, Program for Resource Efficient Communities, University of Florida
Mark Kaplan*, Vice President, Mosaic Fertilizer, LLC
Anjane'yulu' Krothapalli, Ph.D. Director, Sustainable Energy & Science Center, Florida State University
Ted McCullough, Vice President of Generation, Gulf Power Company
Jerry Montgomery*, Senior Vice President, Conservation & Environmental Sustainability, Walt Disney World Parks and Resorts
Maribel Nicholson-Choice, Attorney, Greenberg Traurig
Jack Shreve*, Senior Counsel to the Governor, Office of the Governor
Eric Silagy, Vice President General Manager, Florida Power & Light
Stephen Smith, Executive Director, Southern Alliance for Clean Energy
Ann Stanton, Energy Analyst, Florida Building Commission
Jennifer Szaro, Renewable Energy Manager, Orlando Utilities Commission

Government Policy and Coordination

David Ash, Aide to Senator Al Lawson, the Florida Senate
David G. Bates, Shareholder, Corporate Department, Gunster, Yoakley & Stewart, P.A.
Thomas "Tommy" Boroughs*, Partner, Holland & Knight
Sheri Coven, Director of Intergovernmental Affairs, Florida Department of Community Affairs
Carolyn Dekle, Executive Director, South Florida Regional Planning Council
Mimi Drew, Deputy Secretary of Regulatory Programs, Florida Department of Environmental Protection
James M. Fenton, Ph.D.*, Director, Florida Solar Energy Center
Dan Gelber*, Representative, Florida House of Representatives
Susan Glickman, Southeast Representative, The Climate Group
Margaret (Pegeen) Hanrahan, Mayor, City of Gainesville
Tim L. Hernandez*, Principal, New Urban Communities Corporation
R.E. LeMon, Associate Vice Chancellor, Florida Board of Governors, Florida Education Center
Joe McClash, County Commissioner, Manatee County Board of Commissioners
Pam McVety, Founding Member, Big Bend Climate Action Team
Daniel O'Keefe, J.D., Council Member, East Central Florida Regional Planning Council
Keisha Rice, Deputy Director, Florida Office of Tourism, Trade & Economic Development
Kevin Thibault, Assistant Secretary of Intermodal Systems Development, Florida Department of Transportation
Rich Unger, Board President of Florida Chapter, American Planning Association
Deena Reppen, Deputy Executive Director, Government and Public Affairs, South Florida Water Management District
Rhys Williams, President, Tequesta Bioventures, Inc.

Transportation and Land Use

Janet Bowman, Director of Legislative Policy & Strategies, The Nature Conservancy
William A. "Billy" Buzzett, Vice President of Strategic Planning, St. Joe Company
Peter Calvert, Chief Technical Officer, EarthFirst Americas
Tim Chapin, Professor, Department of Urban and Regional Planning, Florida State University
Greg Chelius, Florida State Director, Trust for Public Land
Charles Clary, III, Founding Principal, DAG Architects, Inc.
Suzanne Cook, Executive Director, Florida Green Building Coalition
Jeff Day, Director of Transportation & Maintenance, Publix Supermarkets, Inc.
Coleman Edmonds, Vice President, Deputy General Counsel & Assistant Secretary, Auto Nation, Inc.
Howard Glassman, Executive Director, Florida Metropolitan Planning Organization Advisory Council
Robert "Buzz" Hoover*, President, Gate Biofuels, LLC and Vice President, Petroleum Supply, Gate Petroleum Company
Lonnie Ingram, Ph.D.*, Professor of Microbiology, Institute of Food and Agriculture Sciences, University of Florida
Terry Joseph, Executive Director, West Florida Regional Planning Council
Dave Mica, Executive Director, Florida Petroleum Council
Charles Pattison*, President, 1000 Friends of Florida
David Peebles, Business Development, ETH Bioenergy-Odebrecht Construction, Inc.
Larry Peterson, Director of Architecture & Sustainable Planning, Kitson & Partners
Preston Robertson, Vice President for Conservation & General Counsel, Florida Wildlife Federation
Ted Smith, President, Florida Automobile Dealers Association

* Member of The Governor's Action Team on Energy and Climate Change

Acknowledgments

The work of the Governor's Action Team on Energy and Climate Change was accomplished only through the willingness of many to lend their time and expertise. The Action Team wishes to acknowledge those contributions and to express gratitude to all who have helped this process along.

The Action Team applauds the leadership of Governor Charlie Crist on the issues of energy and global climate change and is grateful to Chris Kise for his contributions at Action Team meetings as the Special Advisor to the Governor on Energy and Climate Change.

The Action Team would like to thank Representative Stan Mayfield, a member of the Action Team, who died on September 30, 2008 after a courageous battle with cancer. Representative Mayfield's leadership on environmental legislation was instrumental in moving Florida forward in addressing climate change. He will be sorely missed.

Commissioner Charles Bronson, Florida Department of Agriculture and Consumer Services, provided valuable information on the measures his agency is undertaking. Alastair Totty, First Secretary, Climate Change, British Embassy, Washington, D.C., for his comments in support of the Action Team's work. In the spirit of the United Kingdom–State of Florida Partnership Agreement, Keith Allan, Her Majesty's Consul General in Miami, has been helpful to the Action Team process.

The Cap-and-Trade Technical Work Group (TWG) would like to thank Jill Duggan, Head of International Emissions Trading for the United Kingdom Department of Environment, Food and Rural Affairs; Warren Bell, Manager of the Climate Change Section, British Columbia Ministry of Water, Lands and Air Protection; Patrick Cunningham, Deputy Director, Arizona Department of Environmental Quality; and Kate Zyla, World Resources Institute, for the presentations and thoughtful insight they provided to the TWG.

The Government Policy TWG would like to thank Nathan Buehler, Marketing & Communications Manager at the Oregon Economic & Community Development Department, for his presentation.

The Adaptation TWG would like to thank Jim Murley and the late Nick Bollman at Florida Atlantic University (FAU) for the intellectual capital provided to the group in developing its final recommendations to the Action Team. The work of the FAU team was supported by the National Commission on Energy Policy who generously offered their findings for use by the Action Team.

State agency personnel were essential to supporting the Action Team. Chairman Sole wishes to express his gratitude to the following: Nancy Blum, Bruce Deterding, Julie Ferris, Jennifer Fitzwater, Carla Gaskin, Kelly Layman, James McNeil, Melanie Meinhardt, Teresa Mussetto,

Allena Nelson, Mollie Palmer, and Kathy Shoaf from the Florida Department of Environmental Protection; Tom Ballinger and Mark Futrell from the Florida Public Service Commission; Kathy Neill from the Florida Department of Transportation; and Steve Adams, Brenda Buchan, Kelley Smith, Jeremy Susac, Rob Vickers and Sarah Williams from the Governor's Energy Office.

The Action Team would also like to thank the members of the public who participated in the Action Team and TWG meeting process for their thoughtful comments and contribution.

Special thanks is given to Thomas D. Peterson, Jeff Wennberg and the Center for Climate Strategies and its dedicated team of professionals that contributed time, energy and expertise in providing facilitation services and technical analysis, including Rachel Anderson, Alison Bailie, Donna Boysen, Tiffany Burns, Ken Colburn, Laurie Cullen, Bill Dougherty, Lewison Lem, Steve Roe, Adam Rose, Linda Schade, Joel Smith, Randy Strait, June Taylor, David Von Hippel, Jessica Ward, and Dan Wei.

The Center for Climate Strategies would like to thank organizations that provided financial support: Florida Department of Environmental Protection, Blue Moon Fund, Emily Hall Tremaine Foundation, Energy Foundation, Marisla Foundation, Rockefeller Brothers Fund, Sandler Family Support Foundation, The Turner Foundation, and WestWind Foundation.

Executive Summary

During the past 14 months, the Governor's Action Team on Energy and Climate Change (Action Team) worked diligently to develop the Florida Energy and Climate Change Action Plan (Action Plan). In keeping with the guidance provided in Executive Order 07-128 by Florida Governor Charlie Crist, the Action Team has developed this integrated Action Plan that will, through careful coordination, secure Florida's energy future, reduce greenhouse gas emissions, and heavily support and sustain strategic economic development in the emerging "green tech" sector.

The principal conclusions that have emerged from the Action Team process include:

- Based upon the findings of the 4th Assessment of the Intergovernmental Panel on Climate Change, Florida's resources, communities, and economy are expected to experience significant impacts if the current trajectory of global greenhouse gas emissions is not reversed;
- Early action to address global climate change has significant energy security benefits for Floridians, while positioning the state to become a regional and hemispheric hub of green technology innovation and investment;
- Energy efficiency, demand-side management, and energy conservation present Florida with numerous opportunities to reduce energy costs, increase the buying power of Florida's families, and make the state's business sector more cost-competitive in the global market;
- Investments today in low-carbon energy sources – renewables, nuclear power, and biofuels – will stimulate Florida's economy and redirect current expenditures on imported fossil fuels toward Florida-based energy sources retaining significant flows of money within local economies;
- Market-oriented regulations – many already authorized in Florida law – will efficiently guide a low-carbon economy while protecting energy consumers, maintaining Florida's agricultural competitiveness, and building more sustainable communities.

This Phase 2 report provides 50 separate policy recommendations, plus an additional set of comments toward the current regulatory work to develop Florida's cap-and-trade program to reduce harmful greenhouse gas emissions. These recommendations, if implemented, would result in greenhouse gas emission reductions that would surpass the Governor's 2017 and 2025 emission reduction targets by 11 percent and 34 percent, respectively. Additionally, while some of the recommendations result in an overall societal cost to implement, many were identified to have an overall societal cost-savings. The total net cost savings of all Action Team recommendations combined is more than \$28 billion from 2009 to 2025. Additionally, the recommendations would increase Florida's energy security by reducing our dependence on fossil fuels resulting in a total fuel savings of 53.5 billion gallons of petroleum, 200.2 million

short tons of coal, and 6.394 billion cubic feet of natural gas during the period of 2009 through 2025.

The Action Team completes its charge during a time of economic uncertainty. While it may be assumed by some readers that the current economic environment would hamper Florida's progress toward a low-carbon economy, the Action Team firmly believes that current economic conditions precisely sharpen the "call to action" first issued by Governor Crist in 2007. Now is the time for strategic investment in Florida's low-carbon energy infrastructure if we are to be successful in diversifying the state's economy, creating new job opportunities, and positioning Florida's "green tech" sector as an economic engine for growth.

The analyses and recommendations provided in the Action Plan are based on current data and projections in the areas of science, demographics, energy consumption, and economics. As Florida moves forward in implementing this Action Plan, it is essential that the Florida Energy and Climate Commission continually update and review these analyses as additional data and information become available.

Background

On July 12 and 13, 2007, Governor Crist hosted "Serve to Preserve: A Florida Summit on Global Climate Change" in Miami. This unprecedented event gathered leaders of business, government, science, and advocacy to examine the unique risks of climate change to Florida and the nation, and to explore the economic development opportunities available through an aggressive response to climate change. At the conclusion of the summit, Governor Crist signed three Executive Orders and two partnership agreements (with Germany and Great Britain) to propel Florida to the forefront of states actively working to address global climate change. One of those orders, Executive Order 07-128 established the Governor's Action Team on Energy and Climate Change and tasked it with creating a comprehensive Florida Energy and Climate Change Action Plan to achieve or surpass the statewide targets for greenhouse gas reduction.

On November 1, 2007, the Action Team issued its Phase 1 report that recommended a range of policies to reduce greenhouse gas emissions and increase Florida's energy security. A number of key issues were referred to Phase 2 for further study and more detailed recommendations.

At the outset of 2008, the State of Florida had a number of energy and climate change initiatives under way. Many of these were in response to the three Executive Orders issued by Governor Crist in 2007. The Legislature passed three bills during the 2008 Regular Session that significantly impacted energy and climate change issues. The most notable is House Bill 7135 (HB 7135), which contains many provisions that are moving Florida aggressively forward in energy security and climate change mitigation. While some of the recently enacted policies and programs are in rulemaking, Florida can point to a significant number of early achievements in

state government greenhouse gas emissions reductions, private sector renewable energy projects, utility-based solar energy, energy efficiency, and related research and development.

The Action Team reconvened in February 2008 to begin Phase 2 of Executive Order 07-128 requirements. As identified in the Action Team's Phase 1 report, a facilitated, stakeholder-based, consensus-building process was developed for Phase 2. The Center for Climate Strategies facilitated and provided technical support for this phase of the process. As part of this effort, the Action Team designated six Technical Working Groups to focus on specific issues and sectors of the economy. The six Technical Working Groups were:

- Energy Supply and Demand;
- Transportation and Land Use;
- Agriculture, Forestry, and Waste Management;
- Government Policy and Coordination;
- Cap-and-Trade; and
- Adaptation.

The Action Team and the Technical Working Groups worked diligently in order to meet the October 2008 deadline for completion of this Phase 2 Report. The 28 Action Team members appointed by the Governor gathered a total of eight times in Phase 2 during 2008, representing more than 60 hours of deliberation as a full group. The 122 appointed members of the six Technical Working Groups met more than 71 times on toll-free, public access conference calls, representing more than 155 hours of combined meeting time.

The Action Team's recommendations in this Phase 2 Report build on Florida's accomplishments in 2007 and 2008 and point the way forward for 2009 and beyond.

Inventory of Florida's Greenhouse Gas Emissions

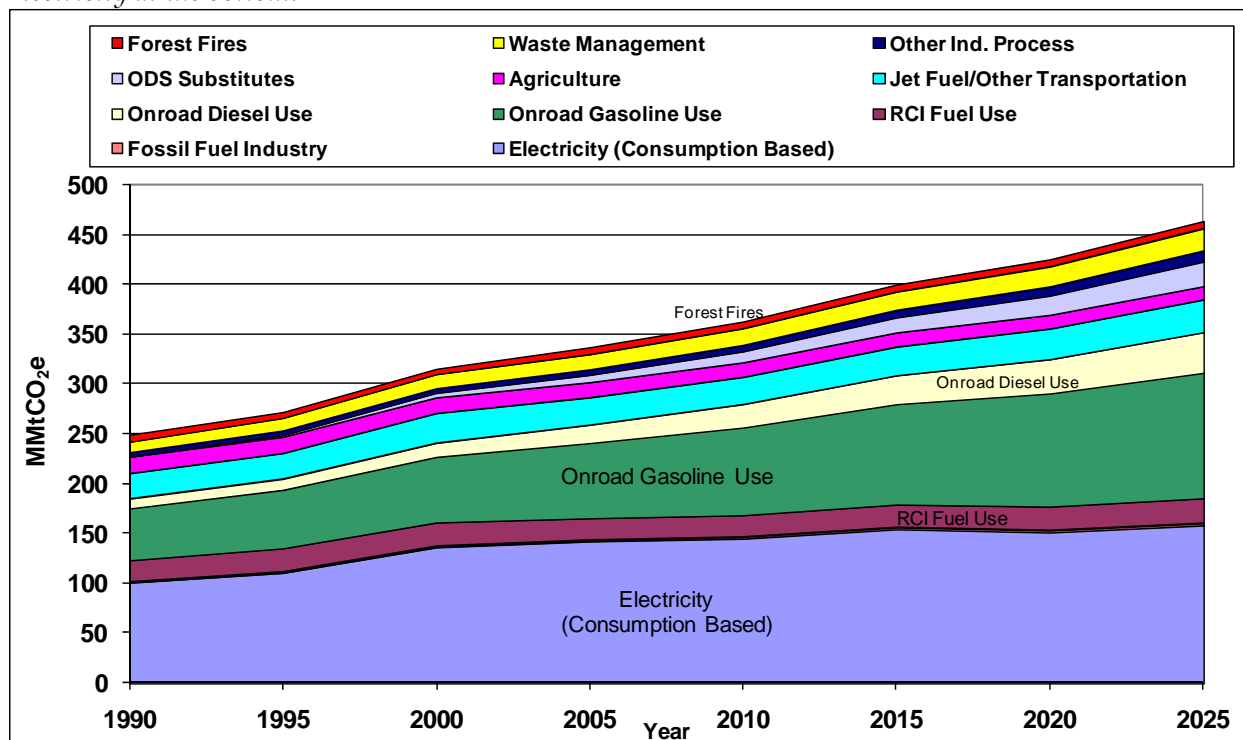
In 2005, Florida's gross emissions accounted for approximately 337 million metric tons of carbon dioxide equivalent. Florida's gross emissions of greenhouse gases grew by 35 percent between 1990 and 2005 (roughly twice the national average of 16 percent), driven largely by the growth of population and emissions associated with economic development. The state's emissions on a per capita basis remained relatively flat between 1990 and 2005, as compared to U.S. per capita emissions, which declined slightly (2 percent) during the same period. In the absence of recent developments that Florida has undertaken to control its emissions, gross greenhouse gas emissions are projected to rise steeply to about 463 million metric tons of carbon dioxide equivalent by 2025, or 86 percent more than 1990 levels.

Figure EX-1 depicts the historical and projected gross greenhouse gas emissions by key sectors, during the period from 1990 to 2025. The modeled gross emission levels are predicted using a

consumption-based approach and represent the business as usual, or base case scenario. Florida's 16.7 million acres of forests serve to capture and store greenhouse gas emissions (known as "carbon sinks"). On a net emissions basis (including carbon sinks), Florida accounted for approximately 309 million metric tons of carbon dioxide equivalent of emissions in 2005.

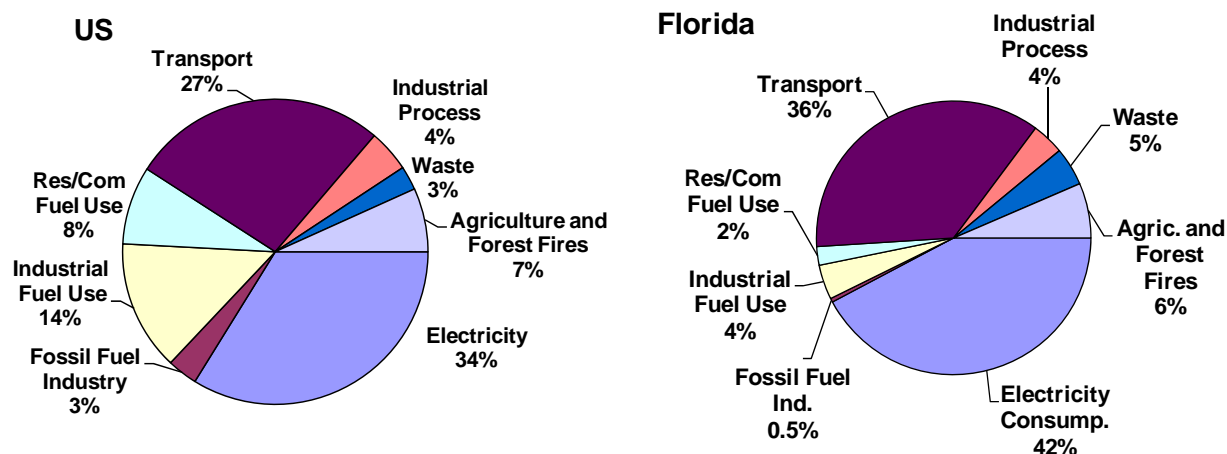
Figure EX-1. Gross greenhouse gas emissions by sector, 1990–2025: historical and projected (consumption-based approach) business as usual/base case

Colors on the graph are displayed left to right, top to bottom in the key, putting Forest Fires at the top and Electricity at the bottom.



RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone depleting substance.

Figure EX-2. Gross greenhouse gas emissions by sector, 2005: Florida and U.S.



The principal sources of Florida's greenhouse gas emissions in 2005 are electricity consumption and transportation, accounting for 42 percent and 36 percent of Florida's gross greenhouse gas emissions, respectively. Other sources of greenhouse gases include emissions from; agriculture and forest fires, waste management, industrial processes, industrial fuel use, residential fuel use, and the fossil fuel industry. Figure EX-2 depicts the 2005 gross greenhouse gas emissions by each of these sectors in Florida and the U.S.

Action Team Recommendations

The Action Team recommends 50 policy actions relating to: energy supply and demand; transportation and land use; agriculture, forestry, and waste management; government policy and coordination; and adaptation strategies associated with climate change. For 28 of these recommendations, the Center for Climate Strategies provided a specific analysis and quantification of the estimated reduction in greenhouse gases associated with each recommendation.

In addition, as part of the cap-and-trade discussion, the Action Team offers a suite of recommendations as guidance to the Florida Department of Environmental Protection as its cap-and-trade rulemaking occurs before submitting its market-based emissions limiting program to the Legislature for consideration and ratification in the 2010 Session (as required by HB 7135).

Table EX-1 shows the levels of emissions for selected years for the reference case, recent actions, target levels and the 28 Action Team recommendations that were quantified.

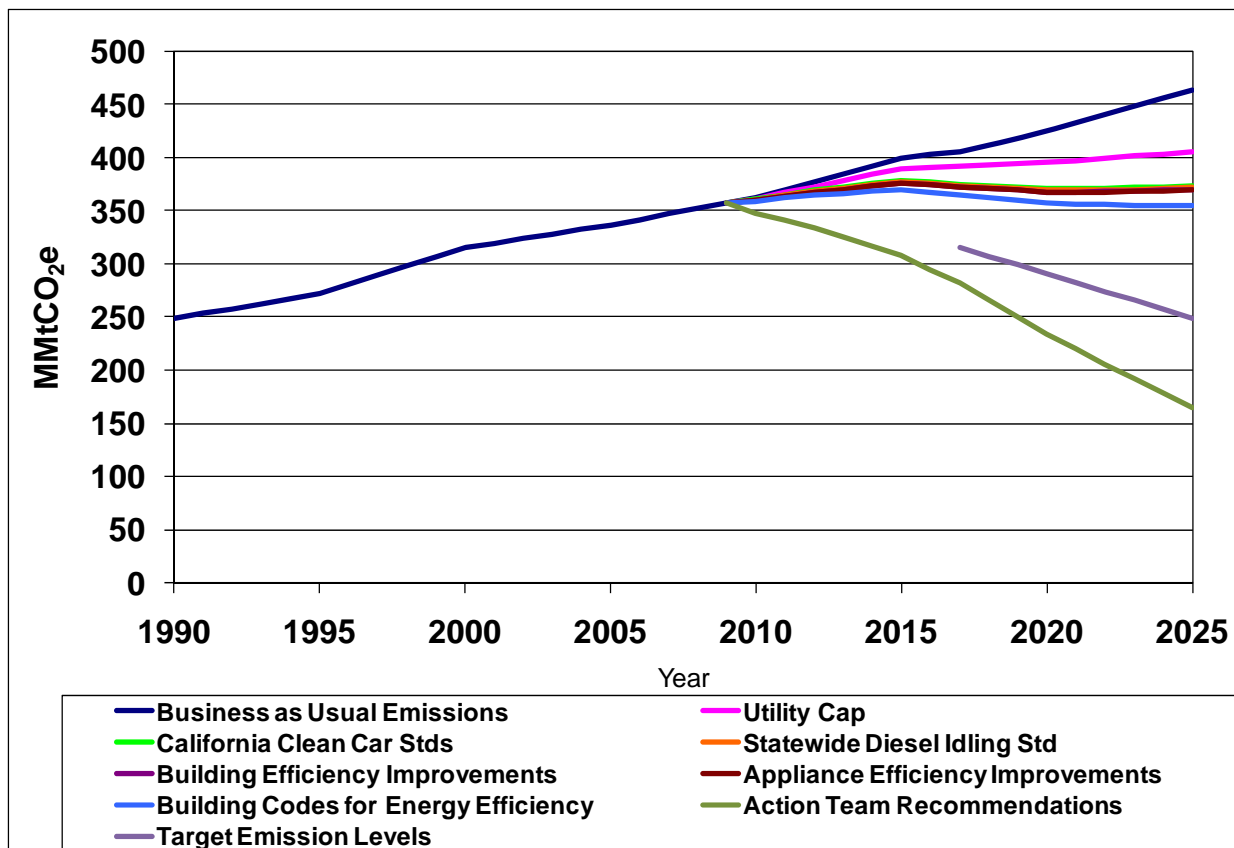
Table EX-1. Annual emissions: reference case projections and impact of Action Team recommendations (consumption-basis, gross emissions)

Annual Emissions (MMtCO _{2e})	1990	2000	2005	2017	2025
Reference Case Projections	248.8	315.0	336.6	405.0	463.3
Reductions From Recent Actions (Executive Order 07-127)				40.6	108.7
Projected Greenhouse Gas Emissions After Recent Actions				364.4	354.6
Target Emission Levels				315.0	248.8
Total Greenhouse Gas Reductions From Action Team Recommendations				82.6	189.8
Difference Between Action Team Reductions and Target Emission Levels				-33.2	-84.0
Projected Annual Emissions After Quantified Action Team Reductions				281.8	164.8

MMtCO_{2e} = million metric tons of carbon dioxide equivalent.

Figure EX-3 shows the total greenhouse gas emissions since 1990 and the reference case projection of emissions from 2005 through 2025 (dark blue line). Below this reference case is a family of lines that represent the contributions of each of the major recent and planned measures resulting from Executive Order 07-127, including improved building codes, utility cap, state clean car standards, and appliance efficiency standards. The impact of these actions is projected to be a 24 percent reduction from the reference case; and would result in a leveling of Florida’s greenhouse gas emission growth. The green line represents the cumulative benefits of the Action Team’s quantified policy recommendations. Assuming all recommended policies are adopted, in 2017 total emissions would drop to 281.8 million metric tons of carbon dioxide equivalent, or 30 percent below the reference case and 11 percent below the governor’s 2017 target. In 2025, assuming all recommended policies are adopted, total emissions would drop to 164.8 million metric tons of carbon dioxide equivalent, more than 64 percent below the reference case and 34 percent below the Governor’s 2025 emissions target.

Figure EX-3. Annual greenhouse gas emissions: reference case projections and Action Team recommendations (consumption-basis, gross emissions)



MMtCO₂e = million metric tons of carbon dioxide equivalent.

Colors on the graph are displayed left to right, top to bottom in the key, putting Business as Usual Emissions at the top and Action Team Recommendations at the bottom.

Table EX-2 provides a summary by sector of the estimated cumulative impacts of implementing all of the Action Team’s recommendations. Note that the cumulative impacts shown in Table EX-2 account for overlaps between policies by eliminating potential double counting of emission reductions and costs or cost savings and have been adjusted for other interactions between the recommended policy actions.

Table EX-2. Summary by sector of estimated impacts of implementing all of the Action Team recommendations (cumulative reductions and costs/savings)

Sector	Greenhouse Gas Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
	2017	2025	Total 2009–2025		
Energy Supply	44.4	106	841	-\$16,143	-\$19
Transportation and Land Use	12.7	25.1	214	-\$18,400	-\$86
Agriculture, Forestry, and Waste Management	25.4	58.2	469	\$5,974	\$13
Government Policy and Coordination	<i>Non-quantified, enabling options</i>				
Adaptation Strategies	<i>Non-quantified</i>				
Cap-and-Trade	<i>Results not included in cross-sector totals</i>				
TOTAL (includes all adjustments for overlaps and recent actions)	82.6	190	1,548	-\$28,569	-\$18

MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

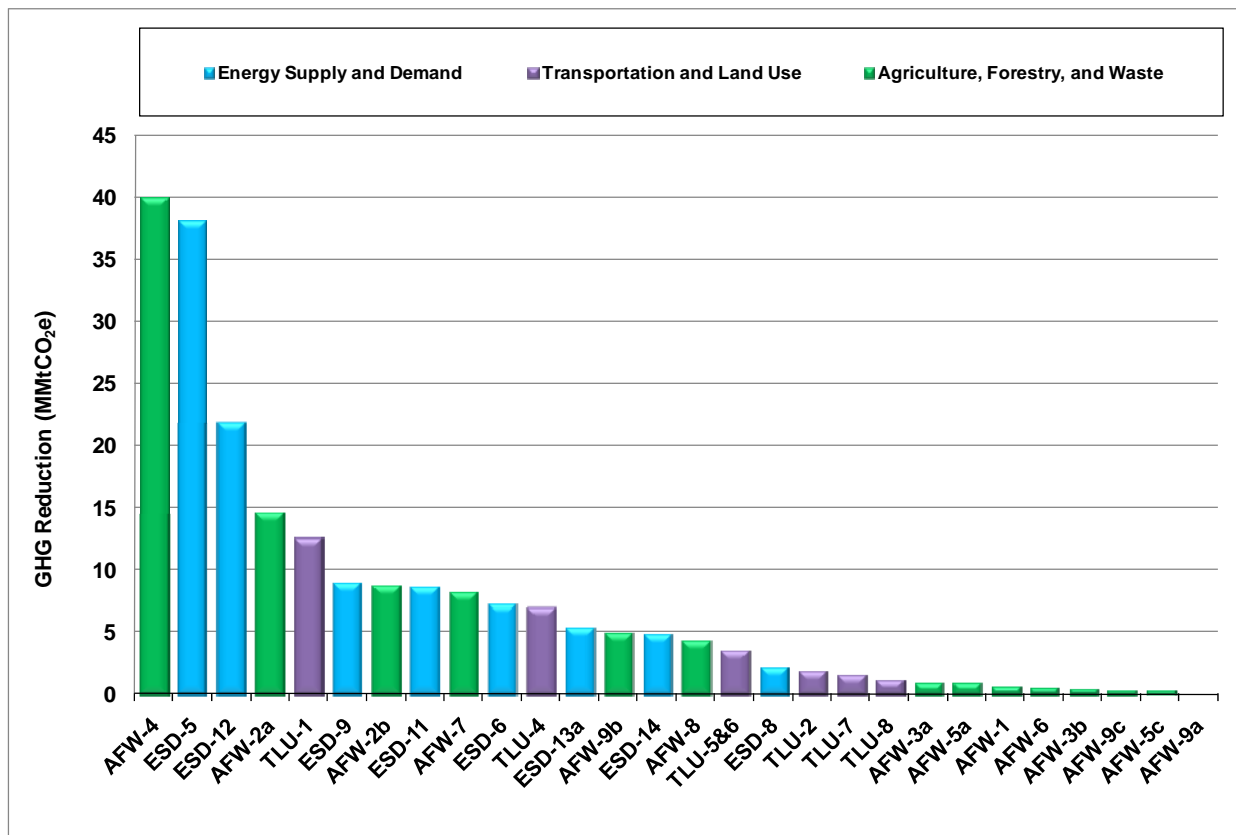
Negative values in the Net Present Value and the Cost-Effectiveness columns represent direct net *cost savings* associated with the options. Within each sector, values have been adjusted to eliminate double counting and other interactions for options or elements of options that overlap.

In order, the sectors with the greatest potential for emissions reductions are:

- energy supply and demand at 56 percent of total reductions and a total net cost savings of \$19 per ton;
- agriculture, forestry, and waste management at 27 percent of total reductions and a net cost of \$13 per ton; and
- transportation and land use at about 15 percent of total potential emissions reductions and a net cost savings of \$86 per ton.

The total net cost savings of all Action Team recommendations combined (after adjustment for overlaps and interactions) is more than \$28 billion from 2009 to 2025, at an average net savings of \$18 per ton greenhouse gas emissions removed during the same period.

Figure EX-4. Greenhouse gas reductions in 2025 from 28 recommended policies



Key to Figures EX-4 and EX-5	
AFW-1 Forest Restoration	ESD-5a Renewable Portfolio Standards
AFW-2a Afforestation of Forested Landscape	ESD-6 Nuclear Power
AFW-2b Afforestation of Urban Forestry	ESD-8 Combined Heat and Power Systems
AFW-3a Forest Mgt. for Carbon Storage – Pine	ESD-9 Power Plant Efficiency Improvements
AFW-3b Forest Mgt. for Carbon Storage - Public	ESD-11 Landfill Gas-to-Energy
AFW-4 Use of Forestry, Biomass, Feedstocks	ESD-12 Demand-Side Management Programs
AFW-5a Farming Soil Carbon Management	ESD-13a Energy Efficiency in Residential Buildings
AFW-5c Farming Nutrient Management	ESD-14 Improved Building Codes for Efficiency
AFW-6 Reduce Loss of Green Space	TLU-1 Develop and Expand Low-Greenhouse Gas Fuels
AFW-7 Promote In-state Biofuel Production	TLU-2 Low Rolling Resistance Tires
AFW-8 Promote Municipal Solid Waste Tech.	TLU-4 Improve Transportation System Mgt.
AFW-9a Biomass-to-Energy Manure	TLU 5&6 Land Use Planning Processes and Increasing Choices in Modes of Transportation
AFW-9b Biomass-to-Energy Biosolids	TLU 7 Incentive Programs for Increased Vehicle Fleet Efficiency
AFW-9c Biomass-to-Energy Bio-products	TLU 8 Increasing Freight Movement Efficiencies

Quantified recommendations are ranked in Figure EX-4 according to their potential to reduce emissions in 2025. This figure indicates that the greatest reductions are offered by the three policy recommendations known as:

- AFW-4 (Expanded Use of Agriculture, Forestry, and Waste Management, Biomass Feedstocks for Electricity, Heat, and Steam Production);
- ESD-5 (Promoting Renewable Electricity through Renewable Portfolio Standard, Incentives, and Barrier removal); and
- ESD-12 (Demand-Side Management/Energy Efficiency Programs, Funds, or Goals for Electricity).

Figure EX-5 displays the recommendations according to their respective cost-effectiveness, from lowest cost (highest savings) to highest cost. Recommendations with negative numbers represent a total net benefit to Florida’s economy after accounting for the costs to implement the recommendation. In most of these cases, a specific investment will be required to initiate the option. Policy recommendations TLU-1 (Develop and Expand Low-Greenhouse Gas Fuels) and TLU-2 (Low Rolling *Resistance Tires and Other Add-On Technologies*) are the policies with the lowest cost-per-ton reduced. Policy recommendation AFW-6 (Reduce the Rate of Conversion of Agricultural Land and Open Green Space to Development) has the highest cost per ton.

Figure EX-5. “Opportunity Map” Identifying the Costs and Cost Savings in 2025 from 28 Recommended Policies (Negative Number indicates Cost Savings)

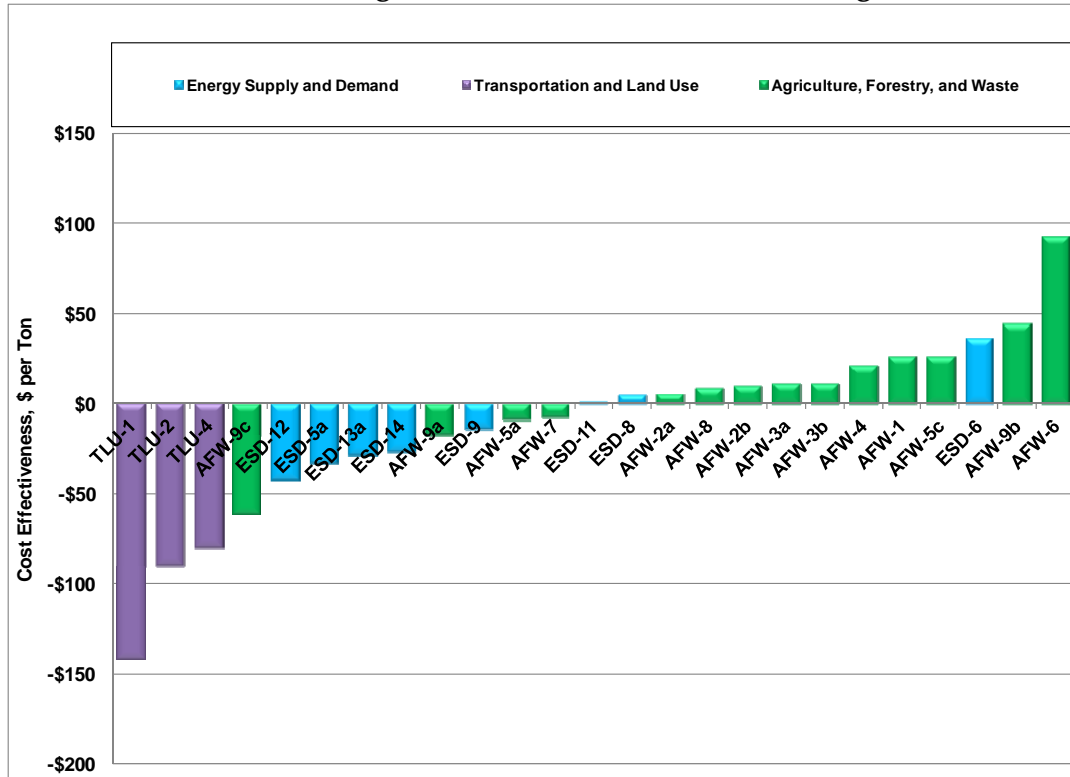
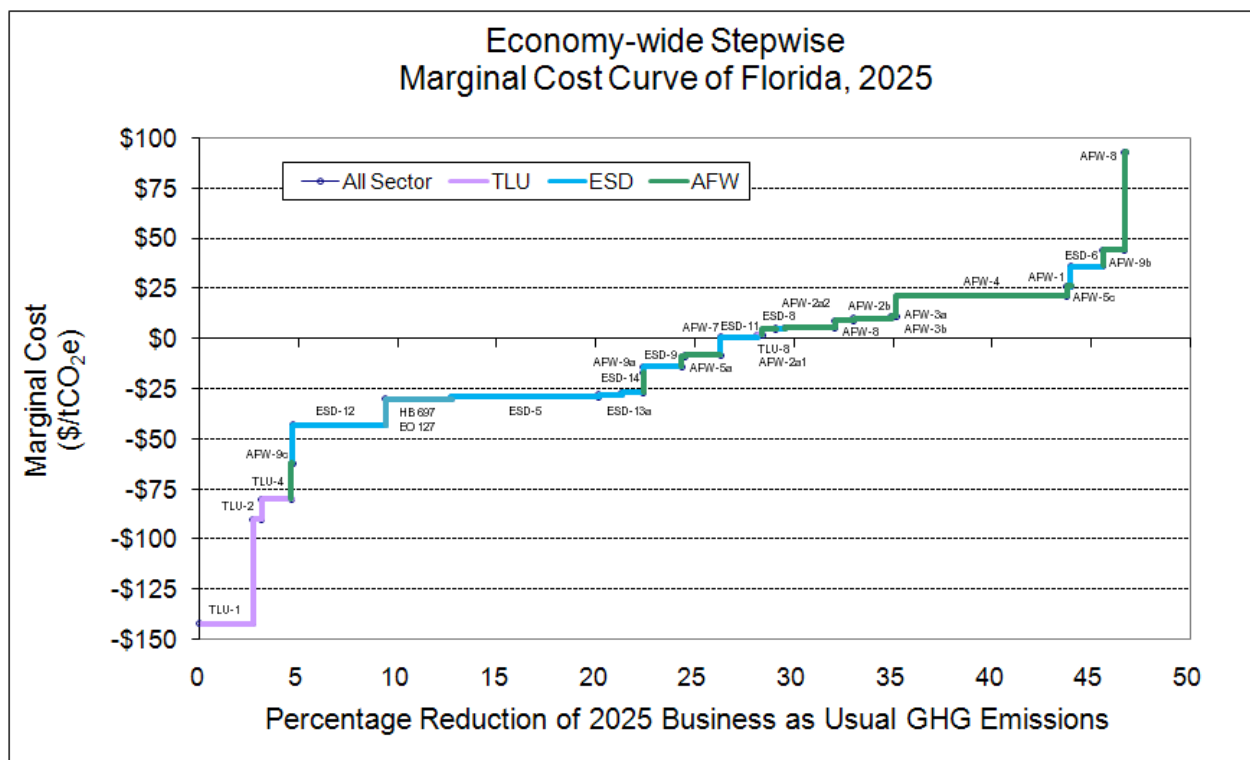


Figure EX-6 displays the quantified policy recommendations in the form of a “cost curve” or step-function showing both policy costs and benefits in 2025. The vertical axis represents the cost or cost savings (negative cost) for each recommendation, which are ranked from lowest cost (highest savings) to highest cost. The horizontal axis represents the amount of greenhouse gas reductions offered by the recommendation, computed as “percent reduction below business-as-usual,” with each recommendation’s width proportional to its greenhouse gas reduction potential. The wider the recommendation’s step, the greater the greenhouse gas mitigation. Each policy moving to the right achieves an increased “percent reduction below Business As Usual,” but at an increasing cost.

EX-6. Cost curve for 28 policy recommendations

(Key for Figure EX-6 follows Figure EX-9)



Unquantifiable Recommendations

Some recommendations within this report are not quantified. While many of these unquantifiable policies were estimated by Technical Working Groups and the Action Team to have the likely effect of producing emissions reductions and will involve net costs or cost savings, some of them are foundational—that is, they enable other policies. The lack of quantified results for these recommendations should not be seen as an indication that they are less important or less valuable than the others.

Adaptation

Adaptation represents a unique challenge for Florida. The product of the adaptation investigation is a comprehensive planning framework to guide Florida over the coming years and decades to manage climate impacts that Floridians will likely face regardless of the success of state, national, or international mitigation efforts. The Adaptation recommendations are a comprehensive first look at the issues and opportunities facing Floridians, and contain recommendations for further study and examination as well as measures that can be undertaken immediately to adapt to the many consequences of climate change that may occur in the near future.

Cap-and-Trade

One area of investigation directly assigned to the Phase 2 process from the Phase 1 Report was an examination of cap-and-trade program design. Shortly thereafter, HB 7135 directed the Florida Department of Environmental Protection to initiate rulemaking to create a cap-and-trade program for fossil-fired electric generation plants. The Legislature identified 11 major program design and policy questions to be addressed through rulemaking. The Action Team Chairman (DEP Secretary Michael Sole) suggested that the Action Team provide pre-rulemaking guidance. Therefore, the Action Team asked CCS to perform economic modeling of two policy alternatives, which examined the benefits of Florida joining one of two existing regional climate initiatives. Those results are given in Appendix B. The modeling was not utilized to estimate the cumulative greenhouse gas reductions (or the costs or benefits of the alternatives) in a manner consistent with that used for the other quantified policies. Nor were the emissions reductions and costs of the cap-and-trade options included in the total or summary results. The cap-and-trade program is intended to be implemented concurrently with other recommended policy actions, to guarantee that emissions targets are met within the covered sectors, and, potentially, to generate additional reductions and cost savings.

Government Policy

The Government Policy and Coordination Technical Working Group presented five policies that were ultimately adopted for recommendation by the Action Team. These policies fall into two categories: efforts that enable or enhance the successful implementation of policies recommended for specific sectors, and policies that foster the development and creation of technologies and businesses that mitigate greenhouse gases and promote the creation of jobs and economic growth. Finally, the Government Policy Coordination Technical Working Group examined the multiple planning authorities at all levels of government in Florida, and the Action Team has recommended measures to incorporate greenhouse gas considerations into government planning processes and improve coordination among entities with overlapping jurisdiction.

Energy Security

The Action Team focused considerable time and consideration on the issue of increasing Florida's energy security. Table EX-3 provides a summary total of fuel savings for quantified recommendations by fuel type. Figure EX-7 shows the relative savings of petroleum by policy recommendation. Figure EX-8 shows each recommendation's coal savings by million short tons. Figure EX-9 shows each recommendation's natural gas savings in billions of cubic feet.

Table EX-3. Total fuel savings

Total Fuel Saved 2009-2025 All Recommendations		
Petroleum	53.5	billion gallons
Coal	200.2	million short tons
Natural Gas	6,394.0	billion cubic feet

Figure EX-7. Petroleum savings by recommendation, 2009-2025

(Key for Figure EX-7 follows Figure EX-9)

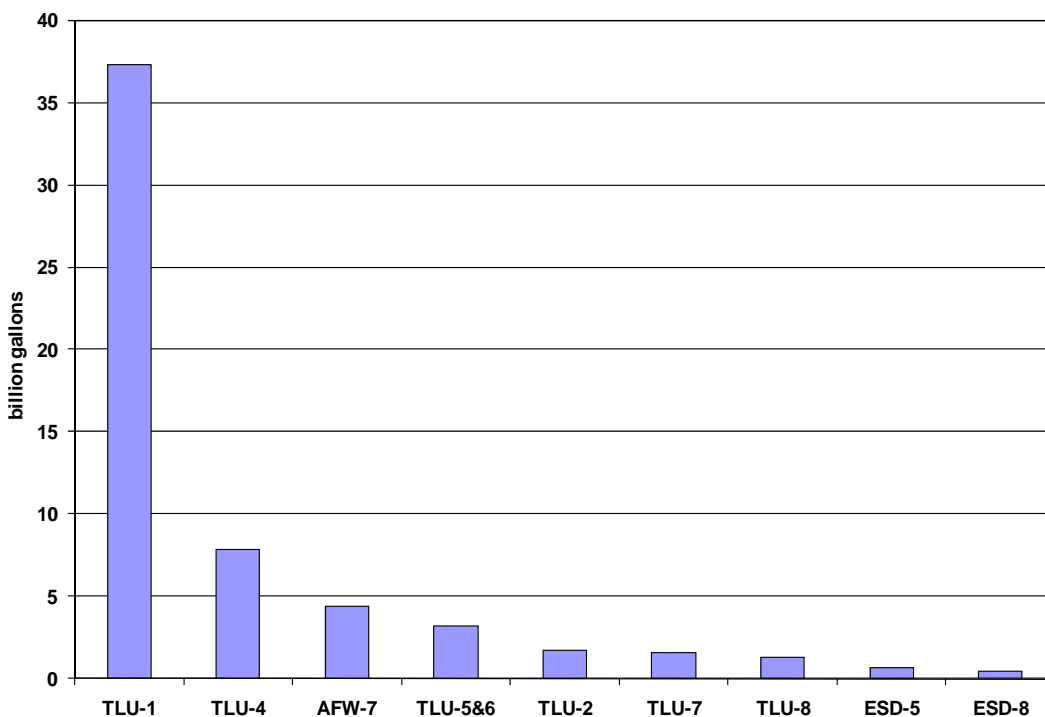


Figure EX-8. Coal savings by recommendation, 2009-2025

(Key for Figure EX-8 follows Figure EX-9)

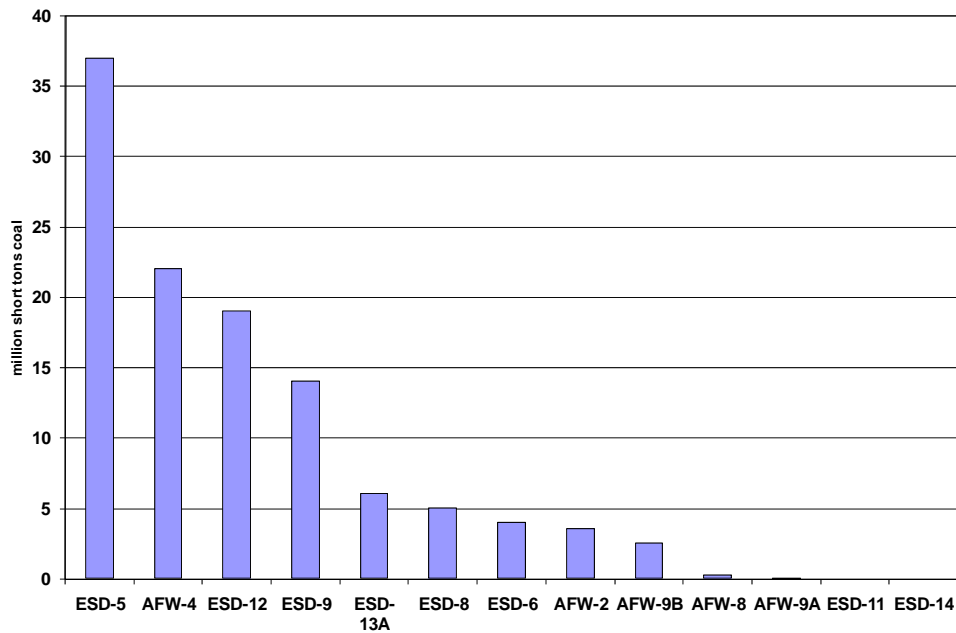
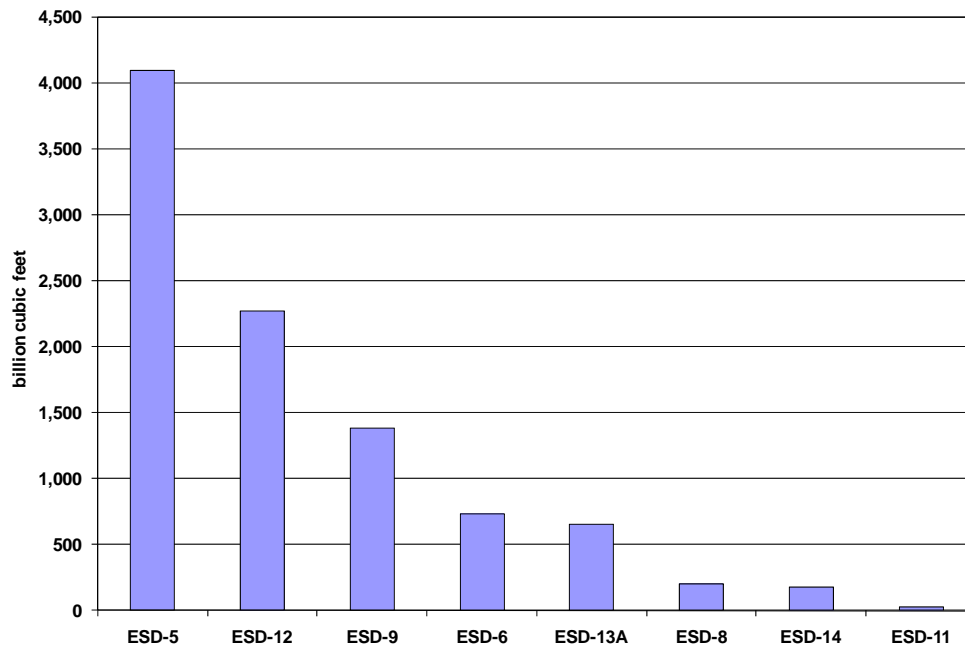


Figure EX-9. Natural gas saved by recommendation, 2009-2025

(Key for Figure EX-9 is on the following page)



<i>Key to Figures EX-7, EX-8, and EX-9</i>	
AFW-1 Forest Restoration	ESD-5a Renewable Portfolio Standards
AFW-2a Afforestation of Forested Landscape	ESD-6 Nuclear Power
AFW-2b Afforestation of Urban Forestry	ESD-8 Combined Heat and Power Systems
AFW-3a Forest Mgt. for Carbon Storage – Pine	ESD-9 Power Plant Efficiency Improvements
AFW-3b Forest Mgt. for Carbon Storage - Public	ESD-11 Landfill Gas-to-Energy
AFW-4 Use of Forestry, Biomass, Feedstocks	ESD-12 Demand-Side Management Programs
AFW-5a Farming Soil Carbon Management	ESD-13a Energy Efficiency in Residential Buildings
AFW-5c Farming Nutrient Management	ESD-14 Improved Building Codes for Efficiency
AFW-6 Reduce Loss of Green Space	TLU-1 Develop and Expand Low-Greenhouse Gas Fuels
AFW-7 Promote In-state Biofuel Production	TLU-2 Low Rolling Resistance Tires
AFW-8 Promote Municipal Solid Waste Tech.	TLU-4 Improve Transportation System Mgt.
AFW-9a Biomass-to-Energy Manure	TLU 5&6 Land Use Planning Processes and Increasing Choices in Modes of Transportation
AFW-9b Biomass-to-Energy Biosolids	TLU 7 Incentive Programs for Increased Vehicle Fleet Efficiency
AFW-9c Biomass-to-Energy Bio-products	TLU 8 Increasing Freight Movement Efficiencies

Action Team Recommendations for Each of the Six TWG Sectors

The following summary tables outline the Action Team’s recommendations across each of the six technical working groups. For those recommendations that were quantified during the process, emission reduction potential and cost effectiveness are detailed within each table. Additional detail regarding the policy recommendation is presented in the summary chapters and within the technical appendices of this report.

Table EX-4. Energy Supply and Demand recommendations summary

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value (See Note 2) 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Policy
		2017	2025	Total 2009–2025			
Tier 1							
ESD-5	Promoting Renewable Electricity through Renewable Portfolio Standard (RPS), Incentives and Barrier Removal (20% by 2020)	17	34.5	319	-\$9,274	-\$29	Approved
ESD-6	Nuclear Power	0.0	7.3	49.4	\$1,782	\$36	Approved
ESD-7	Integrated Resource Planning (IRP)	Not to be quantified					Approved
ESD-8	Combined Heat and Power (CHP) Systems	1.8	2.2	26.5	\$126	\$5	Approved
ESD-9	Power Plant Efficiency Improvements	8.4	8.9	111.4	-\$1,541	-\$14	Approved
ESD-11	Landfill Gas-To-Energy (LFGTE)	3.7	8.7	64.7	\$79	\$1	Approved
ESD-12	Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity	13.0	21.8	201.4	-\$8,566	-\$43	Approved
ESD-13a	Energy Efficiency in Existing Residential Buildings	3.4	5.4	50.4	-\$1,432	-\$28	Approved
ESD-14	Improved Building Codes for Energy Efficiency	0.0	4.9	9.9	-\$265	-\$27	Approved
ESD-15	Training and Education for Building Operators and Community Association Managers	<i>Not to be quantified</i>					Approved
ESD-17	Consumer Education Programs	<i>Not to be quantified</i>					Approved
ESD-23	Decoupling	<i>Not to be quantified</i>					Approved
Recent Actions							
	Building Codes for Energy Efficiency (HB 697 and Executive Order 127)	8.0	15.4	136.5	-\$4,082	-\$30	Not applicable
Sector Totals		47.4	93.6	832.8	-\$19,090	-\$23	
Sector Totals After Adjusting for Overlaps (see Note 3)		44.4	106.4	841.3	-\$16,143	-\$19	
Reductions from Recent Actions		8.0	15.4	136.5	-\$4,082	-\$30	
Sector Totals, including recent actions and adjustment for overlaps		52.4	121.8	977.8	-\$20,226	-\$21	

Table EX-5. Transportation and Land Use recommendations summary

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Energy Security Fuel Savings (Gallons Saved 2009–2025) (million gallons)	Level of Support
		2017	2025	Total 2009–2025				
TLU-1	Develop and Expand Low-GHG Fuels	6.20	12.62	106.41	–\$15,161	–\$142	37,290	Approved
TLU-2	Low Rolling Resistance Tires and Other Add-On Technologies	0.80	1.84	13.99	–\$1,259	–\$90	1,665	Approved
TLU-3	Smart Growth Planning	Not Quantified Separately; Included in Other Analyses						Approved
TLU-4	Improving Transportation System Management (TSM)	3.94	6.98	63.91	–\$5,106	–\$80	7,858	Approved
TLU-5&6	Land Use Planning Processes and Increasing Choices in Modes of Transportation	1.77	3.54	28.29	NQ	NQ	3,200	Approved
TLU-7	Incentive Programs for Increased Vehicle Fleet Efficiency	0.84	1.56	13.14	NQ	NQ	1,564	Approved
TLU-8	Increasing Freight Movement Efficiencies	0.59	1.10	11.52	\$21	\$2	1,302	Approved
	Sector Totals	14.14	27.64	237.26	–\$21,505	–\$110	52,879	
	Sector Total After Adjusting for Overlaps	12.73	25.14	214.35	–\$18,400	–\$106	48,786	
	Reductions from Recent Actions	19.10	34.11	307.24				
	Sector Total Plus Recent Actions	31.83	59.25	521.59				

Table EX-6. Agriculture, Forestry and Waste Management recommendations summary

Option No.	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Energy Security Fuel Savings	Status of Policy	
		2017	2025	Total 2009–2025					
AFW-1	Forest Retention—Reduced Conversion of Forested to Non-Forested Land Uses	0.5	0.6	7.2	\$186	\$26		Approved	
AFW-2	Afforestation and Restoration of Non-Forested Lands								
	A. Forested Landscape							Approved	
	Afforestation	1.6	3.1	28	\$134	\$4.9			
	Reforestation	6.1	11.6	104	\$555	\$5.3			
	B. Urban Forestry	4.6	8.7	78	\$759	\$10	3.5 million short tons coal, or 76,000 cubic feet natural gas	Approved	
AFW-3	Forest Management for Carbon Sequestration								
	A. Pine Plantation Management	0.5	0.9	7.9	\$84	\$11		Approved	
	B. Non-Federal Public Land Management	0.3	0.4	3.9	\$41	\$11		Approved	
AFW-4	Expanded Use of Agriculture, Forestry, and Waste Management (AFW) Biomass Feedstocks for Electricity, Heat, and Steam Production	21	40	361	\$7,432	\$21	22 million short tons coal or 486,000 cubic feet natural gas	Approved	
AFW-5	Promotion of Farming Practices That Achieve GHG Benefits								
	A. Soil Carbon Management	0.5	0.9	8.0	–\$74	–\$9	5 million gallons of diesel fuel	Approved	
	B. Land-Use Management That Promotes Permanent Cover	N/Q							Approved
	C. Nutrient Management	0.2	0.3	2.6	\$68	\$26		Approved	
	D. Improved Harvesting Methods to Achieve GHG Benefits	N/Q							Approved
AFW-6	Reduce the Rate of Conversion of Agricultural Land and Open Green Space to Development	0.2	0.5	4.2	\$394	\$93		Approved	

AFW-7	In-State Liquid/Gaseous Biofuels Production	4.0	8.2	68	-\$532	-\$8	4,075 million gallons gasoline and 271 million gallons diesel	Approved
AFW-8	Promotion of Advanced Municipal Solid Waste (MSW) Management Technologies (Including Bioreactor Technology)	1.9	4.4	34	\$294	\$9	190,000 short tons coal or 4,000 cubic feet NG and 109 million gallons diesel	Approved
AFW-9	Improved Commercialization of Biomass-to-Energy Conversion and Bio-Products Technologies							
	A. Manure Digestion/Other Waste Energy Utilization	0.04	0.09	0.8	-\$13	-\$17	4,500 short tons coal or 100 cubic feet natural gas	Approved
	B. WWTP Biosolids Energy Production & Other Biomass Conversion Technologies	2.4	5.0	42	\$1,848	\$44	2.5 million short tons coal or 55,000 cubic feet natural gas	Approved
	C. Bio-Products Technologies and Use	0.2	0.3	2.6	-\$161	-\$62		Approved
AFW-10	Programs to Support Local Farming/Buy Local	N/Q						Approved
	Sector Totals	44	85	752	\$11,014	\$15		
	Sector Total After Adjusting for Overlaps*	25	58	469	\$5,974	\$13		
	Reductions From Recent Actions	—	—	—	—	—		
	Sector Total Plus Recent Actions	25	58	469	\$5,974	\$13		

Table EX-7. Government Policy and Coordination recommendations summary

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Policy
		2015	2025	Total 2009–2025			
GP-1	Targets, Reporting, Funding, and Accountability Measures	<i>Not to be Quantified</i>					Approved
GP-2	Public Awareness and Education	<i>Not to be Quantified</i>					Approved
GP-3	Inter-Governmental Planning Coordination and Assistance	<i>Not to be Quantified</i>					Approved
GP-4	“Green” Business Development Policies	<i>Not to be Quantified</i>					Approved
GP-5	Introduce Core Competencies Into Professional Licensing Programs	<i>Not to be Quantified</i>					Approved

Table EX-8. Adaptation Strategies recommendation summary

Framework Identifier.	Planning Framework Element	Status of Policy
ADP-1	Advancing Science Data and Analysis for Climate Change	Approved
ADP-2	Comprehensive Planning	Approved
ADP-2.1	Local Government Level	Approved
ADP-2.2	Regional Government Level	Approved
ADP-2.3	State Government Level	Approved
ADP-3	Protection of Ecosystems and Biodiversity	Approved
ADP-3.1	Uplands, Freshwater and Marine Systems	Approved
ADP-3.2	Beaches and Beach Management	Approved
ADP-3.3	Species Protection	Approved
ADP-4	Water Resource Management	Approved
ADP-5	Built Environment, Infrastructure and Community Protection	Approved
ADP-5.1	Building Codes and Regulation	Approved
ADP-5.2	Flood Protection	Approved
ADP-5.3	Beaches as Infrastructure	Approved
ADP-5.4	Transportation and Other Infrastructure	Approved
ADP-6	Transportation and Other Infrastructure (moved into ADP-5)	Approved
ADP-7	Economic Development	Approved
ADP-7.1	Tourism	Approved
ADP-7.2	Other Resource-based Industries	Approved
ADP-7.2.1	Agriculture	Approved
ADP-7.2.2	Forests	Approved
ADP-7.2.3	Marine	Approved
ADP-7.2.4	Aquaculture	Approved

Framework Identifier.	Planning Framework Element	Status of Policy
ADP-7.2.5	Mining	Approved
ADP-7.3	Construction	Approved
ADP-8	Insurance (Property and Casualty)	Approved
ADP-9	Emergency Preparedness and Response (Extreme Events)	Approved
ADP-10	Human Health Concerns	Approved
ADP-10.1	Health Care	Approved
ADP-10.2	Air Quality	Approved
ADP-10.3	Wastewater Treatment	Approved
ADP-10.4	Disaster Response	Approved
ADP-10.5	Medical Treatment and Biomedicine Development	Approved
ADP-11	Social Effects	Approved
ADP-11.1	Social Justice Issues	Approved
ADP-11.2	Food and Water Security	Approved
ADP-11.3	Housing	Approved
ADP-11.4	Intersection of Climate Change and Human Behavior	Approved
ADP-12	Organizing State Government for the Long Haul	Approved
ADP-13	State Funding and Financing	Approved
ADP-14	Coordinating with Other Regulatory and Standards Entities	Approved
ADP-14.1	Federal Government	Approved
ADP-14.2	Professional Societies	Approved
ADP-15	Public Education and Outreach	Approved

The Science of Climate Change and Its Importance and Opportunities for Florida

Executive Order 07-128 created the Governor's Action Team on Energy and Climate Change (Action Team) in the summer of 2007. The Action Team was tasked to develop a series of recommendations for addressing climate change in Florida. A brief description of the science of climate change and the potential impacts to Florida is provided here to assist the reader in understanding the nature of these recommendations and the importance of taking action. There are numerous benefits, both environmental and economic, which accrue both to the State of Florida and the private sector due to pursuing energy efficiency and investing in alternative energy technologies.

Natural Warming

The sun's energy drives the Earth's weather and climate and heats its surface. Some of this energy radiates back into space, but some is trapped by naturally occurring greenhouse gases (GHGs) such as carbon dioxide (CO₂), water vapor, and other gases. GHGs are necessary to life as we know it; because they keep the planet's surface warmer than it would be otherwise. However, as the concentrations of these gases continue to increase in the atmosphere, the Earth's temperature is rising above traditional levels. According to the U.S. National Oceanic and Atmospheric Administration and the U.S. National Aeronautics and Space Administration data, the Earth's average surface temperature has increased by about 1.2 to 1.4° Fahrenheit in the past 100 years. The eight warmest years on record (since 1850) have all occurred in the past 10 years (since 1998), with the warmest year being 2005.

Human Activities are Changing the Earth's Climate

In May 2001, the White House asked the National Academy of Sciences (NAS) to assess the current understanding of climate change by answering key questions related to both causes of climate change and projections of future change. The NAS released a report, *Climate Change Science: An Analysis of Some Key Questions* (2001), and a second report, *Understanding and Responding to Climate Change* (2008), the latter of which stated, "... [C]limate changes observed over the last several decades are likely mostly due to human activities" and "... additional evidence collected over the past several years has increased confidence in this conclusion."

The accumulation of some GHGs in the atmosphere is a natural part of the Earth's climate system and has been beneficial to our living environment. However, due to the extensive combustion of fossil fuel and land use changes over the past several hundred years, concentrations of GHGs in the Earth's atmosphere now exceed pre-industrial era amounts. Between 1970 and 2004, global emissions increased by 70 percent, with a full 24 percent increase occurring in the 14 years between 1990 and 2004. During that time, GHGs increased from 28.7 to

49 gigatons (GT). Of those, emissions of CO₂ grew by about 80 percent between 1970 and 2004, with the largest increase of 28 percent occurring during the 14 years between 1990 and 2004.¹

The largest growth in global GHG emissions occurring between 1970 and 2004 came from the energy supply sector, with a 170 percent increase. The next-largest growth in emissions came from the transportation sector with 120 percent, then the industrial sector with 65 percent, and finally land use and forestry with 40 percent. Between 1970 and 1990, direct emissions from agriculture grew by 27 percent. Without specific action, by 2030, global emissions of CO₂ from energy use are projected to grow from 45 percent to 110 percent more than emissions measured in the year 2000.²

Fossil fuel consumption in automobiles and electric power plants worldwide results in the emission of approximately 5.5 billion metric tons of CO₂ each year, and deforestation contributes an estimated additional 1.6 billion metric tons annually.³ GHG increases of methane and nitrous oxide are due primarily to agricultural activities.

If GHGs continue to increase, climate models predict that the average temperature at the Earth's surface could increase from 2.5 to 10.4°F by 2100.⁴ Members of the NAS and the scientific members of the Intergovernmental Panel on Climate Change (IPCC) are certain that human activities are changing the composition of the atmosphere, and that increasing the concentration of GHGs will change the planet's climate.⁵ At this point in time, scientists do not know with certainty how much it will change, at what rate it will change, or what the exact effects will be.

Florida's Emissions of Greenhouse Gases

Florida's gross GHG emissions increased from 248.8 million metric tons in 1990 to 336.6 million metric tons in 2005 as shown in Figure 1. Florida's GHGs come primarily from fossil fuel combustion attributable to the utility and transportation sectors. The utility sector accounts for 44 percent of GHGs and the transportation sector accounts for 37 percent of GHGs. This means that Florida's GHGs are largely attributed to supplying consumer demand for electricity and transportation. Future GHG growth in Florida is anticipated to come from these same sectors.

¹ Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, Working Group III, May 2007, available at: http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/04_05_07_ipcc_report.pdf

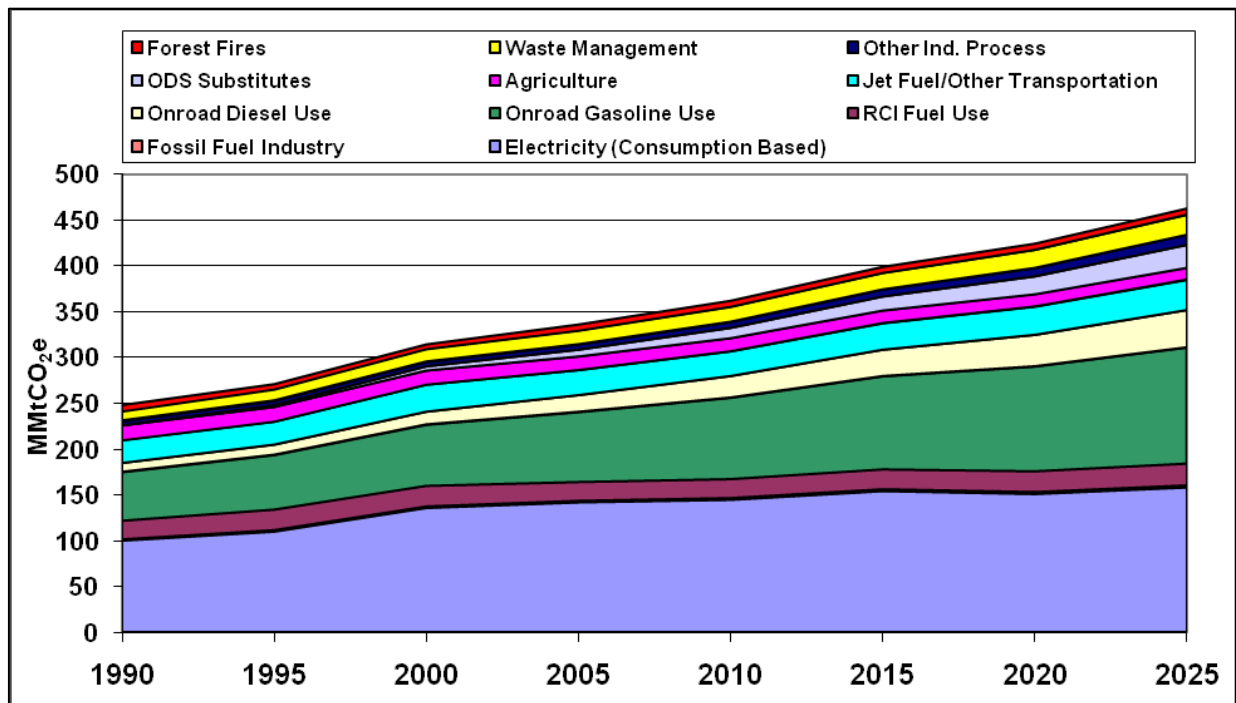
² Ibid.

³ U.S. National Aeronautics and Space Administration. "Earth Observatory: The Carbon Cycle," available at: http://earthobservatory.nasa.gov/Library/Carboncycle/carbon_cycle.html

⁴ IPCC. 2007. "Climate Change 2007: the Physical Science Basis," Solomon, S., D. Qin, M. Manning, eds. Contribution of Working Group I to the Fourth Assessment Report of the IPCC, available at: http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/02_02_07_climate_report.pdf

⁵ U.S. Environmental Protection Agency. "Climate Change: Basic Information," available at: <http://www.epa.gov/climatechange/basicinfo.html>

Figure 1. Actual and projected greenhouse gas emissions in Florida by sector, 1990–2025



While climate science is complex and evolving, the scientific community has reached a strong consensus regarding the science of global climate change. The world is undoubtedly warming. This warming is largely the result of emissions of carbon dioxide and other GHGs from human activities, including fossil fuel combustion, industrial processes, and changes in land use, such as deforestation. Although legitimate differences of opinion exist regarding the most effective mix of policies to address this problem, mitigation of GHGs is the essential component.

The Effects of Global Climate Change on Florida

With the release of each new report by the IPCC and the NAS, the consequences of global climate change are becoming better understood. By virtue of Florida's geography, changes in climate and sea level are of particular concern.

The impacts of climate change on Florida will result directly from an increase in air and water temperatures, sea level rise, and a change in precipitation levels.

- **Air Temperature Rise**—The IPCC predicts that the average temperature at the Earth's surface could increase from 2.5 to 10.4°F by 2100.⁶

⁶ IPCC. 2007. "Climate Change 2007: the Physical Science Basis," Solomon, S., D. Qin, M. Manning, eds. Contribution of Working Group I to the Fourth Assessment Report of the IPCC, available at:

http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/02_02_07_climatereport.pdf.

- **Sea Level Rise**—Higher temperatures are expected to raise sea level by expanding ocean water, melting mountain glaciers and small ice caps, and causing portions of the coastal section of the Greenland and Antarctic ice sheets to melt or “slide” into the ocean. The IPCC estimates that the global average sea level will rise between four and 35 inches, depending on the magnitude of warming.
- **Future Precipitation and Storm Changes**—Tropical storms and hurricanes are likely to become more intense, produce stronger peak winds, and produce increased rainfall over some areas due to warming sea surface temperatures (which can strengthen these storms).⁷

Each of these changes will impact the various sectors of Florida's economy, such as health, agriculture, forestry, water resources, coastal areas, and animal and sea-life species.

- **Health**—Human health can be affected directly and indirectly by climate change in part through extreme periods of heat and cold, storms, and diseases spread by mosquitoes in warm climates.⁸ Florida's population of senior citizens, particularly those living alone, would be most adversely affected by heat waves and heat-related illnesses.⁹ Further, sea surface warming could increase health threats from marine-borne illnesses, shellfish poisoning, and harmful algal blooms.¹⁰
- **Agriculture**—Citrus crop yields could decrease with warmer temperatures in the southernmost part of Florida because of the lack of a sufficient dormant period. Changes in cotton and sorghum production are unclear because increasing CO₂ levels and rainfall would likely increase yields. However, the shorter growing season brought on by increasing temperatures could result in plants producing fewer or smaller seeds and fruit.¹¹ In the short-term, it appears there may be benefits in the agricultural section from global warming; however, the effects in the long-term are unknown.
- **Forestry**—Changes in tree species, geographic extent, and the health and productivity of forests can be expected with a warmer climate. The mixed conifer/hardwood forests found in the northern and Panhandle sections of Florida are likely to retreat northward. These forests eventually would give way to wet tropical forests such as tropical evergreen broadleaf forests and dry tropical savanna. If conditions become drier, the current range of forests could be reduced and replaced by grasslands and pasture.¹²

⁷ Ibid.

⁸ U.S. Environmental Protection Agency. “Climate Change: Basic Information,” available at: <http://www.epa.gov/climatechange/basicinfo.html>

⁹ U.S. Environmental Protection Agency. “Climate Change and Florida.” EPA 230-F-97-008i, September 1997. [http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUKSV/\\$File/fl_impct.pdf](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUKSV/$File/fl_impct.pdf)

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid.

- **Water Resources**—Evaporation is likely to increase with a warmer climate, and that could result in lower river flow and lower lake levels during drier periods. If stream flow and lake levels drop, groundwater could also be reduced. Saltwater intrusion from sea level rise could threaten aquifers used for urban water supplies. These changes could further stress South Florida's water resources. In contrast, more intense rain could increase flooding in some areas.¹³
- **Oceans** – High water temperatures lead to the bleaching of coral, which is the expulsion of the symbiotic algae that corals need for survival, growth, and reproduction. While some corals can recover from bleaching other corals will be eliminated which will reduce local and regional coral diversity. Ocean acidification is another impact of climate change on oceans caused by the increases in atmospheric concentration of CO₂. Higher CO₂ concentration in the air increases the amount of CO₂ dissolved in ocean waters. Increased ocean acidity lowers the concentration of carbonate, which corals and other marine organisms need to build their skeletons.¹⁴
- **Coastal Areas**—As sea level rises, Florida's wetlands and lowlands along the Gulf and Atlantic coasts could be inundated. Adverse impacts in these areas could include loss of land and structures, loss of wildlife habitat, accelerated coastal erosion, exacerbated flooding and increased vulnerability to storm damage, and increased salinity of rivers, bays, and aquifers, which would threaten supplies of fresh water.¹⁵
- **Land Plants and Animals**—Scientists are seeing spring events occurring earlier each year. In North America, a northern shift is occurring in plant and animal ranges. Scientists are seeing shifts in ranges and changes in algal, plankton, and fish abundance in Florida associated with rising water temperatures, as well as related changes in salinity, oxygen levels, and circulation.¹⁶

If Florida and other states and nations act now to reduce GHG emissions, many of these effects can be avoided, minimized, or mitigated. The actions necessary to reduce GHG emissions are available to every household, every community, and every state in the nation. There is a cost associated with some of these actions, but there is also a direct cost for failing to act.

Addressing Climate Change through a Market-Based Solution

There is more than one method for encouraging the reduction in GHGs within the Florida economy. Options range from taxing to mandatory cuts to seeking market-based solutions. The U.S. Environmental Protection Agency had success in the 1980s with reducing acid rain through

¹³ Ibid.

¹⁴ The Pew Center on Global Climate Change, [Coral Reefs & Global Climate Change](http://www.pewclimate.org/docUploads/Coral_Reefs.pdf), February 2004
http://www.pewclimate.org/docUploads/Coral_Reefs.pdf

¹⁵ U.S. Environmental Protection Agency. "Climate Change and Florida." EPA 230-F-97-008i, September 1997.
[http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUKSV/\\$File/fl_impct.pdf](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUKSV/$File/fl_impct.pdf)

¹⁶ Ibid.

the use of market-based solutions, and many in the world believe the same can be accomplished with GHGs. The market-based solution being pursued by the European Union, as well as the Regional Greenhouse Gas Initiative and the Western Climate Initiative here in the United States, uses a cap-and-trade program to reduce emissions. This initiative is discussed at greater length in Chapter 4. By seeking a market-based solution to Florida's climate change concerns, the resulting economic stimulus will provide multiple benefits to the state. Not only will Florida benefit by slowing climate change through reducing GHGs, but it will stimulate the economy through the creation of new energy technologies, new business opportunities, new green jobs, and a reduction in the state's dependence on foreign sources of fuel, which translates to better energy security.

Market mechanisms are an efficient means to address GHG reductions because these mechanisms use price signals to provide incentives to individuals. To enhance the effectiveness of market mechanisms, consumer outreach programs can educate citizens on the critical role that everyday choices play in reducing GHG. By making conscious choices to conserve energy and to use energy more efficiently, Floridians can make a measurable difference in reducing GHG emissions.

Stimulating Economic Development

In order to address Florida's energy future, the public and the private sector must invest in new fuel sources, new technologies, new infrastructure, and more efficient homes, buildings, appliances, and transportation. These investments also represent real business opportunities in the private sector.

Florida Governor Charlie Crist has pointed out repeatedly that there are many commercial opportunities that can be created by new economic ventures in Florida, specifically that "there is gold in green" for Florida in alternative energy technologies. If Florida is successful in expanding hydrogen, biomass, solar, wind, and ocean energy programs, it will be poised to provide other states and nations with the technologies, expertise, and manufactured parts to take advantage of Florida's renewable energy industry. Entrepreneurs and businesses have the opportunity to invest in new technologies and build an alternative energy market while strengthening Florida's economic future.

Efforts to address energy security and global climate change are creating new markets for products and services that did not exist 20 years ago. One particular sector of Florida's economy that is already seeing new investments is agriculture. In order to reduce national reliance on foreign sources of petroleum, the transportation sector is investing in biofuels. Evidence of the economic opportunities in Florida for alternative fuels is offered by the success of the past three Farm-to-Fuel programs sponsored by the Florida Department of Agriculture and Consumer Services and with the movement of biofuel companies into the state and start-ups created within the state.

Businesses and investors are keenly interested in the new opportunities offered by alternative fuels and emerging technologies. During both of Governor Crist's "Serve to Preserve" Summits

on Global Climate Change in 2007 and 2008, attendees heard the experiences of to both emerging and established technology companies capitalizing on the commitment to develop alternative forms of energy. At the state, national, and global levels, venture capitalists are investing in the advanced energy technology sector. In 2006, venture capitalists invested \$740 million into biofuel firms, compared with \$111 million invested in 2005.¹⁷ The broader advanced energy technology sector attracted \$2.9 billion in venture capital in 2006, outpacing even the Fiscal Year 2008 federal appropriations of \$2.7 billion.¹⁸

Achieving Energy Security

Approximately 58 percent of the oil consumed by the United States is imported. Of total imports, 49 percent originates in the Western Hemisphere, 21 percent from Africa, 16 percent from the Persian Gulf, and 14 percent from others sources.¹⁹ Projected trends by the U.S. Department of Energy show dependence on oil imports continuing to increase. In May 2001, the National Energy Policy Development Group concluded that this imbalance, "...if allowed to continue, will inevitably undermine our economy, our standard of living and our national security." Geopolitical challenges are driving the United States to focus on energy security by increasing the domestic production of energy rather than depending on foreign nations.

The pursuit of energy security in the United States has focused on five main objectives:

1. Increase the energy efficiency of transportation, appliances, buildings, power plants, and transmission lines;
2. Modernize energy infrastructure by adding new transmission facilities, retiring old generators that release high emissions, and investing in public transportation;
3. Diversify the fuels used in the electric and transportation sectors;
4. Develop cleaner domestic fuels; and
5. Invest in and encourage alternative and new technologies.

Florida is looking to achieve those same objectives on a state level. Increasing energy efficiency and conservation in our homes, offices, buildings, and industry can have the largest impact on increasing energy security. In addition to every citizen taking personal responsibility to pursue energy efficiency and conservation, the state must upgrade and modernize its energy infrastructure. These upgrades need to come in the form of investments in cleaner electrical generators, new transmission facilities that can accommodate renewable energy sources, and public transportation systems.

¹⁷ Cleantech Venture Network. "Envy with Green(tech)," TeleSoft Partners. 2007.

¹⁸ Ibid.

¹⁹ United States Energy Information Administration.

The fuel that drives Florida's electric generators comes from out of state and out of the country. For example, coal is delivered to Florida by rail or barge, natural gas is delivered through pipelines, oil is delivered by tanker, and nuclear fuel is delivered by rail and truck. Florida receives 98 percent of its transportation fuel by sea via barge and tanker ship into seven ports. Any one of these transport systems that fuel Florida's electricity and transportation sectors could be, and has been, disrupted by a disaster or severe weather.

In an effort to diversify the state's fuel supply and attempt to keep consumer costs affordable, a number of Florida-based utilities are looking at nuclear facilities for the first time in decades. Because nuclear plants have zero GHGs in the production phase of their plant life cycle, nuclear energy has taken on increased importance in strategies for meeting future energy demand. Two Florida utilities have expressed interest and intent to expand current nuclear capacity or construct new nuclear generating facilities. Through the Energy Policy Act of 2005, the federal government offers tax incentives, loan guarantees, and other subsidies for nuclear power generation. Florida also enacted statutory provisions in 2006 and 2008 to allow for "advanced cost recovery" for nuclear power and its associated transmission system. Ongoing concerns regarding nuclear waste disposal remain a key issue that needs to be addressed.

Florida's utilities are also increasing investments in energy efficiency and in renewable sources of electricity generation. Important changes to Florida law enacted by the 2008 Florida Legislature expanded the range of energy efficiency program coverage and provided added incentives to utilities to achieve additional efficiency gains. Further, investments in renewable sources of energy are increasing in Florida due to increased fossil fuel prices as well as a range of policy actions that have removed market barriers, offset capital costs, and provided guidance for the establishment of a renewable portfolio standard for Florida utilities.

In the transportation sector, national energy security issues focus on U.S. refineries. Currently, domestic oil refineries are running at near-maximum capacity and represent a bottleneck in the oil supply chain. Due to environmental, safety, and aesthetic reasons, adding oil refinery capacity is difficult. Biofuels may help stabilize near-term oil prices by serving as fuel extenders, allowing fuel companies to sell more gallons than their petroleum refineries are capable of producing. Since biofuel plants do not pose as many of the same concerns as oil refineries, they are viewed as a solution to the refinery capacity dilemma. As the demand for transportation fuels increases, Florida's infrastructure for producing, storing, and transporting that fuel or biofuel to market will need to expand, including new storage capacity in some of Florida's ports.

Conclusion

Few single elements have as much economic impact and are as critical to the economic health of the state as energy. Whether it is the electricity to run homes or businesses or the petroleum to power transportation systems, energy is the lifeblood of the economy. Due to its economic importance, one of the primary goals of Florida's energy policy must be to ensure a clean, reliable, fair, and affordable energy supply. This goal is consistent with reducing GHGs

because, by encouraging investment in energy efficiency and the use of clean renewable energy sources, Florida will be reducing its demand for imported fuel and securing better sources of energy for the future.

To position the state to take economic advantage of the emerging technology industry, Florida must act now to reduce GHG emissions. Hand-in-hand with pursuing energy efficiency measures that build on the 2008 Legislature's work, Florida should encourage the development of alternative energies to achieve the goals of:

- Mitigating the potential impacts to Florida from climate change;
- Further stimulating economic development in the state associated with the existing and emerging alternative energy industries; and
- Achieving energy security by reducing dependence on foreign fuels.

History and Status of State Actions

In recent years, the State of Florida has undertaken a number of actions to address the issues of energy and climate change. For example, in 2006, the Legislature passed Florida's first comprehensive energy plan, prompted by a series of events, including very active 2004 and 2005 hurricane seasons that heightened concern over energy reliability, energy security, and energy supply. More recently, the growing body of evidence in support of the threat posed by greenhouse gas (GHG) emissions and climate change led Florida Governor Charlie Crist to intensify the state's efforts to address these complex and interrelated challenges. The following provides a brief overview of these and other efforts to date.

2007 Energy and Climate Change Initiatives

On July 12 and 13, 2007, Governor Crist hosted "Serve to Preserve: A Florida Summit on Global Climate Change." The first-ever summit of its kind in Florida brought together leaders of business, government, science, environmental stakeholders, and advocacy groups to examine the risks to Florida and the nation posed by global climate change. At the conclusion of the summit in Miami, Governor Crist signed three Executive Orders and two international partnership agreements that propelled Florida to the forefront of states actively working to address climate change.

Executive Order 07-126 directed state government to "lead by example" by quantifying operational emissions and meeting specific reduction targets by implementing a range of GHG emission reduction efforts that impact state government facilities and vehicle fleets, and by using the purchasing power of state government to promote energy efficiency and reduced emissions.

Executive Order 07-127 established reduction targets for utility sector GHG emissions in Florida. Specifically, the Executive Order established the following emission reduction targets: by 2017, reduce GHG emissions to 2000 levels; by 2025, reduce GHG emissions to 1990 levels; and by 2050, reduce GHG emissions to 80 percent below 1990 levels.

As first steps toward meeting these targets, the Executive Order directed the Florida Department of Environmental Protection (DEP) to set maximum allowable GHG emissions levels for electric utilities, adopt the California motor vehicle emission standards upon the U.S. Environmental Protection Agency's approval of the pending waiver, and adopt a statewide diesel engine-idling reduction standard.

The Executive Order further directed that modifications to the 2007 Florida Energy Code for Building Construction include a 15 percent increase in energy efficiency performance as well as a 15 percent increase in the energy efficiency of certain appliances sold in Florida by 2009. Finally, it requested that the Florida Public Service Commission (PSC) adopt a 20 percent Renewable Portfolio Standard with a strong focus on solar and wind energy, adopt the Institute

of Electrical and Electronics Engineers Standard 1547 for Interconnecting Distributed Resources with Electric Power Systems, and require net metering for on-site renewable technologies of up to one megawatt (MW) in capacity.

Executive Order 07-128 established the Governor's Action Team on Energy and Climate Change and tasked it with creating a comprehensive Florida Energy and Climate Change Action Plan to achieve or surpass the statewide targets for GHG reduction specified in Executive Order 07-127. Executive Order 07-128 provided the Action Team with a two-phase process for submitting recommendations. The Action Team was directed to submit its Phase 1 Report to the Governor by November 1, 2007, and its Phase 2 report in October 2008.

The Governor signed partnership agreements with Germany and the United Kingdom focused on climate policies and mutual economic benefits. Pursuant to these agreements, the State of Florida is exchanging delegations with Germany and with the United Kingdom to create a forum for sharing public policy experience and exchanging science and technology, placing a particular emphasis on the sharing of ideas and policies related to energy efficiency and renewable energy sources. The individual partnership agreements also will increase climate-friendly trade.

On August 13, 2007, Governor Crist appointed the first 21 members to the Action Team and appointed DEP Secretary Michael Sole as Chairman and Mayor Rick Baker of the City of St. Petersburg as Vice Chairman. Membership included a diverse cross section of stakeholders, including representatives of business, utilities, academia, and environmental organizations. To meet the first deadline set by Executive Order 07-128, the Action Team conducted more than 36 hours of hearings. The Action Team listened to presentations from international, national, and Florida-based experts, dozens of members of the public, and other interested parties.

Phase 1 Report—Florida's Energy and Climate Change Action Plan: On November 1, 2007, the Governor's Action Team on Energy and Climate Change issued its first report. The report's 35 findings and 30 recommendations addressed the requirements outlined in Executive Order 07-128, and were organized into the following key categories:

1. The power generation sector;
2. The transportation sector;
3. The government sector;
4. Organizing state government for Florida's energy future; and
5. A blueprint for development of actions.

The report recommended policies to:

- increase energy efficiency and conservation;
- examine the potential for capture, sequestration, and storage of carbon;
- expand the production of renewable energy; and
- further examine the role of nuclear energy in Florida.

The Action Team deferred until the Phase 2 Report a recommendation on the precise mechanism for regulating carbon emissions in the state but did recommend pursuing the design of a market-based policy of cap-and-trade for tradable emissions credits; establishing linkages with ongoing emissions trading markets; and reporting emissions to The Climate Registry by the state's electric utilities. The Action Team also recommended that DEP examine and propose additional industry sectors for inclusion in mandatory emissions reporting.

The Action Team acknowledged the importance of transportation in reducing overall GHG emissions. The report contained a series of transportation-related recommendations, including the incorporation of emission reduction strategies into local, state, and regional growth and transportation planning; incentives for reducing vehicle miles traveled; and promotion of efficient public transit systems and low-carbon vehicles. The Action Team also recommended continuing existing incentives for research and development of new fuels, as well as promoting life cycle analyses for fuels in order to comprehend the full impact on the state's resources and environment.

Building on the requirements of Executive Order 07-126, the Action Team identified additional energy and emissions savings opportunities in state government operations and facilities. The Phase 1 Report included recommendations to extend, by statute, the Executive Branch actions contained in the Governor's Executive Order to all other state government operations. The Action Team also recommended removing any barriers to the use of energy performance savings contracts for state government facilities, and providing incentives to assist local governments in achieving green building or similar standards.

The Action Team examined the state's roles in policy, energy regulation, program implementation, and research and market development, and recommended that the state foster greater public-private cooperation with universities and other research centers to develop a low-carbon and alternative energy/technology market in Florida.

Finally, the Action Team recommended the use of a facilitated stakeholder process to in Phase 2 develop the detailed emission reduction strategies that would provide the blueprint for development of actions contained in the final Florida's Energy and Climate Change Action Plan. The Action Team recognized that the stakeholder process must be guided by rigorous analyses of the costs and benefits of various policy options.

2008 Energy and Climate Change Initiatives

At the outset of 2008, the State of Florida had a number of energy- and climate change-related initiatives under way. The Governor's Action Team resumed deliberations and intensified its examination of policy recommendations for its Phase 2 Report. Meantime, the Florida Energy Commission (created by the 2006 Legislature) submitted its final report about this same time, which contained a wide range of recommendations relating to energy affordability, security, efficiency, reliability, and climate change. The Florida Senate and the House of Representatives also embarked on their own respective inquiries into energy and climate change issues, holding committee workshops with experts chosen by the committees.

2008 Energy Legislation—During the 2008 Regular Session, the Legislature enacted several bills that significantly impacted energy and climate change issues. The most notable legislation was House Bill 7135 (“The Energy, Climate Change, and Economic Security Act of 2008”). This comprehensive energy bill codified many of the provisions contained in Governor Crist's 2007 Executive Orders. By drawing on the efforts of the Governor's Action Team on Energy and Climate Change, the Florida Energy Commission, and the extensive deliberations of the Senate and House of Representatives, the bill:

- Created the Florida Energy and Climate Commission within the Executive Office of the Governor to centralize energy and climate change policy development and program implementation;
- Authorized the DEP to develop cap-and-trade regulations for GHG emissions for sources in Florida, subject to legislative ratification in the 2010 Regular Session;
- Expanded key economic development programs to attract specific investments in the renewable energy sector to Florida;
- Adopted a “10 by 10” Renewable Fuel Standard requiring that all gasoline sold for motor vehicles in Florida contain 10 percent ethanol by 2010;
- Required the PSC to develop rules for a renewable portfolio standard subject to legislative ratification in the 2009 Regular Session and provided cost recovery guidance to the PSC for renewable energy projects developed in advance of the final rule;
- Required major emitters to report GHG emissions via The Climate Registry;
- Required the reduction of energy consumption and associated GHG emissions from local and state government operations by requiring that public buildings be constructed to meet recognized green building standards; by considering energy and climate performance in vehicle, commodity, and meeting space procurement; by promoting active energy management among state agencies; and by increasing energy and water efficiencies from government facilities by streamlining existing statutes governing guaranteed performance savings contracts;

- Increased the role of energy efficiency in Florida's energy policy through revisions to the Florida Energy Efficiency and Conservation Act, provided goals for the Florida Building Commission to increase efficiency standards by 10 percent in each triennial review and achieve a 50 percent increase by 2019, and increased efficiency requirements for certain appliances;
- Created the Florida Energy Systems Consortium within the State University System to better coordinate energy-related research in support of Florida's energy and climate change policy objectives; and
- Balanced the need for expanded electric transmission infrastructure within Florida with the need for conservation land protection and informed public participation in the siting process by providing the terms and conditions for use of state lands; clarifying timelines in the transmission line siting process; and increasing public participation through new mail notice requirements and additional hearings for local residents.

On June 25 and 26, 2008, Governor Crist convened the second Annual "Serve to Preserve: A Global Summit on Climate Change." The Governor was joined by members of the Florida Legislature for the signing of House Bill 7135, the landmark 2008 energy legislation. The 2008 summit focused not only on the need to pursue alternative fuels for environmental reasons, but also for the economic benefits brought about by the infusion of green technologies. At the conclusion of the summit, Governor Crist signed a new public-private partnership making Florida among the first states to join the Alliance for Sustainable Air Transportation, which places a premium on energy conservation and air travel safety.

Phase 2 Report—Florida's Energy and Climate Change Action Plan: Pursuant to Executive Order 07-128, the Action Team reconvened in February 2008 to begin Phase 2. Governor Crist expanded the membership of the Action Team from 21 to 27 voting members and retained a 28th ex officio member. Additionally, the Center for Climate Strategies (CCS) was asked to help facilitate and provide technical support. CCS worked with DEP in the development of a stakeholder-based consensus-building process.

As part of this effort, the Action Team designated six Technical Working Groups to focus on specific issues and sectors of the economy and tasked them with responsibility for providing technical analysis and designing policy options for consideration by the full Action Team. The Technical Working Groups consisted of Action Team members (as the minority) as well as other individuals with interest and expertise in issues being addressed (as the majority). The six Technical Working Groups were:

- Energy Supply and Demand;
- Cap-and-trade;
- Transportation and Land Use;
- Agriculture, Forestry, and Waste Management;

- Government Policy and Coordination; and
- Adaptation Strategies.

The Action Team and Technical Working Groups worked diligently to meet the October 2008 deadline for completion of the Phase 2 Report. The 28 Action Team members met a total of eight times, representing more than 60 hours of deliberation. The 122 members of the six Technical Working Groups met 71 times, representing more than 155 hours of combined meeting time. Their respective recommendations are the substance of this report and are discussed at length in subsequent chapters and appendices.

Current Status of Energy and Climate Change Initiatives

While many of the recently enacted policies and programs still might be considered to be in the developmental stage, the State of Florida can point to a significant number of early achievements. Similarly, a number of private sector entities, local governments, community-based organizations, and academic institutions have launched their own energy- and climate change-related initiatives. As a result, Florida is increasingly recognized as a leader in addressing the challenges and opportunities associated with energy and climate change. The following are examples of these accomplishments:

Leading by Example—Through the establishment of the Florida State Greenhouse Gas Reduction Scorecard, the state has generated the first comprehensive assessment of GHG emissions from state government-owned vehicles and facilities. The Department of Management Services has implemented Environmentally Preferred Purchasing to assist state entities in the purchase of climate-friendly products. DMS also has established programs to support energy performance contracting in state facilities, and increased fuel efficiency in the state's motor vehicle fleet.

GHG Emission Reductions—The Florida DEP has issued its proposed rule for reducing emissions resulting from long-duration on-road diesel engine idling and is in the process of rule development for adoption of the California motor vehicle emissions standards. The DEP continues the rule development process in support of a cap-and-trade program to reduce GHG emissions from electric utilities.

Renewable Energy—The PSC has adopted new rules to promote the development and interconnection of customer-owned renewable generation and minimize costs for customers attempting to interconnect to their utility service. The rules encourage the development of renewable generation by expanding the size of eligible systems, expanding the type of eligible systems from solely photovoltaic to all renewable technologies, expediting the interconnection of customer-owned renewable generation, and allowing customers to offset consumption through net metering. The PSC is continuing its rule development process in support of the establishment of a statewide Renewable Portfolio Standard.

A number of Florida utilities have taken the initiative to expand renewable energy production. For example, one Florida-based utility has received approval to begin construction of three solar

energy centers that will make Florida the second-largest supplier of utility-generated solar power in the nation. Similarly, several utilities are aggressively pursuing additional biomass and co-firing opportunities. A number of Florida's municipal and cooperative utilities have launched their own solar and biomass generation initiatives.

Energy Efficiency—As previously noted, Florida agencies are implementing a wide range of programs designed to increase energy efficiency and reduce carbon emissions within state government operations. The Florida Building Commission is finalizing revisions to the Florida Building Code that will significantly enhance the energy efficiency of new buildings constructed in Florida. Almost 300 hotels and motels around the state have been designated and recognized in the DEP's Florida Green Lodging Program, a public-private partnership that encourages the lodging industry to adopt energy efficient and sustainable practices.

Numerous utilities and local governments have established financial incentives and related programs to encourage the adoption of energy efficiency improvements by consumers. Through a myriad of grant, loan, and rebate programs, these entities are making a variety of energy efficiency measures (increased insulation, solar hot water heating, high-efficiency appliances and HVAC, building envelope improvements, etc.) more affordable to home and building owners.

Energy Policy Governance—Effective July 1, 2008, the Governor's Energy Office was established within the Executive Office of the Governor to centralize and strengthen Florida's energy policy development capabilities. This office staffs and supports the Florida Energy and Climate Commission, the nine-member long-term panel created by HB 7135 and appointed by the Governor (7), Chief Financial Officer (1), and Commissioner of Agriculture and Consumer Services (1).

Investment Policies – In recognition of the emerging risks associated with climate change, Florida became the first state in the nation to institute a process to formally analyze investments for the financial impacts of climate change. This initiative, coordinated through Chief Financial Officer Alex Sink, will assess how public fund managers incorporate climate risk in portfolio holdings as part of prudent investment management. Similarly, Florida has joined with a dozen other states representing more than \$1.5 trillion in assets under management to create an action plan to boost fund investments in energy efficiency and clean energy technologies as well as require tougher scrutiny of carbon-intensive investments that may pose long-term financial risks.

Energy-related Research—The recently created Florida Energy Systems Consortium is focusing on a range of projects that have the highest potential of generating near-term impact given the cumulative expertise and infrastructure of all 11 state universities. Areas of focus include, but are not limited to, development of an integrated bioenergy industry; solar thermal power for bulk power and distributed generation; development of Florida's vast ocean energy potential; Florida-based low-cost manufacturing of photovoltaic systems; integration of photovoltaic

storage/lighting systems; energy-efficient building technologies and zero-energy homes; and efficient and reliable energy delivery infrastructure.

Conclusion

During the past two years under Governor Crist, Florida has established a solid foundation of policies and programs in response to the increasingly clear dangers associated with climate change. Through the leadership of Governor Crist and the Legislature, the state has acted not only to address the challenges but also to create an atmosphere where Floridians can benefit economically from emerging alternative energy technologies and processes. While the early indications are promising, more work is necessary in the coming years. This report is intended to provide specific strategies that put Florida on the path toward further significant emissions reductions meet the state's overall goals.

Chapter 1

Background and Overview

Action Team and Technical Work Group Deliberations

The Governor's Action Team on Energy and Climate Change (the Action Team) held its first meeting of the Phase 2 process on February 1, 2008, followed by nine months of intensive fact-finding and consensus building. During this period, the Action Team's six Technical Working Groups (TWGs) were instrumental in developing specific findings and recommendations for Action Team consideration. The six TWGs are:

- Energy Supply and Demand;
- Cap-and-Trade;
- Transportation and Land Use;
- Agriculture, Forestry and Waste Management;
- Government Policy Coordination; and
- Adaptation Strategies.

The Action Team's deliberations relied on a facilitated, stepwise consensus-building approach. With oversight by the Florida Department of Environmental Protection (DEP), the process was conducted by the Center for Climate Strategies (CCS), an independent facilitation and technical analysis team. The facilitated process was based on procedures used by CCS in a number of other state-level climate change planning initiatives, but adapted specifically for Florida.

CCS provided facilitation and technical assistance to each of the TWGs and the Action Team. The TWGs consisted of Action Team members as well as individuals with an interest in and expertise regarding the issues being addressed by each TWG. The members of the TWGs were appointed by the Action Team Chairman. The TWGs served as independent advisers to the Action Team and generated initial recommendations on policy recommendations. With the guidance and approval of the Action Team they developed draft proposals on the design characteristics and, where possible, quantified the proposed policy recommendations. When members of a TWG did not fully agree on a recommendation to the Action Team, the summary of their effort was reported to the Action Team for further consideration and action. The Action Team then made all final decisions.

Through this process, the Action Team reached technical consensus on specific mitigation options and findings related to benefits, costs, and feasibility issues associated with the options, followed by the development of consensus on individual policy recommendations. The Action Team sought but did not mandate consensus, and it explicitly documented the level of support for individual recommendations and mitigation options.

The recommendations presented in this report recent extensive evaluation and comment by the Action Team, the TWGs, and through public comment. The TWG recommendations to the Action Team were documented and presented to the Action Team at each Action Team meeting. All meetings were open to the public, were properly noticed, and all materials for and summaries of the Action Team and TWG meetings were posted on the Web site of DEP as well as a special Web site set up by CCS.

Contents of the Report

This report presents the summation of the Governor's Action Team on Energy and Climate Change Phase 2. The report is divided into eight chapters. Chapter 1 provides the reader with an overview of how the report is structured. Chapter 2 discusses the Inventory and Forecast data used and the assumptions behind that data. The next six chapters—Chapters 3 through 8—provide summaries of each TWG's recommendations.

Each TWG chapter summary has a companion Technical Appendix that provides a table listing of all the proposed recommendations considered in each TWG along with the quantification of costs and benefits of each, where possible, and a descriptive definition of each recommendation. The Technical Appendices are provided for those readers who want more detail on each recommendation. Following the Technical Appendices is a listing of Acronyms and Abbreviations used in those documents.

Also, there is an Administrative Appendix that contains Governors Crist's three Executive Orders issued in 2007 and the Governor's Action Team on Energy and Climate Change Phase 1 Report.

Chapter 2

Inventory and Projections of Florida GHG Emissions

Introduction

During Phase 1 of the Action Team process, the Florida Department of Environmental Protection (DEP) prepared a preliminary inventory and reference case projections of emissions. That preliminary inventory and reference case projections was revised, updated, and completed by the Center for Climate Strategies (CCS) in June 2008 to provide the Action Team and its Technical Work Groups (TWGs) an understanding of past, current, and possible future GHG emissions in Florida, and to inform the policy recommendation development process. Since that time, the Action Team and TWGs have reviewed, discussed, and evaluated the draft inventory and methodologies, as well as alternative data and approaches for improving the draft GHG inventory and forecast. Based on that review, the inventory and forecasts have been revised to address the comments provided by the Action Team and the TWGs. The information in this chapter reflects the information presented in the final *Florida Greenhouse Gas Inventory and Reference Case Projections* report (hereafter referred to as the Inventory and Projections report) also provided on the Center for Climate Strategies' Web site at http://www.flclimatechange.us/Inventory_Forecast_Report.cfm.¹

Historical GHG emissions estimates (1990 through 2005)² were developed using a set of generally accepted principles and guidelines for state GHG emissions inventories, relying to the extent possible on Florida-specific data and inputs. The reference case projections (2006-2025) are based on a compilation of various existing projections of electricity generation, fuel use, and other GHG-emitting activities, along with a set of simple, transparent assumptions described in the final Inventory and Projections report.

The Inventory and Projections report covers the six types of gases included in the U.S. GHG inventory: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions of these GHGs are presented using a common metric, CO₂ equivalence (CO₂e), which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential-weighted basis.³

¹ Center for Climate Strategies, Final Florida Greenhouse Gas Inventory and Reference Case Projections: 1990–2025. Prepared for the Florida Governor's Action Team on Energy and Climate Change, October 2008.

² The last year of available historical data for each sector varies between 2000 and 2005.

³ Changes in the atmospheric concentrations of GHGs can alter the balance of energy transfers between the atmosphere, space, land, and the oceans. A gauge of these changes is called radiative forcing, which is a simple measure of changes in the energy available to the Earth-atmosphere system (IPCC, 2001). Holding everything else constant, increases in GHG concentrations in the atmosphere will produce positive radiative forcing (i.e., a net increase in the absorption of energy by the Earth). See: Boucher, O., et al. "Radiative Forcing of Climate Change."

There are two ways to account for emissions: either through a consumption-based approach or through a production-based method. It is important to note that the emissions estimates used here reflect the GHG emissions associated with the electricity sources used to meet Florida’s demands, corresponding to a consumption-based approach to emissions accounting. Another way to look at electricity emissions is to consider the GHG emissions produced by electricity generation facilities in the state—a production-based method. The study covers both methods of accounting for emissions, but for consistency, all total results are reported as consumption-based.

Florida GHG Emissions: Sources and Trends

Table 2-1 provides a summary of GHG emissions estimated for Florida, by sector, for 1990, 2000, 2005, 2010, 2020, and 2025. As shown in this table, Florida is estimated to be a net source of GHG emissions (positive emissions, or gross emissions). Since Florida’s forests and forested acreage serve as “carbon sinks” of GHG emissions (removal of CO₂ from the atmosphere, or negative emissions), Florida’s net emissions is arrived at by subtracting the equivalent GHG reduction capacity of emission sinks from the gross GHG emissions totals. The following sections discuss GHG emission sources, sinks, trends, projections, and uncertainties.

Historical Emissions

Overview

In 2005, on a gross emissions consumption basis (excluding carbon sinks), Florida accounted for approximately 337 million metric tons (MMt) of CO₂e emissions, an amount equal to 4.7 percent of total U.S. gross GHG emissions. On a net emissions basis (including carbon sinks), Florida accounted for approximately 309 MMtCO₂e of emissions in 2005, an amount equal to 4.9 percent of total U.S. net GHG emissions.⁴ Florida’s GHG emissions are rising faster than those of the nation as a whole. From 1990 to 2005, Florida’s gross GHG emissions increased by 35 percent, while national gross emissions rose by 16 percent.⁵

Table 2-1. Florida historical and reference case GHG emissions, by sector*

(Million Metric Tons CO ₂ e)	1990	2000	2005	2010	2020	2025
---	------	------	------	------	------	------

Chapter 6 in *Climate Change 2001: The Scientific Basis*. Contribution of Working Group 1 of the Intergovernmental Panel on Climate Change Cambridge University Press. Cambridge, United Kingdom. Available at: http://www.grida.no/climate/ipcc_tar/wg1/212.htm.

⁴ The national emissions used for these comparisons are based on 2005 emissions from U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006*, April 15, 2008, EPA430-R-08-005. Available at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>.

⁵ During this period, population grew by 38 percent in Florida and by 19 percent nationally. However, Florida’s economy grew at nearly the same rate on a per capita basis as the nation (up 32 percent in Florida compared to 33 percent nationally).

Florida's Energy and Climate Change Action Plan

Energy (Consumption Based)	210.3	270.9	286.8	307.3	356.0	385.3
Electricity Use (Consumption)	100.6	136.2	142.2	145.0	151.3	158.5
Electricity Production (in-state)	86.1	124.3	134.1	138.5	151.3	158.5
Coal	54.1	72.3	60.4	69.2	74.4	73.5
Natural Gas	11.1	22.6	38.0	56.1	68.2	78.4
Oil	20.3	28.1	32.0	9.38	5.10	3.75
Biomass (CH ₄ and N ₂ O)	0.015	0.010	0.000	0.000	0.000	0.000
MSW/Landfill Gas	0.37	0.74	3.60	3.24	2.89	2.21
Other	0.34	0.48	0.01	0.57	0.74	0.60
Imported/Exported Electricity	14.5	11.9	8.09	6.57	0.00	0.00
Residential/Commercial/Industrial (RCI) Fuel Use	21.0	23.1	21.2	21.3	23.3	24.4
Coal	2.84	3.02	2.58	2.81	2.83	2.91
Natural Gas	7.73	9.84	7.93	8.15	9.60	10.4
Petroleum	10.1	10.1	10.5	9.86	10.3	10.5
Wood (CH ₄ and N ₂ O)	0.40	0.21	0.22	0.54	0.60	0.64
Transportation	87.6	110.2	121.8	139.2	179.4	200.3
Onroad Gasoline	52.9	66.0	76.2	88.7	114.3	126.7
Onroad Diesel	9.73	14.0	18.3	23.5	34.4	40.7
Marine Vessels	11.1	14.4	14.9	14.3	15.8	16.5
Rail, Natural Gas, LPG, other	0.70	0.69	0.96	0.99	1.04	1.07
Jet Fuel and Aviation Gasoline	13.2	14.5	11.5	11.7	13.9	15.3
Fossil Fuel Industry	1.02	1.36	1.55	1.70	2.00	2.09
Natural Gas Industry	0.95	1.30	1.52	1.67	1.99	2.07
Oil Industry	0.07	0.06	0.04	0.03	0.02	0.01
Industrial Processes	4.38	9.20	12.8	17.6	28.7	36.2
Cement Manufacture (CO ₂)	1.20	1.81	2.75	3.63	6.31	8.32
Limestone and Dolomite Use (CO ₂)	0.38	0.46	0.49	0.52	0.60	0.64
Soda Ash (CO ₂)	0.14	0.15	0.15	0.16	0.16	0.17
Iron & Steel (CO ₂)	1.09	1.15	1.03	1.06	1.12	1.15
Ammonia and Urea (CO ₂)	0.09	0.06	0.06	0.06	0.06	0.06
ODS Substitutes (HFC, PFC)	0.02	4.64	7.45	11.3	19.7	25.2
Electric Power T&D (SF ₆)	1.44	0.87	0.81	0.75	0.69	0.67
Semiconductor Manufacturing (HFC, PFC, and SF ₆)	0.02	0.07	0.06	0.06	0.05	0.05
Waste Management	10.7	14.1	15.3	16.6	19.9	21.9
MSW LFGTE	0.39	0.49	0.51	0.53	0.57	0.59
MSW Flared	0.35	0.58	0.68	0.78	1.04	1.21
MSW Uncontrolled	5.86	8.60	9.52	10.5	12.9	14.3
MSW Uncontrolled & closed over 15 year	1.33	0.97	0.79	0.65	0.43	0.36
Industrial Landfills	0.76	1.05	1.14	1.24	1.46	1.59
Waste Combustion	0.23	0.20	0.19	0.17	0.15	0.14
Municipal Wastewater	1.57	2.01	2.23	2.50	3.15	3.54
Industrial Wastewater	0.22	0.22	0.22	0.22	0.22	0.22
Agriculture	16.3	15.5	15.0	14.4	13.6	13.1
Enteric Fermentation	2.51	2.30	2.18	2.05	1.85	1.75

Manure Management	0.76	0.76	0.69	0.63	0.57	0.55
Agricultural Soils	3.36	2.73	2.43	2.03	1.43	1.14
Agricultural Burning	0.01	0.01	0.01	0.01	0.01	0.01
Rice Cultivation	0.06	0.09	0.06	0.06	0.06	0.06
Agricultural Soils (cultivation practices)	9.63	9.63	9.63	9.63	9.63	9.63
Forest Fires (CH₄ and N₂O)	7.05	5.29	6.82	6.70	6.70	6.70
Gross Emissions (Consumption Basis, Excludes Sinks)	248.8	315.0	336.6	362.6	424.9	463.3
Increase relative to 1990		27%	35%	46%	71%	86%
Emissions Sinks	-17.8	-26.7	-27.3	-27.2	-27.1	-27.1
Forested Landscape	-3.38	-21.1	-21.1	-21.0	-20.9	-20.9
Urban Forestry and Land Use	-14.4	-5.65	-6.23	-6.23	-6.23	-6.23
Net Emissions (Includes Sinks)	230.9	288.3	309.4	335.3	397.8	436.2

MMtCO₂e = million metric tons of carbon dioxide equivalent; CH₄ = methane; N₂O = nitrous oxide; MSW = municipal solid waste; LFTGE = landfill gas to energy; LPG = liquefied petroleum gas; ODS = ozone-depleting substance; HFC = hydrofluorocarbon; PFC = perfluorocarbon; SF₆ = sulfur hexafluoride; NG = natural gas; T&D = transmission and distribution;

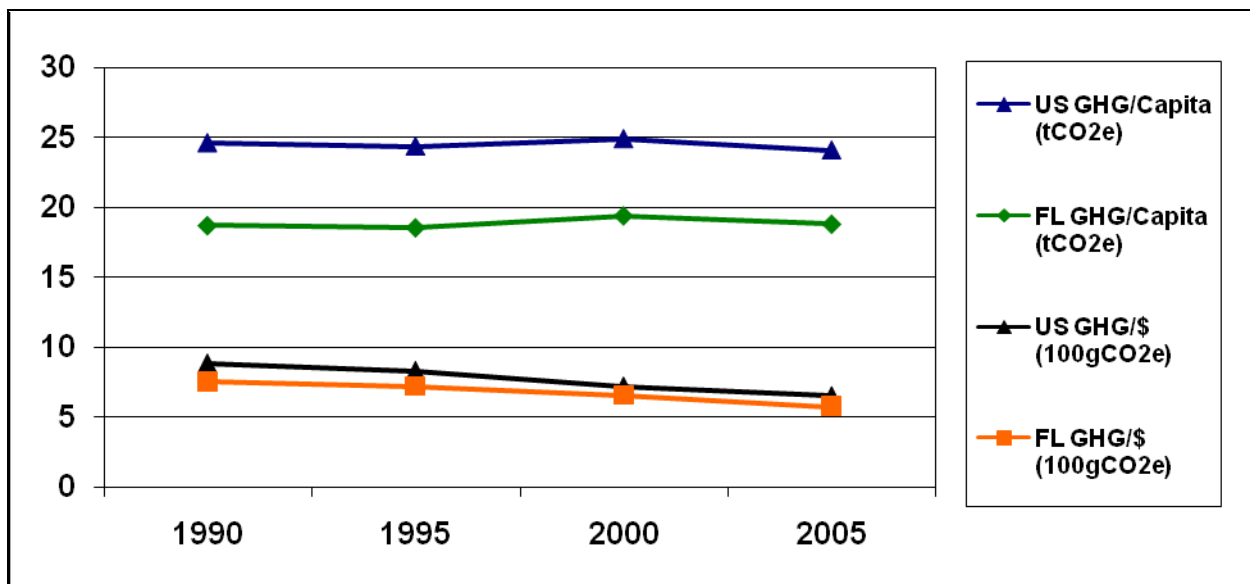
* Totals may not equal exact sum of subtotals shown in this table due to independent rounding.

On a per capita basis, Florida emitted about 19 metric tons (t) of gross CO₂e in 2005, lower than the national average of about 24 tCO₂e. Figure 2-1 illustrates the state's emissions per capita and per unit of economic output. It also shows that Florida per capita emissions have remained relatively flat between 1990 and 2005, similar to the nation as a whole. In both Florida and the nation as a whole, economic growth exceeded emissions growth throughout the 1990-2005 period. From 1990 to 2005, emissions per unit of gross product dropped by 26 percent, both in Florida and nationally.⁶

The principal sources of Florida's GHG emissions in 2005 are electricity consumption and transportation – these account for 42 percent and 36 percent, respectively, of Florida's gross GHG emissions, as shown in Figure 2-2. The direct use of fuels—natural gas, oil products, coal, and wood—in the residential, commercial, and industrial (RCI) sectors accounts for 6 percent of the state's emissions in 2005, significantly lower than the RCI sector contribution for the nation at 22 percent.

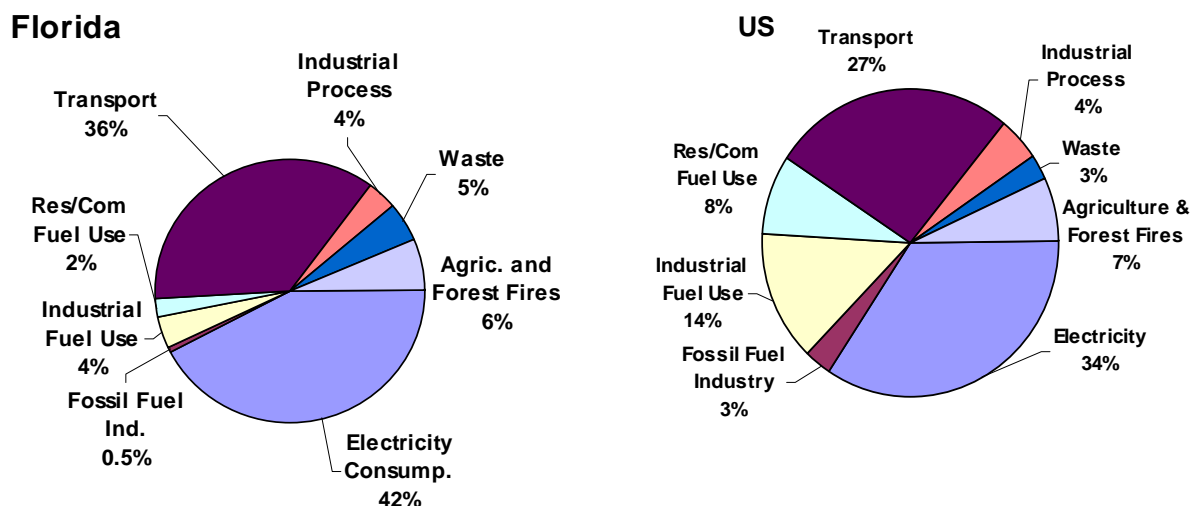
⁶ Based on real gross domestic product (millions of chained 2000 dollars), that excludes the effects of inflation, available from the U.S. Department of Commerce, Bureau of Economic Analysis. "Gross Domestic Product by State." Available at: <http://www.bea.gov/regional/gsp/>.

Figure 2-1. Florida and U.S. gross GHG emissions, per-capita and per-unit gross product



GHG = greenhouse gas; tCO₂e = metric tons of carbon dioxide equivalent; GSP = gross state product; GDP = gross domestic product; g = grams.

Figure 2-2. Gross GHG emissions by sector, 2005: Florida and U.S.



The agricultural and forest wildfire sectors together account for 6 percent of the gross GHG emissions in Florida in 2005. These methane (CH₄) and nitrous oxide (N₂O) emissions primarily come from agricultural soils, rice cultivation, enteric (intestinal) fermentation, and manure management. Landfills and wastewater management facilities produce CH₄ and N₂O emissions that account for 5 percent of total gross GHG emissions in Florida in 2005. These emissions include:

- CH₄ emissions from municipal and industrial solid waste landfills;
- CH₄, CO₂, and N₂O emissions from the combustion of solid waste at open residential sites or in incinerators; and
- CH₄ and N₂O from municipal wastewater and CH₄ from industrial wastewater treatment facilities.

Also, industrial process emissions accounted for another 4 percent of the state's GHG emissions in 2005, and these emissions are rising due to the increasing use of HFCs and PFCs as substitutes for ozone-depleting chlorofluorocarbons.⁷ In addition, emissions associated with the production, processing, transmission, and distribution of fossil fuels accounted for 0.5 percent of the gross GHG emissions in 2005.

Forestry emissions refer to the net CO₂ flux⁸ from forested lands in Florida, which account for about 47 percent of the state's land area.⁹ Florida's forests are estimated to be net sinks of CO₂ emissions in the state, reducing net GHG emissions by 27 MMtCO₂e in 2005.

Reference Case Projections

Relying on a variety of sources for projections, a simple reference case projection of GHG emissions through 2025 was developed. This is illustrated in Figure 2-3 and shown numerically in Table 2-1. Under the reference case projections, Florida's gross GHG emissions would continue to grow steadily, climbing to about 463 MMtCO₂e by 2025, or 86 percent above 1990 levels. This equates to a 1.6 percent annual growth rate from 2005 to 2025. By 2025, transportation emissions would increase to 43 percent while emissions from electricity consumption would decrease to 34 percent. In addition, emissions from industrial processes would increase to 8 percent while emissions from the RCI sector would decrease to 5 percent.

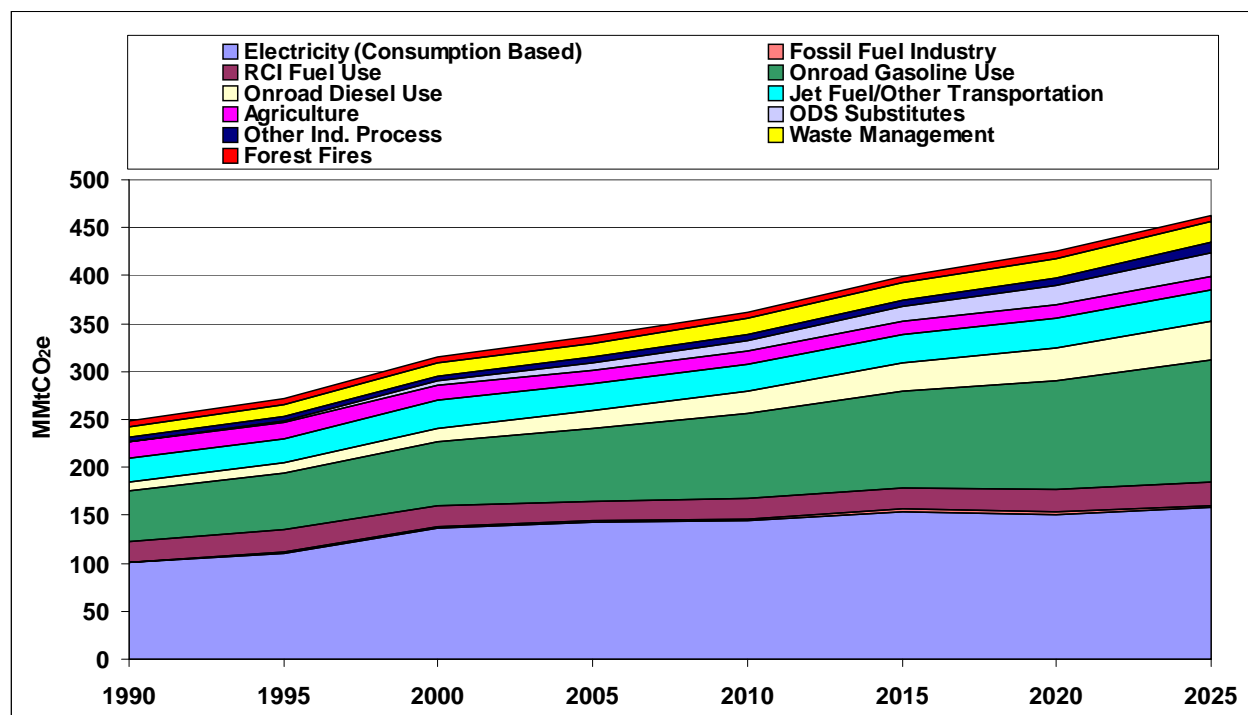
Therefore, emissions associated with the transportation sector are projected to be the largest contributor to future GHG emissions growth in Florida, followed by emissions associated with the increasing use of HFCs and PFCs as substitutes for ozone-depleting substances (ODS) in refrigeration, air conditioning, and other applications. Other sources of emissions growth include electricity consumption, as well as the waste management sector, as shown in Figure 2-4. Table 2-2 summarizes the growth rates in the Florida reference case projections.

⁷ Chlorofluorocarbons are also potent GHGs; however, they are not included in GHG estimates because of concerns related to implementation of the Montreal Protocol on Substances That Affect the Ozone Layer. See Appendix I in the Final Inventory and Projections report for Florida (http://www.flclimatechange.us/Inventory_Forecast_Report.cfm).

⁸ "Flux" refers to both emissions of CO₂ to the atmosphere and removal (carbon sinks) of CO₂ from the atmosphere.

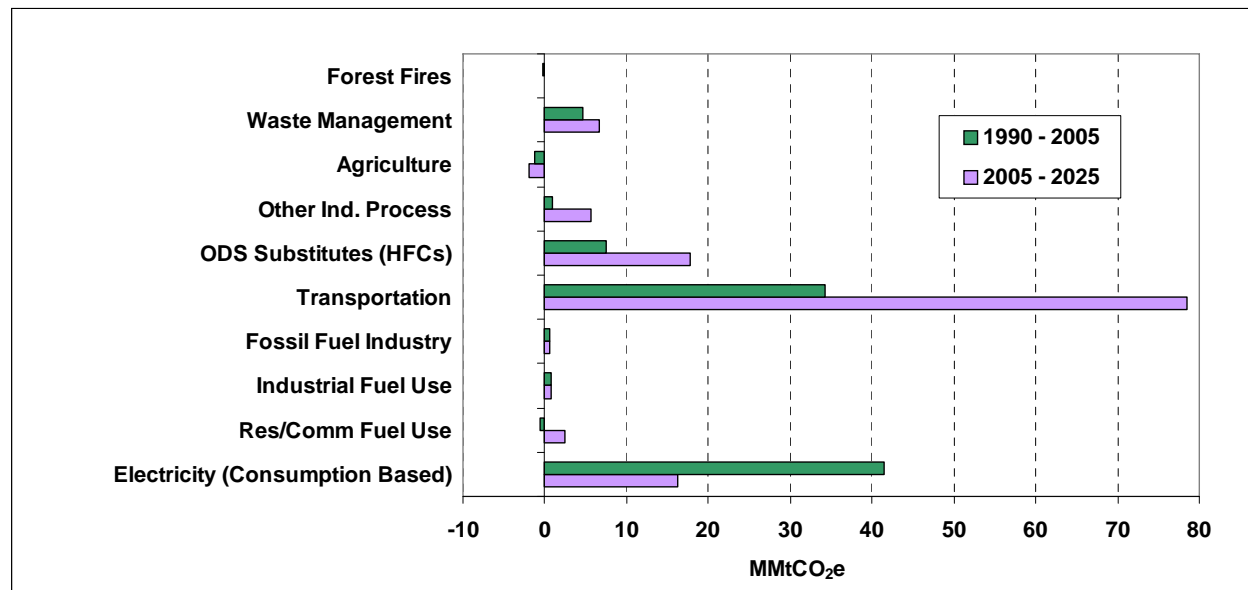
⁹ Total forested acreage is 16.3 million acres. For acreage by forest type, see: Richard A. Birdsey and George M. Lewis. "Carbon in United States Forests and Wood Products, 1987–1997: State-by-State Estimates." Florida Estimate for 1987–1997. Available from the U.S. Department of Agriculture, Forest Service, Northern Global Change Research Program, at: <http://www.fs.fed.us/ne/global/pubs/books/epa/states/FL.htm>. The total land area in Florida is 34.6 million acres (<http://www.50states.com/florida.htm>).

Figure 2-3. Florida gross GHG emissions by sector, 1990–2025: historical and projected



MMtCO₂e = million metric tons of carbon dioxide equivalent; RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone-depleting substance; Ind. = industrial.

Figure 2-4. Sector contributions to gross emissions growth in Florida, 1990–2025: reference case projections



MMtCO₂e = million metric tons of carbon dioxide equivalent; ODS = ozone-depleting substance; HFCs = hydrofluorocarbons; RCI = direct fuel use in residential, commercial, and industrial sectors.

Table 2-2. Key annual growth rates for Florida, historical and projected

	1990-2005	2005-2025	Sources
Population	2.2%	1.7%	From the Demographic Estimating Conference Database, updated August 2007. http://edr.state.fl.us/population.htm
Electricity Sales Total Sales ^a	3% (1990-1999)	2.2% (2000-2007) 1.7% (2008-2025)	For 1990-1999, annual growth rate in total electricity sales for all sectors combined in Florida calculated from EIA State Electricity Profiles (Table 8) http://www.eia.doe.gov/cneaf/electricity/st_profiles/florida.html For 2000-2007, annual growth rates are based on average growth rates in the SERC/FL and SERC NERC regions in which Florida is located, as reported by the FRCC. For 2008-2025, an annual growth rate of 1.7 percent annually was assumed, based on the recommendation of the Action Team’s Energy Supply and Demand TWG, as reviewed and accepted by the Action Team.
Vehicle Miles Traveled	4.1%	2.9%	Based on VMT projections provided by Florida Department of Transportation.

^a Represents annual growth in total sales of electricity by generators in and outside Florida to RCI sectoral demand within Florida.

A Closer Look at the Two Major Sources: Electricity Consumption and Transportation

As shown in Figure 2-2, electricity use in 2005 accounted for 42 percent of Florida’s gross GHG emissions (about 142 MMtCO₂e), which is much higher than the national share of emissions from electricity generation (34 percent). On a per capita basis, Florida’s GHG emissions from electricity consumption are slightly lower than the national average (in 2005, 7.9 tCO₂e per capita in Florida, versus 8.1 tCO₂e per capita nationally). Electricity generation in Florida comes from a diverse mix of natural gas (38 percent of Florida gross electricity production in 2005), coal (28 percent), petroleum (17 percent), and nuclear (13 percent) fuels. Florida imports 10 percent of its electricity from out of state.

As noted above, these electricity emission estimates reflect the GHG emissions associated with the electricity sources used to meet Florida's demand for electricity, corresponding to a consumption-based approach to emissions accounting. For many years, Florida power plants have produced less electricity than is consumed in the state. In 2005, for example, emissions associated with Florida’s electricity consumption (142 MMtCO₂e) were about eight MMtCO₂e higher than those associated with electricity production (134 MMtCO₂e). The higher level for consumption-based emissions reflects GHG emissions associated with net imports of electricity from coal burning generators in other states to meet Florida’s electricity demand.¹⁰ Projections of electricity sales and generation for 2005 through 2025 nominally show Florida’s imports of electricity falling to zero by 2017 as current firm import contracts expire¹¹, though it is

¹⁰ Estimating the emissions associated with electricity use requires an understanding of the electricity sources (both in-state and out-of-state) used by utilities to meet consumer demand. The current estimate reflects some very simple assumptions, as described in Appendix A of the Inventory and Projections report.

¹¹ Import trends used in the revision of the Action Team forecast of electricity sales, production, and electricity sector emissions were taken from the Florida Reliability Coordinating Council (FRCC) report "2008 Regional Load & Resource Plan", published in July, 2008. As noted above, it is recognized that though imports in the FRCC report

recognized that some of these contracts may be renewed, and that Florida will continue to import electricity for the entire period. The reference case projection assumes that production-based emissions (associated with electricity generated in-state) will increase by about 24 MMtCO_{2e} between 2005 and 2025, and consumption-based emissions (associated with electricity consumed in-state) will increase by about 16 MMtCO_{2e}, reflecting the underlying assumption that emissions from electricity imports are decreasing over this time period.

While estimates are provided for emissions from both electricity production and consumption, unless otherwise indicated, the tables, figures, and totals in this report reflect electricity consumption emissions. The consumption-based approach, which is largely unaffected by assumptions regarding power imports, better reflects the emissions (and emission reductions) associated with activities occurring in Florida, particularly with respect to electricity use (and efficiency improvements), and is particularly useful for decision-making. Under this approach, emissions associated with electricity exported to other states would need to be covered in those states' inventories in order to avoid double-counting or exclusions.

Like electricity emissions, GHG emissions from transportation fuel use have risen steadily from 1990 to 2005, at an average annual rate of 2.2 percent. In 2005, gasoline-powered on-road vehicles accounted for about 63 percent of transportation GHG emissions; on-road diesel vehicles for 15 percent; marine vessels for 12 percent; aviation fuels for 9 percent; and rail and other sources (natural gas- and liquefied petroleum gas-fueled vehicles used in transport applications) accounted for the remaining 1 percent. As a result of Florida's population and economic growth and an increase in total vehicle miles traveled (VMT), emissions from on-road gasoline use increased at an annual rate of 2.5 percent from 1990 to 2005. Meanwhile, emissions from on-road diesel use increased by 4.3 percent per year from 1990 to 2005 suggesting an even more rapid growth in freight movement within the state. Emissions from on-road gasoline vehicles in 2025 are projected to increase by 2.6 percent annually from 2005 levels, and emissions from on-road diesel vehicles are projected to increase by 4.1 percent annually from 2005 to 2025, with total transportation emissions expected to reach 200 MMtCO_{2e} by 2025.

Action Team Revisions

The Action Team made the following revisions to the inventory and reference case projections, which explain the differences between the final Inventory and Projections report and the draft initial assessment completed in June 2008:

- *Electricity Consumption:* The electricity supply forecast was revised based on information from the Florida Reliability Coordinating Council (FRCC) forecasts, as modified based on recommendations from the Energy Supply and Demand TWG. Key revisions are:

trend to zero by the end of the FRCC planning period (2017), imports at some level are, in fact, highly likely to continue past that date.

- Florida Electricity Sales: Using TWG recommendations, sales in 2025 are 8.8 percent lower than the original (AEO2007-based) Action Team forecast, and 13.2 percent lower than the (extrapolated) FRCC forecast.
- Transmission and Distribution (T&D) losses: FRCC estimates T&D losses as a fraction of net generation increase over 2008-2013, and are substantially higher (at about 8 percent of net generation in 2013, remaining stable thereafter) than in the original Action Team forecast (based on U.S. Department of Energy *Annual Energy Outlook* figures).
- Revised estimates of electricity generation by type of generation: There is considerably more nuclear and gas-fired electricity, and considerably less coal- and oil-fired generation, than in the earlier forecast prepared for the Action Team.
- *Agriculture:*
 - A University of Florida report on soil carbon was utilized to update emissions from the cultivation of organic soils. (Original emissions were based on 1997 U.S. Department of Agriculture data.)
- *Waste Management:*
 - DEP provided supplemental landfill facilities information to update the data from the U.S. Environmental Protection Agency's Landfill Methane Outreach Program. Gaps in activity data were augmented with average values and assumptions (described in Appendix G of the Inventory and Forecast report).
 - Solid waste landfills and emissions were separated into five groups: Municipal Solid Waste (MSW) Landfill Gas-to-Energy, MSW Flared, MSW Uncontrolled, MSW Uncontrolled and Closed Over 15 Years, and Industrial Landfills.
 - Historic (2000-2005) growth in emissions from landfills were used as growth rates for projecting 2006-2025 emissions from waste landfilled.
- *Forestry and Land Use:*
 - The Agriculture, Forestry, and Waste Management TWG provided an updated U.S. Forest Service report, *Florida's Forests – 1995*, which was used to revise historic forest carbon flux values for 1987-1995 and 1995-2005.
 - Projections in forest land carbon flux (2005-2025) were originally kept at 2005 levels. The revised projections take into account annual forest area losses based on U.S. Forest Service reports: *Florida's Forests – 1995*, and *Florida's Forests - 2005*.
 - In addition to wildland fire emissions, the Florida Division of Forestry provided activity data for prescribed burning, which increased the overall emissions from forest fires. Also, forest fires emission forecasts were revised to reflect historic

average emissions; this was done due to uncertainty in future forest fire projections and wide annual fluctuations in acres of forest area burned.

Key Uncertainties

Some data gaps exist in this inventory, and particularly in the reference case projections. Key tasks for future refinement of this inventory and forecast include review and revision of key drivers (such as the transportation, electricity demand, and waste management growth rates) that will be major determinants of Florida's future GHG emissions (See Table 2-2 and Figure 2-4). These growth rates are driven by uncertain economic, demographic, and land use trends (including growth patterns and transportation system impacts), all of which deserve closer review and discussion.

Chapter 3

Energy Supply and Demand (ESD)

Overview of Sectoral Greenhouse Gas Emissions

The Energy Supply and Demand (ESD) sector includes all greenhouse gas (GHG) emissions that are associated with energy usage in the residential, commercial, and industrial (RCI) sectors, as well as emissions from the electricity supply sector. These combined sectors are responsible for the majority of Florida's GHG emissions – 53 percent of the total in 2005. The state's future trends in GHG emissions therefore will depend heavily on future activities and climate policies in the ESD arena. ESD emissions can be separated into two categories – emissions that occur as fuels are used on-site at RCI buildings and facilities, and emissions that occur at sites where electricity is produced.

Direct emissions of GHGs from the RCI sectors result principally from the on-site combustion of natural gas, oil, and coal, plus non-energy sources of GHG emissions. Some examples include carbon dioxide (CO₂) generated during cement production; the use of sulfur hexafluoride (SF₆) in the utility industry; the leakage of hydrofluorocarbons (HFCs) from refrigeration and related equipment; and the release of methane (CH₄) and nitrous oxide (N₂O) during oil and gas production and distribution. In Florida, direct emissions from RCI sectors in 2005 account for 11 percent of total GHG emissions – 6 percent from on-site combustion and 5 percent from non-energy sources.

Considering only the direct emissions that occur within buildings and industries, however, ignores the GHG emissions associated with electricity use in these facilities. Virtually all electricity sold in Florida is consumed as the result of activities in the RCI sectors. Emissions associated with producing the electricity consumed in Florida were responsible for about 42 percent of Florida's total GHG emissions in 2005. Since Florida imports almost 10 percent of its electricity from other states, the GHG emissions associated with the imported electricity are included in the accounting of Florida's total emissions.

Figure 3-1 shows GHG emissions from the ESD sectors by fuel type from 2005 through 2025, and illustrates the large fraction of emissions associated with electricity use. As described in Chapter 2, Inventory and Projections, estimates of future GHG emissions are based on projections from the Florida Reliability Coordination Council, the U.S. Energy Information Administration, and other sources. The resulting forecasts indicate that GHG emissions from the ESD sectors will increase by 24 percent from 2005 to 2025, with large increases expected from industrial process activities.

Figure 3-1 Projected ESD GHG emissions by fuel type in Florida, 2005 to 2025

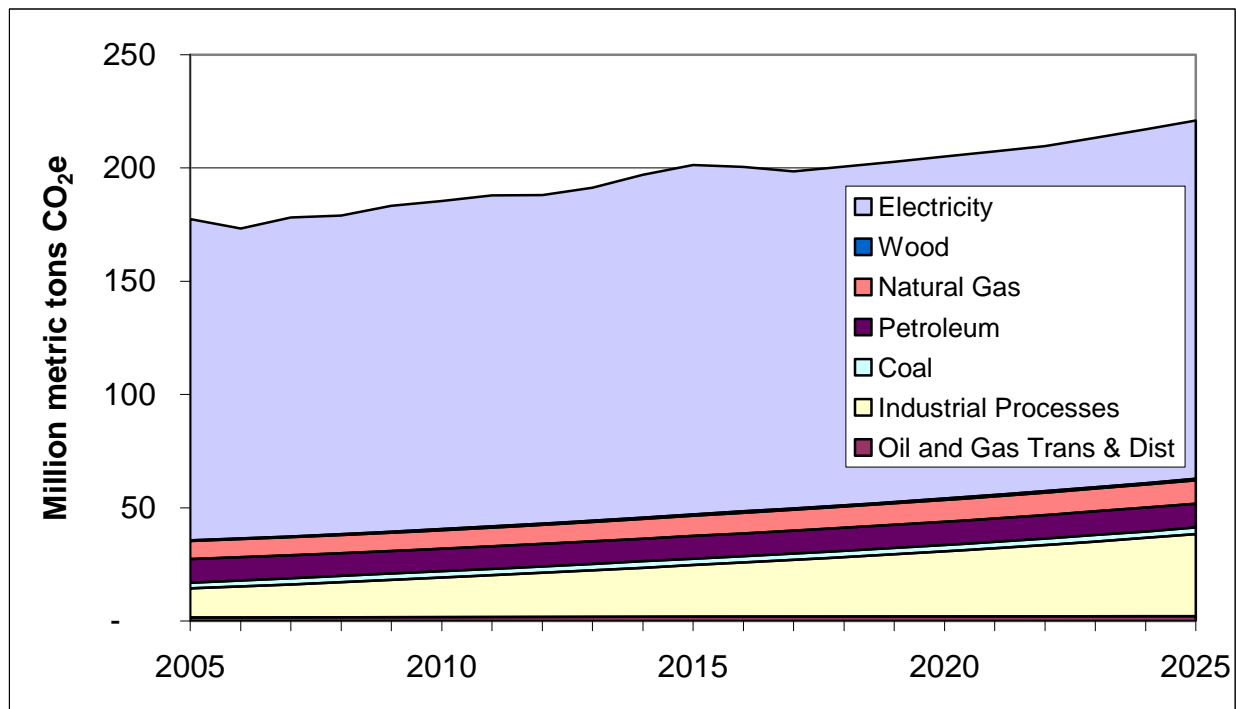
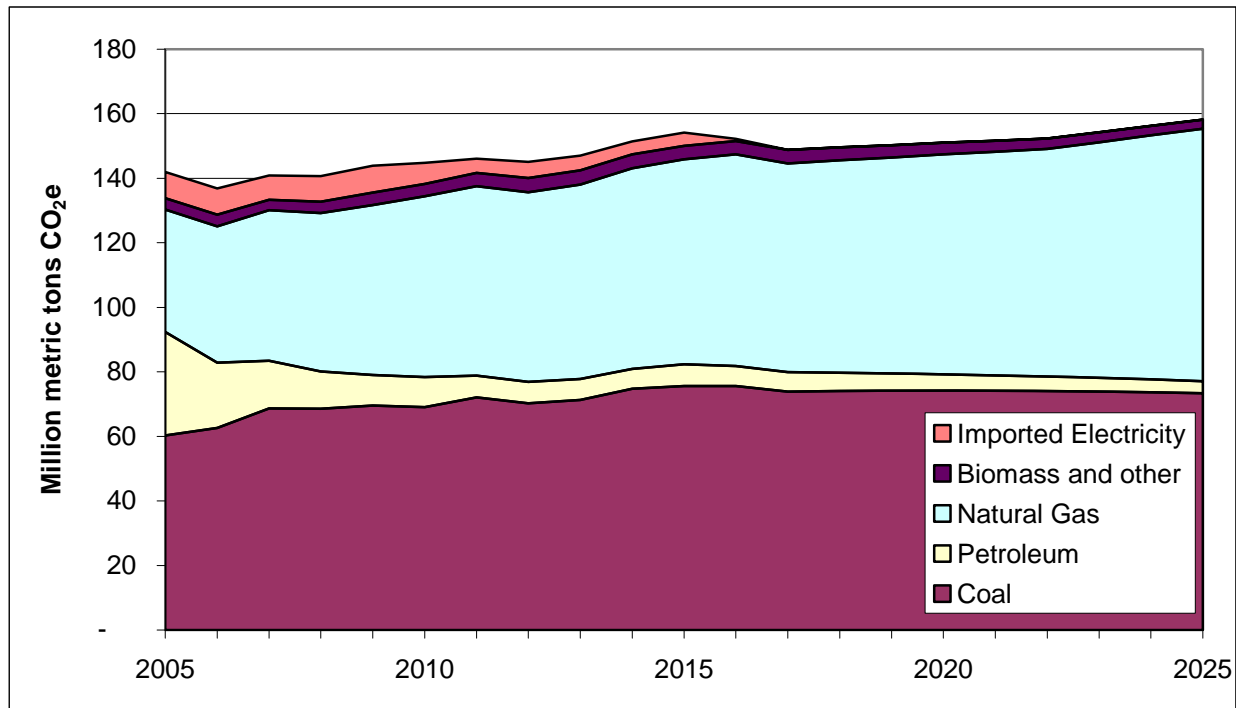


Figure 3-2 shows projected GHG emissions from electricity use in Florida. This information repeats the GHG emissions associated with electricity use in Figure 3-1, but provides additional information on the GHG emissions associated with different fuels used to produce electricity. (Nuclear and renewable power do not appear in Figure 3-2 because consumption of these resources does not directly result in GHG emissions.) As indicated, GHG emissions from electricity use increase by 11 percent from 2005 to 2025, even as electricity sales increase by 39 percent over the same time period. Florida’s electricity sector is projected to be less GHG-intensive due to a combination of more nuclear power and more efficient natural gas generation, and less coal and petroleum generation. See Chapter 2 for more information on reference case projections from the electricity sector.

Figure 3-2 Projected Electric Sector GHG emissions by fuel type in Florida, 2005 to 2025



Key Challenges and Opportunities

As shown in the above charts, Florida's GHG emissions from ESD could increase by 24 percent between now and 2025. Florida's increasing population and economic growth, combined with increases in energy consumption per person, are key drivers for this projected increase in emissions. While countering the growth in emissions from the ESD sectors is no small challenge, Florida has a number of opportunities to reduce emissions. The choice and implementation of which climate policies and supporting initiatives will be key to helping citizens and businesses take full advantage of these reduction opportunities.

The opportunities to reduce GHG emissions from ESD in Florida include improving energy efficiency in new and existing buildings and industrial facilities, using renewable resources and other low-GHG energy sources (such as solar water heating, photovoltaics, biomass, and nuclear power) to replace fossil fuels for producing electricity and heat, and increasing distributed (consumer-sited) electricity generation based on combined heat and power.

Recent actions by Governor Crist, the Florida Legislature, and all aspects of state government demonstrate a strong commitment to exploring opportunities that will reduce energy consumption and increase renewable energy supply. In 2008, the Legislature passed new

energy efficiency standards in the statewide building codes. The requirements are to be incrementally scaled up to provide a 50 percent improvement in energy efficiency by 2019, relative to the 2007 codes. In addition, Florida's Energy Efficiency and Conservation Act (FEECA) was enacted in 1980, placing an emphasis on reducing the growth rates of weather-sensitive peak demand, reducing and controlling the growth rates of electricity consumption, and reducing the consumption of scarce resources such as petroleum fuels. The Florida Public Service Commission (PSC) adopted rules requiring those electric utilities that are subject to FEECA to implement cost-effective energy efficiency programs and additional incentives for increased efficiency gains, as required by the 2008 legislation signed into law by Governor Crist.

Florida has taken a multifaceted approach to reducing barriers to renewable generation and bringing those technologies to market. For example, the PSC has approved standard offer contracts to reduce regulatory lag and negotiations between qualifying renewable facilities and utilities. In 2008, the PSC approved tariffs to implement one of the nation's most aggressive net-metering laws, intended to promote the development and interconnection of customer-owned renewable generation, such as solar photovoltaic power. The PSC is developing a rule for a Renewable Portfolio Standard (RPS), which could encourage utility-scale renewables. This rule will be presented to the Legislature in 2009.

Overview of Policy Recommendations and Estimated Impacts

The Governor's Action Team on Energy and Climate Change (Action Team) recommends a set of 19 policies for the ESD sector, offering the potential for significant GHG emission reductions. A summary of the ESD recommendations developed is shown in Table 3-1. Policies were grouped into "Tier 1" and "Tier 2" in order to focus the resources for analyzing these opportunities. Criteria for the tiers were based on the following:

- Tier 1 – recommendations which were expected to lead to significant GHG reductions by 2025 and were relatively straightforward to analyze (information readily available, similar policies had been implemented elsewhere).
- Tier 2 – policies that did not meet the criteria for Tier 1.

The Action Team noted the importance of all of the ESD policies, including both Tier 1 and Tier 2, but chose to focus quantitative analysis and subsequent recommendations (as described below) on the Tier 1 recommendations. (More information on Tier 2 options can be found in Appendix A.) Table 3-1 also includes estimated GHG reductions of recent policy actions that have been implemented by Florida. Many of Florida's recent policy actions are included in the reference case forecast. Changes to the building code, however, were quite recent, and since the impacts of those changes are not reflected in the forecast, they have been estimated for the Action Team, with the results of the analysis presented below.

Table 3-1 Summary List of Policy Recommendations

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value (See Note 2) 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Recommendation
		2017	2025	Total 2009–2025			
Tier 1							
ESD-5	Promoting Renewable Electricity through Renewable Portfolio Standard (RPS), Incentives and Barrier removal (20% by 2020)	17	34.5	319	-\$9,274	-\$29	Approved
ESD-6	Nuclear Power	0.0	7.3	49.4	\$1,782	\$36	Approved
ESD-7	Integrated Resource Planning (IRP)	Not to be quantified					Approved
ESD-8	Combined Heat and Power (CHP) Systems	1.8	2.2	26.5	\$126	\$5	Approved
ESD-9	Power Plant Efficiency Improvements	8.4	8.9	111.4	-\$1,541	-\$14	Approved
ESD-11	Landfill Gas-To-Energy (LFGTE)	3.7	8.7	64.7	\$79	\$1	Approved
ESD-12	Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity	13.0	21.8	201.4	-\$8,566	-\$43	Approved
ESD-13a	Energy Efficiency in Existing Residential Buildings	3.4	5.4	50.4	-\$1,432	-\$28	Approved
ESD-14	Improved Building Codes for Energy Efficiency	0.0	4.9	9.9	-\$265	-\$27	Approved
ESD-15	Training and Education for Building Operators and Community Association Managers	<i>Not to be quantified</i>					Approved
ESD-17	Consumer Education Programs	<i>Not to be quantified</i>					Approved
ESD-23	Decoupling	<i>Not to be quantified</i>					Approved
Recent Actions							
	Building Codes for Energy Efficiency (HB 697 and Executive Order 127)	8.0	15.4	136.5	-\$4,082	-\$30	Not applicable
Sector Totals		47.4	93.6	832.8	-\$19,090	-\$23	
Sector Totals After Adjusting for Overlaps (see Note 3)		44.4	106.4	841.3	-\$16,143	-\$19	
Reductions from Recent Actions		8.0	15.4	136.5	-\$4,082	-\$30	
Sector Totals, including recent actions and adjustment for overlaps		52.4	121.8	977.8	-\$20,226	-\$21	

Policy No.	Policy Recommendation	Energy Security Fuel Savings (Saved 2009 - 2025)		
		Coal (million short tons)	Natural gas (billion cubic feet)	Petroleum (million gallons)
Tier 1				
ESD-5	Promoting Renewable Electricity through Renewable Portfolio Standard (RPS), incentives and barrier removal (20% by 2020)	37	4,092	654
ESD-6	Nuclear Power	4	733	61
ESD-7	Integrated Resource Planning (IRP)	<i>Not quantified</i>		
ESD-8	Combined Heat and Power (CHP) Systems	5	198	431
ESD-9	Power Plant Efficiency Improvements	14	1,383	241
ESD-11	Landfill Gas-To-Energy (LFGTE)	0	27	4
ESD-12	Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity	19	2,266	326
ESD-13a	Energy Efficiency in Existing Residential Buildings	6	650	100
ESD-14	Improved Building Codes for Energy Efficiency	0	171	4
ESD-15	Training and Education for Building Operators and Community Association Managers	<i>Not quantified</i>		
ESD-17	Consumer Education Programs	<i>Not quantified</i>		
ESD-23	Decoupling	<i>Not quantified</i>		
Recent Actions				
	Building Codes for Energy Efficiency (HB 697 and Executive Order 127)	16	1,750	279
Sector Totals		85	9,520	1,822
Sector Totals After Adjusting for Overlaps (see Note 3)		172	6,394	68
Reductions from Recent Actions		16	1,750	279
Sector Totals, including recent actions and adjustment for overlaps		188	8,144	347

Policy No.	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value (See Note 2) 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Option
		2017	2025	Total 2009–2025			
Tier 2							
ESD-1	Technology Research and Development (R&D) with Commercial Opportunities	The Action Team noted the importance of all options but the focus for analysis and subsequent recommendations was on Tier 1 policies.					
ESD-4	Electricity Transmission and Distribution Improvements						
ESD-13b	Incentives for New Residential Buildings and Master Planned Communities Achieving High Energy Performance Standards						
ESD-16	More Stringent Appliance/Equipment Efficiency Standards						
ESD-18	Incentives to Promote Implementation of Customer-Sited Renewable Energy Systems						
ESD-21	Rate Structures and Technologies to Promote Reduced Greenhouse Gas (GHG) Emissions						
ESD-22	Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Natural Gas						

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent; HB = House Bill.

Note: The numbering used to denote the above pending priority policies are for reference purposes only; it does not reflect prioritization among these important policies.

Note 2: Negative numbers in the “Net Present Value” column denote recommendations for which the discounted value of the monetary **benefits** of the recommendation are greater than the discounted total **costs** of the policy.

Note 3: The emissions reduction and cost estimates shown for each individual recommendation presume that each policy is implemented alone. Many recommendations interact extensively, as they target the reduction of energy use or emissions from the same sources. Therefore, if multiple recommendations are implemented, the results will not simply be the sum of each individual recommendation result. After individual recommendation assessments were complete, a “combined policies” assessment was conducted to estimate total emission reductions, and to capture the overlaps among policies that are reported here.

These Tier 1 recommendations include efforts to increase the use of renewable and waste-based resources for generating electricity (ESD-5, ESD-11), increase the use of nuclear power (ESD-6), improve the energy and GHG emissions performance of buildings, power plants and other activities (ESD-9, ESD-12, ESD-13a, ESD-14), and increase the penetration of combined heat and power systems (ESD-8). All of these recommendations have been quantitatively analyzed, and the estimates prepared suggest that the recommendations can provide substantial reductions in

GHG emissions. Other Tier 1 recommendations include support for electric power planning requirements (Integrated Resource Planning, ESD-7) that directly considers attributes such as GHG emissions, Training and Education for Building Operators and Community Association Managers (ESD-15), Consumer Education Programs (ESD-17), and a regulatory policy recommendation (Decoupling, ESD-23) designed to reduce disincentives for investor-owned utilities to increase customers' energy efficiency. These recommendations are crucial policies that support the ESD recommendations and have been quantitatively analyzed, but have not been analyzed individually.

The ESD recommendations yield an annual GHG emissions reduction, from reference case projections, of 92 MMtCO_{2e} in 2025, and cumulative reductions of 708 MMtCO_{2e} from 2009 through 2025, at a net cost of approximately -\$16 billion through the year 2025 on a Net Present Value (NPV) basis. This result accounts for overlaps between recommendations and for the cumulative changes that the electricity savings (through efficiency) and generation, provided by the recommendations, will have on the patterns of electricity demand and supply in Florida. The weighted-average cost of saved carbon for the combination of all ESD recommendations evaluated is -\$23/tCO_{2e} avoided. The negative costs indicate that, over time, the savings from the recommendations (from energy efficiency and/or avoided use of fossil fuels) will exceed the costs of implementation.

The Action Team also analyzed the estimated impact of Florida's recent changes to its building code, as described above, which is expected to result in substantial GHG emission reductions of about 15 MMtCO_{2e} in 2025, and cumulative reductions of about 136 MMtCO_{2e} through 2025. The net cost is approximately -\$4 billion through the year 2025 on an NPV basis.

Energy Supply and Demand (ESD) Policy Descriptions for Tier 1 Recommendations

Tier 1 recommendations are described briefly below. More information on each of these recommendations, plus the Tier 2 options, can be found in Appendix A.

ESD-5. Promoting Renewable Electricity Generation through Renewable Portfolio Standard (RPS), Incentives and Barrier Removal

The fundamental policy objectives of encouraging renewable electricity generation are to reduce GHG emissions, provide fuel diversity, provide more energy security, and stimulate Florida's economy. A Renewable Portfolio Standard (RPS) sets the minimum amount of electricity from renewable sources that must be generated and supplied to the electricity grid in a given year.

This minimum requirement is applied to each utility, but provisions are often made for utilities to purchase renewable electricity or credits from other utilities.

Institutional and market barriers to the development of renewable energy include price distortions, failure of the market to value the public benefits of renewables, the social cost of fossil fuel technologies, inadequate information, institutional barriers to grid interconnection, high transaction costs due to small project size, high financing costs because of lender unfamiliarity, and perceived risk. Developing renewable energy incentives and removing market barriers can complement an RPS policy tool.

The PSC is currently engaged in rulemaking for a RPS in Florida. This rule must be presented to the Legislature in its 2009 Session for its consideration and ultimate ratification. The Action Team recommends that the policy require 20 percent of retail electricity sales be met by renewable energy by 2020.

ESD-6. Nuclear Power

Nuclear power has historically presented a low-GHG source of electricity. No new commercial reactor has come on line in the United States since 1996 due to a combination of high capital costs, the absence of an operational system for permanent disposal of nuclear waste, and perceived risks to public safety. The administration of President George W. Bush has been supportive of nuclear expansion, emphasizing its importance in maintaining a diverse energy supply and its reputation for producing electricity with negligible greenhouse gas emissions during operation. Congress also has offered significant financial subsidies for new nuclear plants in an effort to jump-start the industry, including limitations on liability for nuclear accidents.

As of 2006, nuclear power plants provided about 20 percent of electric power nationally and 14 percent of Florida's generation. The goal for this policy is the installation of two additional (relative to the reference case) reactors/units of 1,100 MW each in 2020. The reference case forecast for the electricity sector assumes the installation of the facilities and capacities that are currently planned and permitted in Florida, including a total of four 1,100 MW reactor units at the Turkey Point and Levy sites. The Action Team also recommends vigorous efforts in Florida and across the nation to continue to improve safety standards for nuclear waste material including management, security, transmittal, long-term storage, and reprocessing of spent nuclear material.

ESD-7. Integrated Resource Planning (IRP)

Integrated Resource Planning (IRP), as it relates to electric utilities, is an economic planning process designed to identify the lowest practical cost at which a utility can deliver reliable energy services to its customers. It differs from traditional resource planning (the 10-Year Planning process currently used in Florida), in that it requires the use of analytical tools that assess and compare the costs and benefits of demand and supply-side energy resources. IRP should help to identify and standardize the critical assumptions across each of the varied planning forums that drive utility resource decisions, while building in flexibility to account for future uncertainties. While originally targeted primarily toward cost-minimization, IRP processes increasingly have considered the environmental risks and the potential costs and benefits associated with future GHG regulations.

This recommendation calls on Florida to undertake an integrated resource planning regime that embraces the idea of “least cost-best fit” as its primary criterion. Depending on its design, the IRP regime in Florida could be a means of implementing many of the other ESD recommendations.

ESD-8. Combined Heat and Power (CHP) Systems

Combined heat and power (CHP) is generally considered to refer to the use of a heat engine or a power station to simultaneously generate electricity and useful heat. CHP systems reduce fossil fuel use and GHG emissions through the improved efficiency of the CHP systems, relative to separate heat and power technologies, and by avoiding transmission and distribution losses associated with moving power from central power stations located far away from where the electricity is used. For this policy, CHP is defined broadly to include large-scale projects for heat and waste heat recovery. Also, it is intended to include the potential capture of all sources of byproduct heat generation, including waste heat from exothermic reactions when sulfuric acid is produced (such as is generated in phosphate fertilizer manufacturing).

The Action Team recommends that this policy be implemented by providing financial incentives and addressing the numerous barriers to development of CHP systems, including: inadequate technical information; institutional barriers; high transaction costs due to small project size; lender unfamiliarity and perceived risk; “split incentives” between building owners and tenants; and utility-related policies, such as interconnection requirements, high standby rates, and exit fees.

ESD-9. Power Plant Efficiency Improvements

Efficiency improvements refer to increasing generation efficiency at power stations through incremental improvements at existing plants (for example, more efficient boilers and turbines, improved control systems, or the use of combined cycle technology) and/or repowering. Repowering existing plants refers to switching to lower- or zero-emitting fuels at existing plants or for new capacity additions. This includes use of biomass or natural gas in place of coal or oil, thus reducing emissions rates at existing plants.

The Action Team recommends consideration of a range of policies that would encourage efficiency improvements and repowering of existing plants by including incentives or regulations as described in other recommendations and offering additional financing opportunities for those efficiency improvements.

ESD-11. Landfill Gas-to-Energy

The capture of methane gas from landfills provides an opportunity to reduce direct emissions of methane from landfills and to produce electricity. Added policy benefits of landfill gas power plants include producing base load-like electric generation, and offering the opportunity for combined heat and power to serve nearby thermal loads.

The Action Team recommends consideration of the expansion of landfill gas-to-energy in Florida either through a mandate or an incentive program.

ESD-12. Demand-Side Management (DSM)/Energy Efficiency Programs, Funds, or Goals for Electricity

Demand Side Management (DSM)/energy efficiency programs, and funds or goals for electricity entail actions that influence the quantity and/or patterns of use of energy consumed by end users. For this recommendation, DSM refers to programs implemented by utilities with the objective of reducing electricity consumption. Historically, Florida DSM programs have focused more on peak-power demand savings than on electrical energy savings; thus, this recommendation represents a shift in the objectives, and therefore the application, of DSM by Florida utilities.

This recommendation focuses on increasing investment in electricity efficiency through programs run by utilities or others, energy efficiency funds, and energy efficiency goals. These

programs may be designed to work in tandem with other strategies that encourage efficiency gains. The policy design includes two key and linked dimensions: achievable/desirable energy savings and policy/administrative mechanisms to achieve these savings.

The Action Team recommends consideration of a range of policy and administrative mechanisms that might be applied include: regulator-verified savings targets; public benefit charges; portfolio standards; “energy trusts”; IRP as noted above; performance-based incentives; decoupling of rates and revenues; and appropriate rate treatment for efficiency. Potential mechanisms include revisions of existing statutes to enable utility investments in energy efficiency at the levels indicated above, and consideration of eligible programs that are cost-effective, taking into account the valuation of carbon dioxide emissions.

ESD-13a. Energy Efficiency in Existing Residential Buildings

With more than 50 percent of electricity in Florida used in residences, focusing attention on energy efficiency improvements to existing home structures has the potential to provide substantial reductions in electricity usage and associated GHG emissions.

The Action Team recommends consideration of a range of measures, including: incentives that focus on existing residential buildings, including low- or zero-interest energy efficiency loans; rewards for alternative business models aimed at delivering energy efficiency services; usage of energy performance benchmarks for buildings and incentives for exceeding the benchmarks; and health and safety standards that complement energy efficiency features.

ESD-14. Improved Building Codes for Energy Efficiency

Buildings are significant consumers of energy and other resources. Building energy codes can be an effective way to ensure that the most energy-efficient practices are incorporated into new or renovated buildings. This policy sets a goal for reducing building energy consumption to be achieved by increasing standards for the minimum performance of new and substantially renovated commercial and residential buildings through the adoption and enforcement of building codes. Building codes would be made more stringent via incorporation of aspects of advanced or next-generation building designs and construction standards, such as sustainable design and green building standards.

House Bills 697 and 7135 signed into law by Governor Crist in 2008 call for the energy efficiency requirements of the Florida Energy Efficiency Code to be incrementally scaled up to 50 percent higher than the 2007 code by 2019. The Action Team recommends that the scale-up of energy

efficiency requirements from House Bill 697 and House Bill 7135 be made to continue beyond 2019.

ESD-15. Training and Education for Building Operators and Community Association Managers

Energy Management Training provides administrative and technical training for energy managers, school officials, building operators, and others responsible for energy-efficient facility operation. The Action Team recommends the following:

- Train commercial building energy managers, for example, by making use of the building operator training and certification program developed in the Pacific Northwest;
- Train industrial energy and facility managers in techniques for improving the efficiency of their steam, process heat, pumping, compressed air, motors, and other systems, perhaps in collaboration with ongoing U.S. Department of Energy programs in this area; and
- Create a credentialing program for certification of “green” energy managers that requires both training and examinations to qualify.

ESD-17. Consumer Education Programs

In many cases, the ultimate effectiveness of emissions reduction activities depends on providing information and education to consumers regarding the energy usage and resulting GHG emissions implications of their choices. Public education and outreach is vital to fostering a broad awareness of climate change issues and effects (including co-benefits, such as clean air and public health) among the state's citizens. Such awareness is necessary to engage citizens in actions to reduce GHG emissions in their personal and professional lives. Public education and outreach efforts should integrate and build on existing outreach efforts involving climate change and related issues in the state. Ultimately, public education and outreach will be the foundation for the long-term success of all of the mitigation actions proposed by the Action Team, as well as those that may evolve in the future from other entities. The Action Team recommends the following measures:

- Institute mandatory labeling programs for time-of-sale energy use for all consumer products, devices, and systems (including all buildings) that can be evaluated by either testing or computer simulation, and educate consumers on the implications of these labels.
- Create a public inquiry “information center” to provide factual answers (vetted by experts in the field) to common energy-efficiency and GHG questions.

- Provide public education materials and energy information that can be used at local levels by minimally trained speakers.
- Create an awards program that recognizes businesses and individuals exhibiting exemplary behavior or performance with respect to local energy and climate public education programs or in local GHG or energy use reduction programs.
- Provide Public Service Announcement (PSA) programs.

ESD-23. Decoupling

Traditional regulatory frameworks tie a utility's recovery of fixed costs of providing service (for example, infrastructure costs) to the quantity of energy sold. As a result, there is a contrary "incentive" for utilities to increase sales in order to boost revenues and minimize investments in energy efficiency (which would lead to lower sales). This recommendation includes the implementation of cost recovery rules that "decouple" the level of utility sales from net revenues earned by investor-owned utilities. Decoupling should be geared exclusively to remove barriers to utility investment in programs to increase customer energy efficiency and reduce customer loads. Decoupling mechanisms should be carefully designed in order to avoid, as much as possible, adverse economic impacts on ratepayers and to ensure that the decoupling mechanism is fair to both consumers and shareholders.

HB 7135 directed the PSC to analyze utility revenue "decoupling" and to provide a report and recommendation to the Governor, President of the Senate, and Speaker of the House of Representatives by 2009. The PSC began its workshops on this topic in August 2008.

Chapter 4

Cap-and-Trade

Overview

A cap-and-trade system works by setting an overall limit on emissions and either selling or distributing, at no cost, emissions “allowances,” or permits to emit pollutants, to regulated entities or sources. These regulated entities must periodically surrender enough allowances to match their reported emissions or face a penalty. In a system that freely grants allowances, those sources that are able to reduce their emissions at a lower cost than the allowance price may do so and then sell those unused allowances to any entity that cannot achieve reductions as cost-effectively. In a system where allowances are initially sold, cost-effective emissions reductions reduce the number of allowances that must be purchased. Either way, cap-and-trade creates a financial incentive for emitters to continually seek out new emission-reducing technologies and cut emissions as much as possible. By creating a market for the allowances, regulated entities have the choice of either purchasing allowances or directly reducing emissions; as a result, resources are directed to the most cost-effective emissions reduction investments. To achieve overall emissions reductions over time, programs gradually lower the emissions “cap” by reducing the total number of available allowances.

Perhaps the best known example of cap-and-trade is the U.S. Environmental Protection Agency (EPA) program to cut acid rain-causing sulfur dioxide (SO₂) emissions from power plants. Established under the 1990 Clean Air Act amendments, this program successfully demonstrated the emissions trading concept by achieving dramatic, cost-effective reductions. More recently, the trading approach has been applied to greenhouse gas (GHG) emissions by the European Union (EU)¹ and proposed by several U.S.-based initiatives, including the Northeast Regional Greenhouse Gas Initiative (RGGI),² the Western Climate Initiative (WCI),³ and the Midwestern Regional Greenhouse Gas Reduction Accord.⁴

The Action Team is charged with identifying means by which Florida can fully achieve or surpass the statewide GHG reductions specified in Executive Order 07-127.⁵ These recommendations must be guided by an evaluation of the possible consequences to Florida's environment, economy, and society from global climate change. In November 2007, the Action Team issued its Phase 1 Report. The report offered broad policy guidance in key areas for consideration by the Governor and Legislature or further consideration by the Action Team, including a market-based regulatory approach for utility emissions.

¹ <http://ec.europa.eu/environment/climat/emission.htm>

² <http://www.rggi.org>

³ <http://www.westernclimateinitiative.org>

⁴ <http://www.midwesternaccord.org/>

⁵ <http://www.flclimatechange.us/ewebeditpro/items/O12F15074.pdf>

In June 2008, Governor Crist signed House Bill 7135 (HB 7135), a comprehensive energy and climate change package aimed at reducing GHG emissions that included public investment and private-market incentives in alternative and renewable energy technologies. Section 65 of HB 7135 required the Florida Department of Environmental Protection (DEP) to propose rules for the creation of a cap-and-trade regulatory program. This chapter presents the results of the Phase 2 consideration called for in the Phase 1 Report and offers pre-rulemaking guidance to the DEP in response to the requirements of HB 7135.

There is growing expectation that Congress will require a federal cap-and-trade program. By initiating, joining, or developing a state and/or regional cap-and-trade system in the meantime, Florida would be taking an important step toward influencing the outcome of the federal policy debate in the state's favor.

Ultimately the pollution-cutting performance of a cap-and-trade program depends largely on how it is structured. Key design parameters are discussed below.

The cap-and-trade policy is designed and analyzed to work in concert with non-cap-and-trade policies and measures. The integration of other policies reduces compliance costs and eases attainment of both goals and caps. Emissions reductions, costs, and cost-savings from many of these other measures help Florida comply with the cap; and they also serve as a basis for the cap-and-trade modeling. As a result, the expected operation of the cap-and-trade program is integrated with other policies and policy recommendations, and is not presented as a stand-alone program.

Policy Recommendations and Estimated Impacts

Reduction Targets and Time Frames

Table 4-1-1 shows the schedule for GHG emission reductions pursuant to Executive Order 07-127.

Table 4-1-1. Schedule for GHG emission reductions

Year	GHG Reduction Goal
2017	2000 levels
2025	1990 levels
2050	20% of 1990 levels

GHG = greenhouse gas.

Sector Coverage

The regulation of GHG emissions should be economy-wide and should commence as soon as possible; however, a cap-and-trade program may apply only to a limited number of sectors. Sector inclusion in the cap-and-trade program should be guided by cost-effectiveness, administrative efficiency, overall reduction potential, experience by other jurisdictions, and whether alternative policies are preferred. The Florida cap-and-trade program should include the electric sector at the beginning. Rulemaking consideration also should be given to:

- (1) industrial stationary source emissions;
- (2) residential and commercial fuel use;
- (3) transportation fuels; and
- (4) energy extraction, processing, and transportation.

These sectors may be better candidates for inclusion in a subsequent phase.

The transportation and residential and commercial fuel use sectors could be considered through rulemaking. They have not been included in cap-and-trade programs to date, although WCI has proposed to include them in its program beginning in 2015. Unlike the electricity, energy extraction, and industrial sectors, these two sectors would most likely have to be regulated upstream of the actual point of emissions. The regulated entity in the transportation and residential and commercial fuel use sectors may need to be the fuel distributor or importer. Transportation and residential and commercial fuel use should be studied further and considered for inclusion in a subsequent phase, or they may be better suited for regulation through non-cap-and-trade market mechanisms. While these and other sectors may not be included in the cap-and-trade program or otherwise regulated at the program start, they should be included or otherwise regulated as soon as possible.

Other sectors may need alternative methods of regulation based on the factors listed above. Land development, forestry, agriculture, and waste management are generally not regulated under a cap-and-trade program due to a lack of historical emissions data, difficulty measuring or verifying current emissions, and other reasons. Emissions reduction projects or programs within these sectors may, however, be well-suited to participate in an “offsets” program as described below.

The Action Team recommends that a *de minimis* exemption below, which sources within the regulated sectors, would be exempt from regulation. The threshold for the exemption could vary by sector.

Regional Programs

First and foremost, a strong national cap-and-trade program is the preferred method for achieving substantial reductions in GHGs, and Florida should advocate for a national program. However, as the federal government deliberates on a national program, Florida should join a regional program to advance its GHG reduction goals. Toward that end, Florida should further examine the economics of joining a regional program, but should not join a regional program where analysis indicates that Florida would be disadvantaged.

Regional Greenhouse Gas Initiative (RGGI) – Initial analysis indicates that Florida would benefit from joining RGGI. RGGI currently comprises 10 northeastern states and will regulate emissions from fossil fuel–powered electric generation units (EGUs) with a nameplate capacity of 25 megawatts (MW) or greater. Two 100 percent auction-based cap-and-trade scenarios for year 2020 are simulated for Florida joining the RGGI program.⁶ The two scenarios correspond to hypothetical allowance prices of \$7/tCO₂e and \$1/tCO₂e, respectively. Preliminary modeling indicates that Florida sources would represent slightly less than half of the total electric generation emissions from the 11 states (10 current states plus Florida), and, depending on assumptions used, would mitigate between 70 and 76 MMtCO₂e in 2020, with the balance of 75 to 80 MMtCO₂e accounted for by allowance purchases. Florida's RGGI sources would expect to see a cost-savings of between \$1.5 and \$2 billion dollars in 2020 by participating. (Note that any additional savings that might be realized from the recycling of the auction revenues by the government are not included.) Complete modeling results and analysis may be found in Appendix B: Cap-and-Trade. The Action Team recommends that Florida seek “observer status” with RGGI as soon as possible to examine the program in greater detail, closely monitor progress, and prepare for membership if it is desired.

Western Climate Initiative (WCI) – Initial analysis indicates that Florida may benefit from joining the cap-and-trade portion of WCI. Further study would be necessary to determine whether participation in the other planned WCI programs (regional low-carbon fuel standard and renewable portfolio standard) would benefit Florida. WCI is currently comprised of seven U.S. states and four Canadian provinces; its proposed cap-and-trade program will cover emissions from multiple sectors representing approximately 90 percent of total regional emissions. The cap-and-trade simulation for Florida joining WCI (based on the WCI proposed program design recommendations released September 23, 2008), covers a much broader range of emission sources than the RGGI simulation (basically all the sectors except the agriculture, forestry, and waste management sectors). The analysis indicates that Florida would be a permit seller in the market. Florida WCI sources would expect to see a cost savings of \$191 million in 2020 by participating in the cap-and-trade program as opposed to achieving the same reductions without it. Florida sources would be expected to mitigate 18.46 MMtCO₂e *more* than required to meet targets due to the relatively low cost of mitigation and the opportunity to sell

⁶ A 100 percent auction is assumed due to limitations in the model resulting from RGGI's low cost mitigation opportunities (see Annex 1 to Appendix B). As a policy matter, the Action Team is neither recommending nor assuming that Florida will use 100-percent auctions as a means of initially distributing allowances.

allowances to other WCI sources. Complete modeling results and analysis are found in Appendix B: Cap-and-Trade. Because WCI is scheduled to begin on January 1, 2012, at the earliest, there is ample opportunity to conduct further economic analysis and possibly observe the early operation of WCI.

The Action Team recommends that Florida seek “observer status” with WCI as soon as possible to examine the program in greater detail, closely monitor progress, and prepare for membership if desired.

These two regional programs may not be mutually exclusive. The Action Team further recommends that Florida explore the economics and potential obstacles, complications, and benefits associated with joining both regional programs.

Other programs – Six Midwestern states and Manitoba are currently engaged in a discussion toward the development of a third regional cap-and-trade program. Recently organized, the group expects to release a draft program design in November 2008, so the Action Team was unable to evaluate whether Florida might benefit. Florida should continue to monitor the progress of this program and investigate the Midwestern program as it develops.

At the same time, Florida should reach out to other Southern states to explore collaborating in one or more ways: (1) jointly influence the development of a national cap-and-trade program; (2) explore the potential for multiple Southern states joining one or more regional programs; (3) help address “leakage” issues (see page 4-9); and (4) explore the creation of a Southern regional climate initiative to reduce GHG emissions, stimulate the development of renewable energy sources, reduce dependence on imported fuels, and stimulate the creation of industries specializing in energy efficiency, renewable energy, and carbon mitigation technologies.

Finally, the Action Team strongly recommends that Florida not pursue a “one state” cap-and-trade program.

Caps and Goals

Florida's GHG reduction cap-and-trade program should be designed to achieve the emission reduction goals set forth in Executive Order 07-127. However, as directed in that Executive Order and the recently enacted HB 7135, Florida should evaluate the conditions under which the state could cost-effectively link its trading system to the systems of other states or regions, such as RGGI or WCI. If Florida joins a regional climate initiative, it should accept the regional goal as long as it is consistent with the state's GHG reduction goals. Current modeling indicates that RGGI should bring Florida's electric sector emissions to the state's goals; however, if it does not, additional policies and measures would be required to reduce GHG emissions to meet the state's goals.

Flexibility and Cost Containment Mechanisms

The mechanisms described below contain a brief description followed by the policy recommendation.

- *Offsets* – Regulated sources can comply with the cap-and-trade program in three ways: reduce emissions directly; acquire and surrender allowances sufficient to cover emissions; or invest in qualifying offset projects and surrender offset credits. Offset projects are voluntary and generate revenue for a project owner through the sale of offset credits, which are equivalent to government-issued allowances. Emission reductions from regulated sources are, therefore, not eligible as offset projects; otherwise these reductions would be double-counted (once for the benefit of the regulated source under the cap, and again for the benefit of the offset purchaser). To ensure the integrity of the emissions cap, offset projects should reduce emissions or sequester carbon from uncapped, out-of-sector projects that are recognized by the program as qualifying for allowance credit. In most cases, any emissions included under any cap-and-trade program's cap cannot be reduced and also qualify as an offset credit under any other cap-and-trade program. Offsets provide an incentive for low-cost investments in uncapped emission reductions as an alternative to higher-cost, in-sector reductions, or allowance purchases.

Recommendation: The cap-and-trade program should allow offsets without limits; however, the offset program must ensure rigorous quality standards.

- *Safety Valve* – A safety valve is a program feature designed to limit or moderate the cost of allowances for the purpose of ensuring that the program will not have an unacceptable impact on consumer costs. Safety valves can be as direct and simple as an allowance price cap, or as indirect and complex as the RGGI's stepped expansion of offset opportunities triggered by allowance prices⁷. The safety valve can be used in conjunction with other tools to mitigate price volatility (such as banking and borrowing). It should be noted that hitting the safety valve price cap would effectively convert the cap-and-trade program into a carbon tax at that price.

Recommendation: The cap-and-trade program needs appropriate allowance price containment mechanisms, especially in the early years. Further study is needed before the specific mechanisms can be recommended.

- *Banking* – Banking allows permit holders to withhold unneeded allowances from the market, or from surrender for emissions compliance, without expiration. A banked allowance may be used in any compliance period beyond the issuance period without penalty. Banking is seen as a means of mitigating market volatility by allowing holders to hold allowances (thereby mitigating supply) when prices are low, and to use or sell them (thereby mitigating demand) when prices are high.

⁷ The Western Climate Initiative employs banking, offsets and three-year compliance periods to mitigate allowance prices but does not have a "safety valve."

Recommendation: The cap-and-trade program should allow unlimited banking.

- *Borrowing*—Borrowing of allowances permits emitters to release excess tons of GHGs in the current compliance period in return for greater reductions in a future compliance period.

Recommendation: Borrowing is an important cost containment mechanism and should be allowed, but agreement by the Action Team was not reached on what conditions (e.g., Warner-Lieberman-type limits by emitter, time limits, or interest) should be imposed.

Allowance Distribution

One of the most difficult issues confronting cap-and-trade program designers is how allowances are initially introduced to the market. The two principal methods are free allocation and auction sale. Free allocation is the method used in the EPA SO₂ trading program and was widely used in the first two phases of the EU Emissions Trading Scheme (ETS) program. Meantime, RGGI will auction nearly all of its allowances, and the EU is gradually moving toward greater reliance on auctions.⁸ WCI is still deliberating on the issue, although it is likely that a decision on how best to distribute allowances will ultimately rest with participating jurisdictions.

Under a free allocation system, jurisdictions distribute allowances free of charge to regulated entities according to a formula based upon historical emissions, benchmarked emissions (the expected emissions per unit output for a facility with a preferred technological configuration), or on some other basis. Free allocation systems may include equity features such as a “reserve” for new market entrants, to avoid creating a competitive disadvantage. The formula that determines the number of allowances allocated to each source can be challenging to create. Historical emissions are a common approach, but issues such as selecting the time period to use as a basis and various equity adjustments can be difficult to determine. Benchmarking is straightforward in principle but very difficult to achieve in practice.

Under an auction system, allowances are presented to the market by sale at auction. Regulated entities are therefore required to purchase allowances. Revenues are collected by the issuing jurisdiction. Auctioning allowances resolves the “allocation basis” and many equity issues arising from the free allocation method but presents a new set of challenges, including the additional cost imposed on regulated entities and consumers. Emitters in some sectors are able to pass these costs on to their customers, but others are not. The cost passed along to the consumer may be a public policy concern and, in cases where competitive pressure prevents this, the economic impact on the emitter might be a concern. However, these concerns can be addressed by designing the program to be revenue neutral and returning the allowance value from the auction to consumers directly or through programs implemented for their benefit. In addition, there is the question of what the issuing jurisdiction will do with the auction revenues.

⁸ On September 25, 2008, RGGI held its first auction, where 100 percent of its allowances were successfully auctioned off at a price of \$3.07.

In the free allocation system, there is a concern regarding windfall profits, as happened in some instances in the EU. This can be an issue when the emitter is not price-regulated and can pass along the cost to customers, as can occur with generators in most of the RGGI states. However, in states where generators are price-regulated, such as Florida, through the Public Service Commission rate hearings, the value of the freely allocated allowance can be directed to the benefit of the ratepayer through rate-setting.

Free allocation and auctioning are not mutually exclusive. Programs can distribute some percentage of allowances using one method and then balance with the other. Programs may change the ratio of free allocation to auction distribution over time. Programs also may distribute allowances to different regulated sectors using different methods or a different mix of methods. Programs may even distribute allowances differently among different classes of sources within a sector (whether municipality-owned utilities, cooperative utilities, or investor-owned utilities).

The Action Team was unable to reach a consensus recommendation on the central issue of initial allowance distribution method. By a 13-5 majority,⁹ the Action Team recommends that strong consideration be given to auctioning a substantial amount of allowances. The Action Team recognizes that as RGGI and WCI evolve, additional information will become available to DEP and the Legislature to better evaluate the use of auctions at the beginning of the cap-and-trade program and over time.

Those Action Team members who were opposed to this recommendation expressed concern that there has been no Florida-specific analysis of the relative cost to the consumer for allowance distribution by either auction or free-of-charge allocation. Without such information, they argue, any recommendation stating a preference would be premature. Concerns included whether requiring some industries to pay for allowances would put them at a competitive disadvantage. Others were concerned that there was no assurance that revenues from the sale of allowances would be used by the state for related purposes such as those stated below.

Those who supported auctioning pointed out that presentations from representatives of RGGI and the EU ETS had recommended the use of auctioning. Others stated that the revenues generated by the auctions would be needed to finance other key policies and measures proposed by the Action Team. At least one member observed that given the differences among electric utilities in the state, there would be no fair way to allocate allowances among them. The member observed that the formula would likely be the subject of intense lobbying in the Legislature, and, if allowances were distributed on the basis of historical emissions, customers of utilities with historically higher electric rates and cleaner generation would be disadvantaged while those with lower rates and higher emissions would be advantaged. Supporters of the position expressed the belief that auctioning is the most fair distribution method.

⁹ The five Action Team members that voted no on this recommendation were: Mayor Rick Baker, Mike Branch, Mark Kaplan, Kathleen Shanahan and Kathy E. Viehe.

By unanimous consent, the Action Team offers the following general recommendations that could guide future policymakers in answering the question of allowance distribution:

Any allowance distribution system needs to be periodically evaluated to determine whether it is working properly and serving the program goals.

- The cap-and-trade program should strive to be revenue-neutral to consumers as much as possible. There are five broad purposes to which allowance value (either the allowances themselves or proceeds from their sale) should be applied. The purposes are not in any priority order:
 - Promote energy efficiency investments,
 - Mitigate impacts on ratepayers and consumers with particular attention to low-income consumers,
 - Accelerate the development and use of emissions mitigation technologies, including renewable or zero-carbon technologies,
 - Mitigate impacts of climate change (for example, fund adaptation strategies), and
 - Protect regulated emitters from competitive disadvantage.

There are a number of other important uses of allowance value which should also be considered, such as stimulating or rewarding investment in carbon emissions abatement technologies, funding program administration, and protecting regulated emitters from economic disadvantage. One member felt strongly that all allowance value should be used to mitigate the program's impact on ratepayers and consumers.

It is the Action Team's strong recommendation that if any revenues are generated from the sale of allowances, they should never be used to supplement General Revenue to the State of Florida.

Reporting

The cap-and-trade reporting system should be consistent with any national requirement. Every effort should be made to ensure that regulated entities are required to complete only one report for both state and national efforts. The reporting system should be as broad as possible; a *de minimis* limit may be needed, given administrative and cost concerns.

Mandatory reporting of GHG emissions is legislatively required at both the state and federal levels. Adoption of reporting rules and collection of emissions data should proceed as quickly as possible in advance of the cap-and-trade program. This is necessary to verify the data from sources and sectors where the historical lack of such requirements injects a significant level of uncertainty into historical emissions estimates and future projections.

Leakage

Leakage occurs when, in response to program incentives, utilities choose to either increase out-of-region fossil-based power purchases, or investors choose to construct new generation units in unregulated border jurisdictions. In either case, both the environmental benefits and in-state investment are lost. It is noted that in a national program, leakage is not an issue. Leakage can be addressed through careful design of the point-of-regulation, as in the First Jurisdiction Deliverer (FJD) plan in WCI. FJD requires compliance from any generator within the region, plus any entity that imports fossil-based power from outside the WCI region.¹⁰

Historically, between 1990 and 2005, electricity imports have contributed between 9 percent and 16 percent of total electricity consumption in Florida. Accordingly, it is critical that the cap-and-trade program baseline include these out-of-state sources and their respective changes over time to accurately define the reduction requirements under the current generation mix.

The Action Team believes leakage is a potentially serious concern. Based on the initial analysis, projected 2020 “business as usual” GHG emissions from imports represent 10 percent of total electricity emissions, or 19.2 million metric tons of carbon dioxide equivalent (MMtCO₂e). This amount is equal to about one-third of the total electric utility sector emissions reductions required by 2020 to meet the Governor’s GHG reduction goals. Further, electricity imports and their associated GHG emissions are expected to increase if Florida’s electricity generation sector is subject to a carbon cap and if generation in adjacent states was not subject to a similar requirement.

The Action Team recommends that leakage must be addressed by any cap-and-trade program or by Florida through other means if a regional cap-and-trade program does not do so.

Trial Period

The first recommendation in Regional Programs is that there should be a strong federal cap-and-trade program and that Florida should be an advocate for national action. It is recommended that a new national program should incorporate a trial period to facilitate the transition, verify data, and sort out administrative and other details. The trial period should afford greater flexibility to the regulated community than would be otherwise allowed, but it should nonetheless impose enforceable, binding compliance obligations on regulated sources.

The second recommendation under Regional Programs is that Florida should join one or more regional programs. The issue of a trial period in these cases is a matter of regional agreement. Florida should support the trial period requirements of any regional program it might seek to join.

¹⁰ RGGI does not address the issue of leakage within the program design. RGGI recognizes the issue and will monitor inter-regional contracts and purchases to assess whether leakage is occurring. RGGI has indicated that if leakage proves to be a serious issue, action will be taken to address it.

Chapter 5

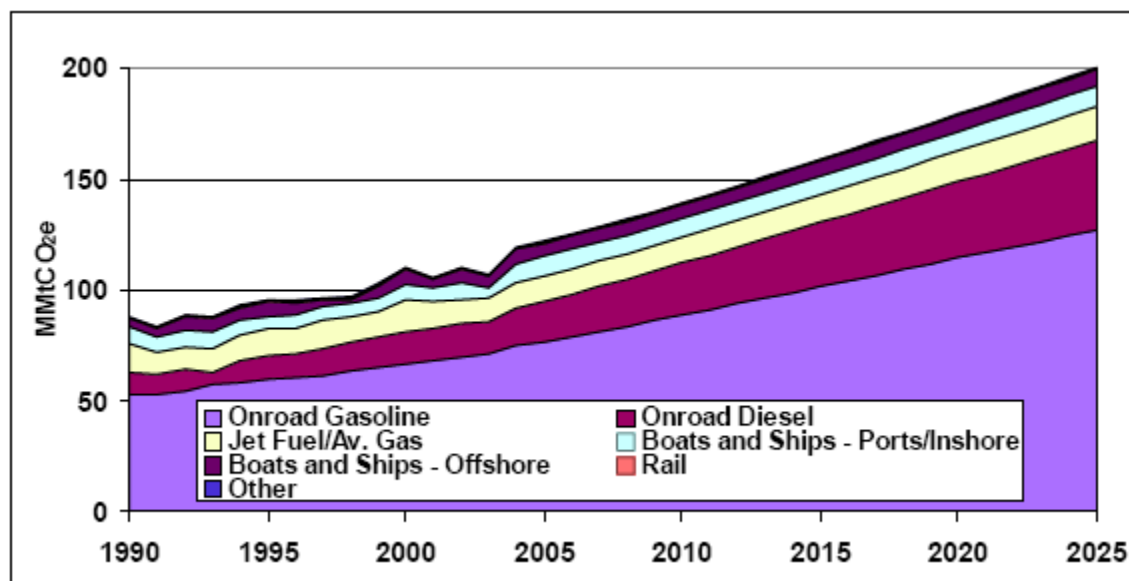
Transportation and Land Use Sectors

Overview of Greenhouse Gas Emissions

The transportation sector is the second-largest contributor to Florida’s gross greenhouse gas (GHG) emissions. In 2005, the sector accounted for 36 percent, or about 122 million metric tons of carbon dioxide equivalent (MMtCO_{2e}), of Florida’s gross GHG emissions. Emissions from the sector increased by 34 MMtCO_{2e} between 1990 and 2005. Transportation’s share of total GHG emissions has increased slightly over this period, accounting for about 41 percent of the state’s net growth in gross GHG emissions.

Figure 5-1 and Table 5-1 show historic and projected transportation GHG emissions by fuel and source. As shown in the figure and table, on-road gasoline vehicles account for the largest share of transportation emissions—about 63 percent in 2005. On-road diesel vehicles account for another 15 percent of emissions, and marine vessels account for roughly 12 percent. Air travel, rail, and other sources produce the remaining emissions.

Figure 5-1. Transportation Gross GHG Emissions by Fuel, 1990–2025



Source: Florida Inventory and Reference Case Projection, October 2008.

Table 5-1. Historic and Projected Gross GHG Emissions from Transportation (MMtCO_{2e})

Source	1990	1995	2000	2005	2010	2015	2020	2025
Onroad Gasoline	52.89	59.46	66.64	76.22	88.70	101.50	114.30	126.68
<i>Automobiles</i>	34.14	33.88	37.03	41.24	48.59	56.05	63.38	70.36
<i>Light-Duty Trucks</i>	17.03	23.80	27.86	33.06	38.08	43.24	48.46	53.51
<i>Heavy-Duty Trucks/Buses</i>	1.64	1.68	1.64	1.80	1.90	2.05	2.28	2.60
<i>Motorcycles</i>	0.09	0.10	0.11	0.12	0.14	0.16	0.18	0.20
Onroad Diesel	9.73	11.03	13.99	18.28	23.48	28.84	34.37	40.72
<i>Automobiles</i>	0.27	0.21	0.19	0.19	0.23	0.32	0.44	0.64
<i>Light-Duty Trucks</i>	0.44	0.62	0.84	1.00	1.33	1.81	2.50	3.60
<i>Heavy-Duty Trucks/Buses</i>	9.01	10.19	12.95	17.10	21.92	26.71	31.43	36.48
Jet Fuel/Aviation Gas	13.23	11.60	14.48	11.48	11.70	12.71	13.87	15.26
Boats and Ships - Ports/Inshore	7.19	5.97	6.96	9.01	8.08	8.45	8.83	9.21
Boats and Ships - Offshore	3.88	6.63	7.42	5.89	6.25	6.61	6.97	7.33
Rail	0.31	0.68	0.28	0.58	0.58	0.58	0.58	0.58
Other	0.39	0.37	0.41	0.38	0.41	0.44	0.46	0.49
Total	87.62	95.76	110.18	121.84	139.19	159.13	179.37	200.26

Source: Florida Inventory and Reference Case Projection, October 2008.

As a result of Florida's population and economic growth and an increase in total vehicle miles traveled (VMT), on-road gasoline consumption grew by 44 percent between 1990 and 2005. Meanwhile, on-road diesel use rose by 88 percent during that period, suggesting an even more rapid growth in freight movement within or across the state boundaries. In the absence of significant increases in vehicle fuel economy, on-road gasoline and diesel emissions are expected to continue to grow at roughly historical rates through 2025. Total transportation emissions are projected to grow by 64 percent, or 78 MMtCO_{2e}, between 2005 and 2025.

The U.S. Energy Independence and Security Act of 2007 contains a provision to increase the corporate average fuel economy (CAFE) of light-duty vehicles (passenger cars and light trucks) to 35 miles per gallon by 2020. The Inventory and Projections report does not include the CAFE or biofuels provisions (or any other provisions) of the Energy Independence and Security Act of 2007. Increases in vehicle fuel economy resulting from this Act will lead to reduced carbon dioxide (CO₂) emissions from on-road vehicles. The effect of the new CAFE standards was accounted for in the estimates of GHG reductions from the various Transportation and Land Use (TLU) sector policy recommendations from the Technical Working Group discussed below.

Key Challenges and Opportunities

Florida has substantial opportunities to reduce GHG emissions from transportation sources. The principal means to reduce GHG emissions in TLU are:

- Improving vehicle fuel efficiency;
- Substituting gasoline and diesel with lower-emission fuels; and
- Reducing total VMT.

In Florida and in the nation as a whole, vehicle fuel efficiency has improved little since the late 1980s, yet many studies have documented the potential for substantial increases in efficiency while maintaining vehicle size and performance. Automobile manufacturers typically oppose dramatic increases in fuel economy. Key points of contention include the cost to manufacturers and the cost to consumers. Even with the adoption of the new federal CAFE requirements, there still may be opportunities for further increases in fuel efficiency while maintaining vehicle size and performance.

The use of fuels with lower per-mile GHG emissions could achieve larger market penetration in Florida. Conventional gasoline- and diesel-fired vehicles can use low-level blends of biofuels. Alternative-technology vehicles can also use higher-level blends, as well as other types of alternative fuels, such as natural gas and hydrogen. The type of fuel used is a crucial determinant of impact on GHG emissions, as some alternative fuels have relatively little GHG benefit. Alternative fuels from biomass, cellulosic residues, and energy crops have been identified by the U.S. Department of Agriculture (USDA) and the U.S. Department of Energy (US DOE) as the best near-term opportunity to reduce oil dependence and GHG emissions.

Key determinants of the possible impact to GHG emissions will be the development and deployment of fuel types. At present, fuel distribution infrastructure is a constraining factor. Existing federal legislation and the 2006 Florida Energy Act provide incentives in the form of corporate income tax credits and sales tax credits for investments in the production, storage, and distribution of biodiesel and ethanol. However, the Florida tax credits “sunset” on June 30, 2010, and are subject to relatively low statewide caps on the amount of credits allowable.

Reducing VMT is crucial to mitigating GHG emissions from the transportation sector. Developing smarter land-use and transportation development patterns that reduce trip length and support transit, ridesharing, biking, and walking can contribute substantially to this goal. A variety of pricing policies and incentive packages can also help to reduce VMT. Developing better planning methods and regulations, and increasing funding of multiple modes of transportation, will be key components in achieving these goals.

Overview of Policy Recommendations and Estimated Impacts

The Florida Governor's Action Team on Energy and Climate Change (Action Team) recommends a set of seven policies for the TLU sector that offer the potential for major economic benefits and emission decreases. Implementing these policy recommendations could lead to emission reductions of:

- 12.73 MMtCO_{2e} annual reductions in 2025, and
- 57.53 MMtCO_{2e} cumulative savings from 2009 through 2025.

The weighted-average cost of the recommended policies is -\$86/MtCO_{2e}, for the policies where cost was quantified. This average value includes policies where individual cost-effectiveness ranges from a net savings of about \$142/MtCO_{2e} to a cost of \$2/MtCO_{2e}. The estimated impacts of the individual policies are shown in Table 5-2.

The policies recommended by the Action Team are described briefly here and in more detail in Appendix C of this report. As stated earlier, the recommendations not only could result in significant GHG emission reductions, but offer a host of additional benefits as well. These benefits include reduced local air pollution, more livable/healthier communities, and economic development and job growth from in-state biofuels production. To yield the levels of savings described here, the recommended policies need to be implemented in a timely, aggressive, and thorough manner.

Low-GHG fuels (TLU-1) and improved transportation system management (TLU-4) are important components of the recommended policies. Transportation fuel providers would need to undertake changes in their production and distribution methods in order to achieve the goals set out in TLU-1. There is feasibility issues associated with transporting large volumes of biofuels to and within the state, as well as distributing biofuels to consumers. For example, ethanol has historically not been moved in the pipeline network used to transport gasoline and diesel fuel. The pipeline industry is currently in the process of adapting technology for pipeline distribution of ethanol. To achieve the goals of TLU-1, the challenges of production and distribution of low-GHG fuels will need to be addressed through this and other means.

TLU-4, taken in concert with other aggressive transportation and land use policy actions, could result in significant reductions to VMT on the order of 7-10 percent in urban areas by 2020. Vehicle hours of travel (VHT) can be reduced by amounts that are associated with these VMT reductions. VHT reduction is recognized as a means of reducing driver delay while reducing fuel consumption in congested traffic.

Several other policies would work with TLU-4, and with each other, to further reduce VMT by increasing the viability of multiple modes of travel and providing incentives to use modes other than single-occupant vehicles (SOVs); these are Smart Growth Planning (TLU-3), and Increasing Choices in Modes of Transportation and Factoring GHG Emissions into TLU Planning Processes (TLU-5 & 6). Smart-growth policies are being considered and implemented around the country in a wide range of communities. Because most policies are deregulatory in nature, this significantly lowers political barriers. However, these policies will face several challenges. They require closer coordination between state government, local government, and businesses in many cases. The availability of funding for the provision of additional transit services is uncertain. Also, patterns of development are subject to economic cycles and many private investment decisions. Yet implementation of these policies is essential to make travel by walking, biking, and transit more feasible. Together these policies address the built environment, transportation infrastructure, and the behavior of individuals to reduce per capita VMT.

Table 5-2. Summary of TLU Policy Recommendations

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effective-ness (\$/tCO ₂ e)	Energy Security Fuel Savings (Gallons Saved 2009–2025) (million gallons)	Level of Support
		2017	2025	Total 2009–2025				
TLU-1	Develop and Expand Low-GHG Fuels	6.20	12.62	106.41	–\$15,161	–\$142	37,290	Approved
TLU-2	Low Rolling Resistance Tires and Other Add-On Technologies	0.80	1.84	13.99	–\$1,259	–\$90	1,665	Approved
TLU-3	Smart Growth Planning	Not Quantified Separately; Included in Other Analyses						Approved
TLU-4	Improving Transportation System Management (TSM)	3.94	6.98	63.91	–\$5,106	–\$80	7,858	Approved
TLU-5&6	Land Use Planning Processes and Increasing Choices in Modes of Transportation	1.77	3.54	28.29	NQ	NQ	3,200	Approved
TLU-7	Incentive Programs for Increased Vehicle Fleet Efficiency	0.84	1.56	13.14	NQ	NQ	1,564	Approved
TLU-8	Increasing Freight Movement Efficiencies	0.59	1.10	11.52	\$21	\$2	1,302	Approved
	Sector Totals	14.14	27.64	237.26	–\$21,505	–\$91	52,879	
	Sector Total After Adjusting for Overlaps	12.73	25.14	214.35	–\$18,400	–\$86	48,786	
	Reductions from Recent Actions	17.68	32.39	284.00				
	Sector Total Plus Recent Actions	30.41	57.53	498.35				

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Note: The numbering used to denote the above recommended priority policy recommendations is for reference purposes only; it does not reflect prioritization among these important recommended policies.

Florida is currently pursuing adoption of the California Clean Car standards which would increase fuel economy standards beyond those set by the new Federal CAFE standards. Because these standards are a part of the Florida Department of Environmental Protection (DEP) rulemaking process, they are not included as one of the TLU policy recommendations. The Clean Car standards must clear several hurdles before Florida or any other state can adopt them, including U.S. Environmental Protection Agency (EPA) approval of the original California Clean Car standards (that other states can then opt into). If for any reason the Florida Department of Environmental Protection (DEP) is not able to implement the Clean Car standards, other technology-based policy recommendations could play a larger role. For example, Incentive Programs for Increased Vehicle Fleet Efficiency (TLU-7) encourages

consumers to buy the most efficient vehicles available on the market. Low Rolling Resistance Tires and Other Add-On Technologies (TLU-2) can improve vehicle fuel economy through vehicle operation and maintenance practices. Other policies, such as Increasing Freight Movement Efficiencies (TLU-8), can promote technological improvements in the heavy-duty vehicle fleet.

Transportation and Land Use Policy Descriptions

The policy recommendations described briefly here could not only result in significant GHG emission reductions and cost savings but also offer a host of additional benefits, such as reduced local air pollution; more livable/healthier communities; and increased transportation choices. Appendix C of this report discusses these policies in more detail.

TLU-1. Develop and Expand Low-GHG Fuels

This recommendation seeks to reduce GHG emissions by decreasing the carbon intensity of vehicle fuels sold in Florida. A low-carbon fuel standard would require all fuel providers in Florida to ensure that the mix of fuel they sell into the Florida market meets, on average, a declining standard for GHG emissions measured in carbon dioxide equivalent (CO_{2e}) per unit of fuel energy. The state should develop, with industry and stakeholder input, a set of standards for low-carbon fuels, which include biodiesel, cellulosic ethanol, hydrogen, compressed natural gas, liquefied petroleum gas, electricity, and low-carbon ethanol blends such as E10 or E85. The standard would be measured on a life cycle basis in order to include all emissions from fuel production to consumption.

Fuel providers (defined as refiners, importers, and blenders of on-road vehicle fuels) will need to report on an annual basis that the fuel mixtures they provide to the market meet the low-carbon fuel standard. Fuel retailers should be encouraged to provide this information to consumers at the point of sale to the extent information is available.

TLU-2. Low Rolling Resistance Tires and Other Add-On Technologies

The goal of this policy is to improve the fuel economy of the light-duty vehicle (LDV) fleet by reducing the rolling resistance of replacement tires without reducing tire lifetime or otherwise increasing the lifecycle carbon footprint of the tires. There are three avenues by which the rolling resistance of tires may be reduced, and fuel economy improved as a result:

- Consumers could purchase more tires currently available that have lower rolling resistance.

- Tire designs could be modified and new technologies could be introduced to reduce rolling resistance.
- Vehicle operations could be improved, especially through improved maintenance of tire inflation.

Currently, tire manufacturers and retailers are not required to provide information about the fuel efficiency of replacement tires. In addition, there is no current minimum standard for fuel efficiency that all replacement tires must meet. State policy and action can help bridge this gap through a variety of mechanisms. The state could set minimum energy efficiency standards for replacement tires and require that greater information about Low Rolling Resistance replacement tires be made available to consumers at the point of sale. Information also can be provided to consumers about fuel efficiency and cost in relation to the purchase, maintenance, and operation of their vehicles. The state could encourage or provide information about complementary add-on technologies that could facilitate vehicle operation practices which improve fuel efficiency. One example is devices such as the Air Alert Valve Caps, which alert vehicle owners when tire pressure is too low.

TLU-3. Smart-Growth Planning

Smart-growth planning looks at how land use planning, site planning, and urban design at the community level can help achieve carbon and GHG emission reduction goals. The essence and intention of smart growth within the context of climate change is to establish a policy framework, clear guidelines, and measurement parameters for the development of new (and the redevelopment of older) communities that will have a net-zero-carbon effect on the general environment and reduce overall GHG emissions. This can be accomplished through the complex interactions of the three primary elements of community development that have a direct impact on GHG emissions and affect climate change:

- Construction energy and building lifetime energy use as measured by the protocols of Leadership in Energy and Environmental Design (LEED™) Green Building Rating System, Green Globes, or the Florida Green Building Coalition (FGBC);
- Individual VMT generation and other transportation energy use (such as deliveries, maintenance, buses, security, health, fire, and safety) necessary to support human communities; and
- The changing of land uses from carbon-sequestering land uses (such as forests, agriculture, parks, and wetlands) to carbon-releasing land uses (such as building sites and roadways) and development patterns.

This policy aims to bring about reductions in GHG emissions through smart-growth planning. The state could achieve this by providing incentives and promoting redevelopment projects that establish more energy-efficient land use patterns. Any redevelopment project should consider the 10 principles of smart-growth in land use planning¹. The 10 principles are as follows:

- 1) Create a range of housing opportunities and choices;
- 2) Create walkable neighborhoods and communities;
- 3) Encourage community and stakeholder collaboration and cooperation;
- 4) Foster distinctive and attractive communities with a strong sense of place;
- 5) Make development decisions that are predictable, fair, and cost-effective;
- 6) Mix the land use;
- 7) Preserve open space, farmland, natural beauty, and critical environment areas;
- 8) Provide a variety of transportation choices;
- 9) Strengthen and direct development toward existing communities; and
- 10) Take advantage of compact building design.

The state also could maximize opportunities to retrofit existing buildings to meet LEED, Green Globes, FGBC, or other approved certification programs that reduce energy consumption and thus reduce GHG emissions.

¹ Smart Growth Online. <http://www.smartgrowth.org>

TLU-4. Improving Transportation System Management (TSM)

Transportation System Management (TSM) is the concept of pairing transportation demand with transportation supply to help transportation networks serve the demand in an effective and efficient manner. Effective system management may utilize a variety of strategies based on advanced technologies, market-based incentives, regulations, and design standards. Each strategy provides a relatively small benefit to GHG reduction, but when applied in concert, substantial gains can be achieved.

TSM strategies attempt to reduce the number of trips being taken by SOVs, shorten trip lengths, reduce vehicle delay, increase the reliability of the transportation network, and reduce idling and other transportation actions that result in increased GHG emissions. The goal of TSM is to reduce the daily VMT per capita on the transportation network. Effective TSM also will reduce VHT per capita, which measures the amount of traffic congestion delay. Reduction of either VMT or VHT is highly correlated with a reduction in GHG emission.

The state could develop and implement a variety of policies and strategies to reduce GHG emissions through TSM. These policies and strategies could include program funding, financial and development incentives, infrastructure investment, and regulatory requirements to promote transportation system management improvements that result in reduced VMT and/or VHT which, in turn, result in reduced GHG emissions. These actions, taken in concert with other aggressive transportation and land use policy actions, should be designed to reduce urban area VMT by 7-10 percent by 2020 and by 9 - 12 percent by 2050; VHT can be reduced by amounts that are associated with these VMT reductions. VHT reduction is recognized as a means of reducing driver delay while reducing fuel consumption in congested traffic.

TLU-5 & 6. Land Use Planning Processes and Increasing Choices in Modes of Transportation

TLU 5 & 6 were combined by the Action Team after it was determined that it was difficult to accurately quantify and compare the cost per ton of CO₂ reductions of transit and rail versus other modes of transportation. The Action Team expressed concern that this quantification might discourage the selection of transit and/or rail as a strategy for the reduction of GHG emissions. The Action Team concluded that transit and rail are important GHG reduction strategies that should be implemented despite high infrastructure costs. This policy seeks to ensure that local and state land use and transportation planning consider the impact of land use and transportation decisions on the reduction of GHG emissions. This policy also aims to double transit ridership; to increase the percentage of people that walk, bicycle, carpool, vanpool, or telecommute; and to develop and implement policies and strategies that include program funding and financial incentives that expand non-automobile infrastructure and provide modal alternatives to SOV travel.

TLU-7. Incentive Programs for Increased Vehicle Fleet Efficiency

Florida can reduce its GHG emissions by improving the fuel economy of the LDV fleet. This recommendation includes several policies and programs to encourage the purchase of low-GHG-emission vehicles through monetary and convenience rewards and incentives throughout the state:

- Tax credits for efficient vehicles.
- Incentive programs for major corporate fleet owners, including rental car and taxi cab companies.
- CO₂-based registration fees and vehicle licensing fees.
- Procurement of efficient fleet vehicles (public, private, or other).
- Study of "feebates."
- Operating incentives for low-GHG vehicles.
- CO₂-based excise taxes.

- CO₂-based product labeling.

TLU-8. Increasing Freight Movement Efficiencies

This policy recommendation aims to reduce the trucking industry's carbon footprint and GHG emissions, while maintaining the current level of service to the state and nation, and encouraging the development and expansion of intermodal and long-distance rail capacity to support both local and transcontinental rail service into and out of Florida. The U.S. Department of Transportation's Federal Highway Administration) lists two major categories of emissions-reducing strategies that Florida can utilize in these goals:

- Technical strategies, which modify a piece of equipment or its fuel to reduce emissions; and
- Operational strategies, which change how a piece of equipment is used, resulting in lower emissions.

Chapter 6

Agriculture, Forestry, and Waste Management

Overview

The Agriculture, Forestry, and Waste Management (AFW) sectors are responsible for moderate amounts of Florida's current greenhouse gas (GHG) emissions. The total AFW contribution to carbon dioxide equivalent (CO₂e) gross emissions in 2005 was 15 million metric tons (MMt), or about 11 percent of the state's total. The AFW contribution to net emissions in 2005 was 3 percent of the state's total, after accounting for the net sequestration of carbon in the forestry sector.

Agricultural emissions include methane (CH₄) and nitrous oxide (N₂O) emissions from enteric (intestinal) fermentation, manure management, agriculture soils, and agriculture residue burning. As shown in Figure 6-1, emissions from soil carbon losses from agricultural soils, livestock soils, manure management, enteric fermentation, and fertilizer application all make significant contributions to the sector totals. Emissions include CO₂ emissions from oxidized soil carbon, application of urea, and application of lime. Sector emissions also include nitrous oxide emissions resulting from activities that increase nitrogen in the soil, including fertilizer (synthetic, organic, and livestock) application and production of nitrogen-fixing crops (legumes), and methane emissions from rice cultivation. There is no significant agricultural burning activity in Florida; therefore, the emissions were estimated to be zero (prescribed burning is covered under the forestry sector).

In keeping with the U.S. Environmental Protection Agency's (US EPA) methods and international reporting conventions, the Inventory and Projections report covers sources of GHGs from human activities. There could be some natural sources of GHGs that are not represented in the inventory and forecast; however these are not addressed in the Governor's Action Team on Energy and Climate Change (Action Team) process. In the forestry sector, since all of the state's forests are managed in some way, all emissions are treated as "anthropogenic," or from human activities. GHG reporting conventions treat all managed forests as anthropogenic sources. Sources such as CO₂ from forest fires and decomposing biomass are captured within the inventory and forecast (as part of the carbon stock modeling performed by the U.S. Forest Service [USFS]). However, methane emissions from decomposition of organic matter/biomass in forests are not currently captured due to a lack of data. This methane is from decomposition in oxygen-free (anaerobic) areas, particularly marshes and bogs.

The CO₂ emissions occurring from the cultivation of organic soils always has been a primary contributor to the state's total agricultural GHG emissions. By 2025, the contribution from this source is estimated to be more than 70 percent of the total agricultural emissions. Methane emissions from digestive processes in ruminant animals, known as enteric fermentation, are declining due to lower animal populations; however, they are estimated to be the second-

highest contributor to agriculture sector totals in 2025 at about 13 percent. The next-highest contributor in 2025 is estimated to be livestock manure application to soils at about 6 percent.

Forestry and land use emissions refer to the net carbon dioxide (CO₂) flux¹ from forested lands in Florida, which account for about 47 percent of the state's land area. The inventory is divided into two primary subsectors: the forested landscape, and urban forestry and land use. Both subsectors capture net carbon sequestered in forest biomass, urban trees, landfills, and harvested wood products. In addition, other GHG sources such as nitrous oxide emissions from fertilizer application in urban areas and CH₄ and N₂O emissions from prescribed burns and wildfires are included.

As shown in Table 6-1, USFS data suggest that Florida's forests sequestered about 21 MMtCO_{2e} per year in 2005 (this excludes estimates of carbon flux from forest soils based on recommendations from the USFS). The negative numbers in Table 6-1 indicate a CO₂ sink rather than a source. Even after accounting for the GHG sources from urban soils and prescribed burns or wildfires, the forestry and land use sector is still estimated to have been a net GHG sink of more than 20 MMtCO_{2e} in 2005. Hence, during this period, forest carbon losses due to forest conversion, wildfire, and disease were estimated to be smaller than the CO₂ sequestered in forest carbon pools such as live trees, debris on the forest floor, and forest soils, as well as in harvested wood products (such as furniture and lumber) and the disposal into landfills of forest products. The forecast for the sector out to 2025 shows a slightly declining trend in the levels of sequestration due to losses of forested area associated with development.

Figure 6-2 shows estimated historical and projected emissions from the management and treatment of solid waste and wastewater. Emissions from waste management consist largely of CH₄ emitted from landfills, while emissions from wastewater treatment include both CH₄ and N₂O. Emissions are also included for municipal solid waste (MSW) combustion. Overall, the waste management sector accounted for about 5 percent of Florida's total gross emissions in 2005. While emissions are expected to grow significantly by 2025, the contribution to the state's total is expected to remain at about 5 percent.

The Action Team acknowledges that there are higher levels of uncertainty in the GHG emissions and forecasts in the AFW sectors compared with those in other sectors (e.g., those where emissions are tied directly to energy consumption). There is a need for continuing investment in research and measurement to refine the AFW Inventory & Forecast report (details on key uncertainties are presented in the appendices).

Opportunities for GHG mitigation in the AFW sector involve measures that can reduce emissions within the sector or reduce emissions in other sectors. Within the sector, changes in crop cultivation can reduce GHG emissions by building soil carbon (indirectly sequestering carbon from the atmosphere) or through more efficient nutrient application (reducing N₂O

¹ "Flux" refers to both emissions of CO₂ to the atmosphere and removal (sinks) of CO₂ from the atmosphere stored in plant tissue.

emissions and embedded GHG emissions within the nutrients). Reforestation projects can achieve GHG reductions by increasing the carbon sequestration capacity of the forests in Florida.

Figure 6-1. Historical and projected net GHG emissions from the Agriculture Sector, Florida, 1990–2025

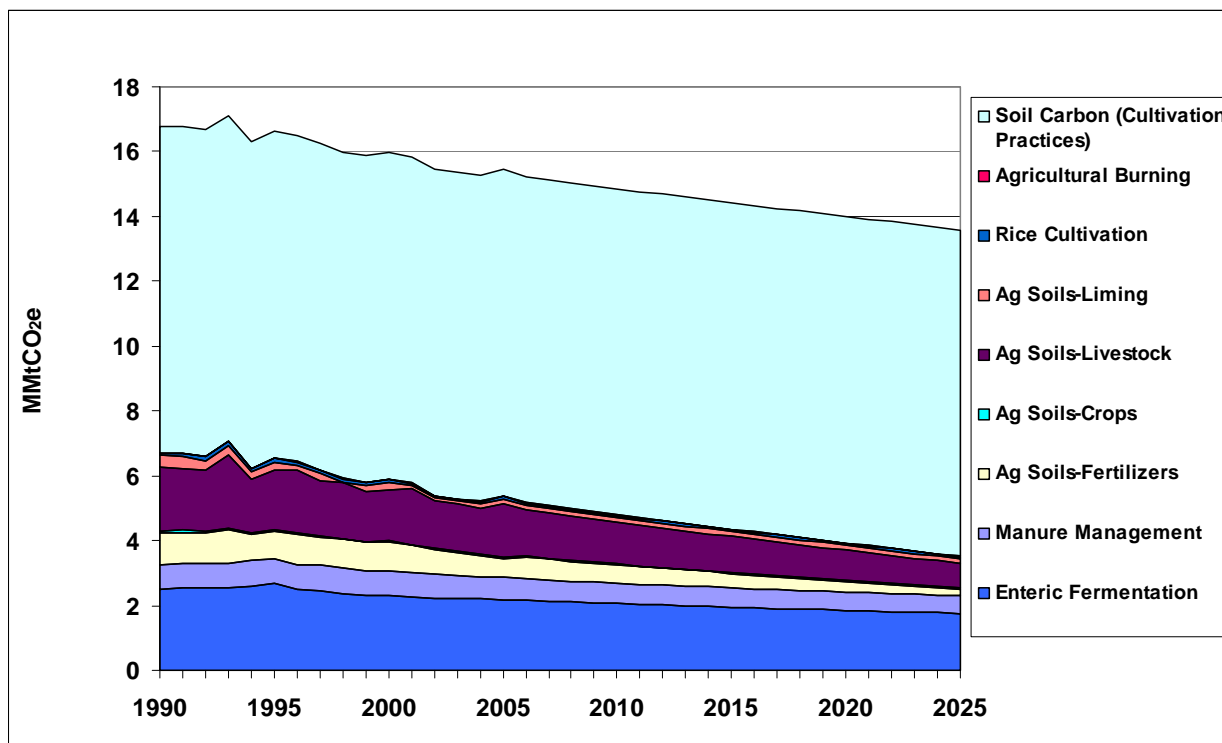
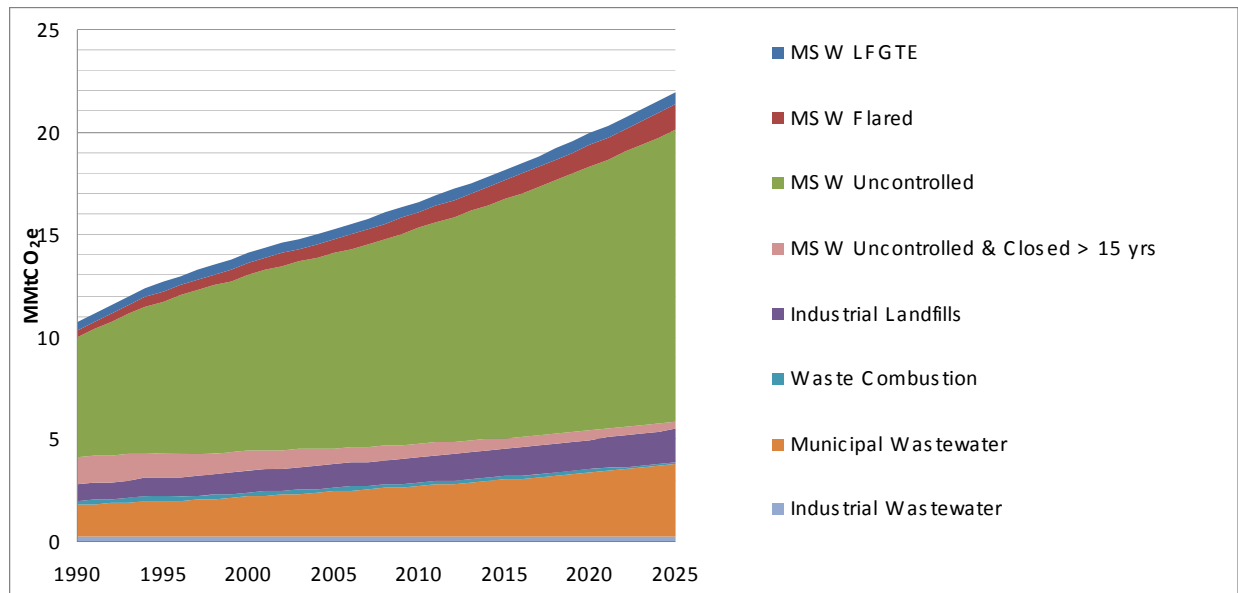


Table 6-1. GHG emissions (sinks) from the Forestry Sector

Subsector	1990	2000	2005	2010	2020	2025
Forested Landscape (excluding soil carbon)	-3.38	-21.1	-21.1	-21.0	-20.9	-20.9
Urban Forestry and Land Use	-14.4	-5.65	-6.23	-6.23	-6.23	-6.23
Forest Wildfires	1.35	1.15	0.16	1.00	1.00	1.00
Forest Prescribed Fires	5.70	4.14	6.66	5.70	5.70	5.70
Sector Total	-10.8	-21.4	-20.5	-20.5	-20.4	-20.4

* Positive numbers indicate net emission. Based on USFS input, emissions from soil organic carbon are left out of the forestry sector summary due to a high level of uncertainty.

Figure 6-2. Estimated historical and projected emissions from waste and wastewater management in Florida



MMtCO₂e = million metric tons carbon dioxide equivalent; MSW = Municipal Solid Waste; LFs = landfills; WW = wastewater.

For GHG reductions outside of the AFW sector, actions taken within the sector such as production of liquid biofuels can offset emissions in the transportation sector, while biomass used to produce electricity or steam can reduce emissions in the Energy Supply and Demand (ESD) sector. Similarly, actions that promote solid waste reduction or recycling can reduce emissions within the sector (future landfill CH₄), as well as emissions associated with the production of recycled products (recycled products often require less energy to produce than similar products from virgin materials). Finally, urban forestry projects can reduce energy consumption within buildings through shading and wind protection.

The following are primary opportunities for GHG mitigation identified by the Action Team:

- **Agricultural crop management:** Implement programs with growers to utilize cultivation practices that build soil carbon and reduce nutrient consumption. By building soil carbon, CO₂ is indirectly sequestered from the atmosphere. New technologies in the area of precision agriculture offer opportunities to reduce nutrient application and fossil fuel consumption. Improved harvesting techniques could also reduce fossil fuel consumption.
- **Agricultural land use management approaches to protect/enrich soil carbon:** Incentive programs are needed to protect crop lands from conversion to developed use or the conversion of lands in conservation programs back to conventional tillage/plowing which releases CO₂. By protecting these areas from development, the carbon in above-ground biomass and below-ground soil organic carbon can be maintained and additional emissions of CO₂e to the atmosphere can be avoided. Indirectly, these measures also support the

objectives of “smart” development by helping to direct more efficient development patterns (see Chapter 5, Policy Option TLU-3—Smart Growth Planning).

- **Production of liquid biofuels:** Production of renewable fuels, such as ethanol from crop residue, forestry biomass, or municipal solid waste, and biodiesel from waste vegetable oils can produce significant reductions when they are used to offset consumption of fossil fuels (for example, gasoline and diesel in transportation and other combustion sources). This is particularly true when these fuels are produced using processes and/or feedstocks that emit much lower GHG emissions than those from conventional sources (sometimes referred to as “advanced” or “next generation” biofuels). The goals to produce more biofuels in-state are linked to the recommendations under TLU-1 for establishing a low-carbon fuel standard and thus consuming more biofuels in-state.
- **Expanded use of forest and agricultural biomass:** Expanded use of renewable energy from biomass removed from the state’s managed forests, crop residues, lawn and garden waste, or municipal solid waste can achieve GHG benefits by offsetting fossil fuel consumption (to produce either electricity or heat/steam). Programs to expand sustainably produced biomass fuel production will likely be needed to supply a portion of the fuel mix for the renewable energy goals of ESD Policy Option ESD-5 (see Chapter 3.)
- **Enhancement/protection of forest carbon sinks:** Through a variety of programs, enhanced levels of CO₂ sequestration can be achieved and carbon stored in the state’s forest biomass. These include afforestation (establishing forests on lands that have not historically been under forest cover) projects, reforestation programs (restocking of harvested forests), urban tree programs, wildfire risk reduction, and other forest health programs. Programs aimed at reducing the conversion of forested lands to non-forest cover also will be important to retain what is currently a net forest CO₂ sink in Florida.
- **Changes in municipal solid waste (MSW) management practices:** By promoting advanced MSW practices, the “cradle to grave” GHG emissions associated with collecting, transporting, and managing MSW can be reduced. Hence, the emissions addressed here include those from both fossil fuel use and waste management (primarily landfills).

Key Challenges and Opportunities

In the agricultural sector, the Action Team found significant opportunity in promoting biofuels production using feedstocks and production methods with superior GHG benefits (superior to conventional starch-based ethanol). It should be noted that the GHG benefits did not include any indirect impacts associated with emissions resulting from land use change.² The recommendations on biofuels production were aimed primarily at production of advanced (cellulosic) biofuels. The production and use of these fuels was found to offer substantial GHG

² Recent research (e.g., Searchinger, T., et al., “Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change,” *Scienceexpress*, February 2008) has indicated that incorporating land conversion impacts into GHG analysis may remove any GHG benefits. Due to concerns and uncertainties such as these, the Action Team developed a biofuels production recommendation focused on biomass, not food crops.

reduction potential (more than eight MMtCO_{2e} by 2025; see AFW-7 in Appendix D). The Action Team quantified two separate goals associated with biofuels production and use: a primary goal of using 20 percent of available biomass to produce biofuels by 2025, and a secondary goal to produce enough biofuel in-state to offset 25 percent of the state's fossil liquid fuels consumption by 2025. Based on the available estimated biomass resources in the state, this secondary goal will be difficult to achieve without significant reductions in fossil fuel use by 2025 (for example, emphasizing the importance of TLU recommendations aimed at reducing vehicle miles traveled).

The Action Team recommendation AFW-4 promotes the expanded use of biomass as an energy source for producing electricity, heat, and steam. Use of biomass to supplant fossil fuels is estimated to reduce about 40 MMtCO_{2e} by 2025. The Action Team conducted a limited assessment of the available biomass resources in the state that indicated sufficient resources were available through 2025 to achieve the goals for both the liquid biofuels recommendation above and this biomass for energy option. However, the Action Team also recognizes the need for additional research on this issue, so that better estimates of sustainably-produced energy feedstocks are assured. As shown in Table D-1 of Appendix D, the Action Team currently estimates that the policy recommendations and business as usual biomass demand will require about 75 percent of the available biomass supply.

Related to biomass utilization for energy purposes, recommendation AFW-9 seeks to improve commercialization of technologies to utilize biomass feedstocks or to produce bio-products. These technologies could include biomass gasification of wastewater treatment plant biosolids, livestock manure, or other organic wastes for energy use and as a direct GHG reduction measure. These technologies also could include anaerobic digestion of livestock manure, or other wastes to reduce methane emissions, and then utilize the methane for energy purposes. Research and development is needed (pilot-scale projects) in addition to funding or other incentives to build commercial-scale facilities.

AFW-10 seeks to increase the production and consumption of locally-produced (state or regional) agricultural products. To the extent that this can be accomplished, overall energy consumption associated with getting food to consumers is reduced and food security in Florida is strengthened. Due to the complexities of the design considerations needed to achieve a more efficient food production system in the state and a lack of data on current food imports, this recommendation requires additional assessment.

Also, within the agriculture sector, the Action Team recommends programs to promote soil management to increase soil carbon levels, thereby indirectly sequestering carbon from the atmosphere. These programs, combined with additional measures to promote more efficient nutrient application, were estimated to achieve a reduction of more than one MMtCO_{2e} per year by 2025. Mechanisms that would assist farmers in reaching the goals of these recommendations include consideration of carbon sequestration offsets in any future cap-and-trade program in which the state participates.

Related to terrestrial carbon management, land use management approaches in the agriculture and forestry sectors are recommended to protect existing above and below ground carbon stocks and potentially enhance terrestrial sequestration in the future. By preserving agricultural and forested lands (AFW-1 and AFW-6), the Action Team estimates GHG savings in 2025 of more than one MMtCO_{2e}. To achieve these reductions, the state will need to work closely with local planning agencies, landowners, and other stakeholders to identify lands suitable for acquisition and conservation easements as well as funding mechanisms. Some of the support could come through existing state programs, such as Florida Forever. Another benefit to these options, which was not quantified, is the reduction in vehicle miles traveled due to more efficient development patterns (see TLU-3).

The estimates for GHG reductions for forest preservation above are conservatively low. The assumed losses of forest to development of about 7,400 acres per year are based on total forest area losses between 1995 and 2005 and include forest area gains that occurred as a result of land use change (such as agricultural land converted to forests). Also, due to high levels of uncertainty in existing emission estimates, the benefits estimated for AFW-1 do not include soil carbon; however, significant losses in soil carbon occur when forests are converted to developed use.

Within the forestry sector, forest management programs (AFW-2 and AFW-3) have the potential to deliver more than 24 MMtCO_{2e}/year of GHG reductions in 2025. These programs include reforestation and afforestation (see page 6-10), urban forestry, and wildfire reduction/restocking/other forest health approaches to minimize terrestrial carbon losses, while enhancing carbon sequestration. The urban forestry component also has the potential to reduce fossil fuel consumption through shading and wind protection of homes and commercial buildings.

For the urban forestry component of AFW-2, the goals are to increase canopy cover in Florida communities such that by 2025, 3 percent of total metropolitan GHG emissions will be offset through carbon sequestration and energy reductions. The recommendation includes a secondary goal to increase tree canopy cover in all developed areas with population greater than 500 residents per square mile to 30 percent by 2025.

Action Team recommendation AFW-8 seeks to reduce the “cradle to grave” GHG emissions associated with MSW management. The recommendation recognizes that a holistic approach to developing an efficient solid waste system is needed to reduce GHG emissions associated with waste collection, transport, and final management (such as landfilling). The goal of AFW-8 is to reduce these “cradle to grave” emissions by 25 percent by 2025. The Action Team recognizes that there are a number of different approaches for waste management entities to use in reducing emissions, including the use of more efficient collection and transport vehicles, use of renewable fuels, and landfill gas management (such as greater methane collection at landfills and use of advanced waste management approaches, including bioreactors). Based on the recommendation, more than four MMtCO_{2e} of GHG emissions are estimated to be reduced annually by 2025.

Overview of Policy Recommendations and Estimated Impacts

As noted above, the 10 policy recommendations for the AFW sector address an array of activities capturing emission reductions, both within and outside of the AFW sectors (such as energy consumption in the ESD and TLU sectors). Taken as a whole, the AFW recommendations offer significant cost-effective emission reductions, as shown in Table 6-2.

Table 6-2. Summary List Policy Recommendations

Option No.	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Energy Security Fuel Savings	Level of Support	
		2017	2025	Total 2009–2025					
AFW-1	Forest Retention—Reduced Conversion of Forested to Non-Forested Land Uses	0.5	0.6	7.2	\$186	\$26		Approved	
AFW-2	Afforestation and Restoration of Non-Forested Lands								
	A. Forested Landscape							Approved	
	Afforestation	1.6	3.1	28	\$134	\$4.9			
	Reforestation	6.1	11.6	104	\$555	\$5.3			
AFW-3	B. Urban Forestry	4.6	8.7	78	\$759	\$10	3.5 million short tons coal, or 76,000 cubic feet natural gas	Approved	
	Forest Management for Carbon Sequestration								
	A. Pine Plantation Management	0.5	0.9	7.9	\$84	\$11		Approved	
	B. Non-Federal Public Land Management	0.3	0.4	3.9	\$41	\$11		Approved	
AFW-4	Expanded Use of Agriculture, Forestry, and Waste Management (AFW) Biomass Feedstocks for Electricity, Heat, and Steam Production	21	40	361	\$7,432	\$21	22 million short tons coal or 486,000 cubic feet natural gas	Approved	
AFW-5	Promotion of Farming Practices That Achieve GHG Benefits								
	A. Soil Carbon Management	0.5	0.9	8.0	–\$74	–\$9	5 million gallons of diesel fuel	Approved	
	B. Land-Use Management That Promotes Permanent Cover	N/Q							Approved
	C. Nutrient Management	0.2	0.3	2.6	\$68	\$26		Approved	

Florida's Energy and Climate Change Action Plan

	D. Improved Harvesting Methods to Achieve GHG Benefits	N/Q						Approved
AFW-6	Reduce the Rate of Conversion of Agricultural Land and Open Green Space to Development	0.2	0.5	4.2	\$394	\$93		Approved
AFW-7	In-State Liquid/Gaseous Biofuels Production	4.0	8.2	68	-\$532	-\$8	4,075 million gallons gasoline and 271 million gallons diesel	Approved
AFW-8	Promotion of Advanced Municipal Solid Waste (MSW) Management Technologies (Including Bioreactor Technology)	1.9	4.4	34	\$294	\$9	190,000 short tons coal or 4,000 cubic feet NG and 109 million gallons diesel	Approved
AFW-9	Improved Commercialization of Biomass-to-Energy Conversion and Bio-Products Technologies							
	A. Manure Digestion/Other Waste Energy Utilization	0.04	0.09	0.8	-\$13	-\$17	4,500 short tons coal or 100 cubic feet natural gas	Approved
	B. WWTP Biosolids Energy Production & Other Biomass Conversion Technologies	2.4	5.0	42	\$1,848	\$44	2.5 million short tons coal or 55,000 cubic feet natural gas	Approved
	C. Bio-Products Technologies and Use	0.2	0.3	2.6	-\$161	-\$62		Approved
AFW-10	Programs to Support Local Farming/Buy Local	N/Q						Approved
	Sector Totals	44	85	752	\$11,014	\$15		
	Sector Total After Adjusting for Overlaps*	25	58	469	\$5,974	\$13		
	Reductions From Recent Actions	—	—	—	—	—		
	Sector Total Plus Recent Actions	25	58	469	\$5,974	\$13		

GHG = greenhouse gas; MMtCO_{2e} = million metric tons of carbon dioxide equivalent; \$/tCO_{2e} = dollars per metric ton of carbon dioxide equivalent; N/Q = not quantified; WWTP = wastewater treatment plant.

* See below for discussion of overlap adjustments.

Note that negative costs represent a monetary savings.

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the recommendations. Totals in some columns may not add to the totals shown due to rounding.

Agriculture, Forestry, and Waste Management Sector Policy Descriptions

The AFW sectors include emissions mitigation opportunities related to the use of biomass energy, protection and enhancement of forest and agricultural carbon sinks, control of agricultural N₂O emissions, production of renewable liquid fuels, reforestation/afforestation, and lower MSW emissions.

AFW-1 Forest Retention—Reduced Conversion of Forested to Non-Forested Land Uses

By retaining forest cover in the state, the current levels of carbon dioxide sequestration (more than 20 MMtCO₂/yr) are protected. In addition, significant losses in both above-ground carbon and soil carbon occur during conversion to developed use. The goals of this recommendation are to stabilize the state's forest base and to achieve no net loss in forested lands by 2015. The goals will need to be achieved through a variety of mechanisms, which could include additional funding to existing programs such as Florida Forever, incentives to forest landowners to retain their lands as working forests, consideration of forest management carbon offset projects in emerging cap-and-trade programs, and active engagement with non-government organizations and stakeholders to increase lands with perpetual conservation easements or acquisitions.

AFW-2 Afforestation and Restoration of Non-Forested Lands

This recommendation seeks to increase the sequestration potential of the state's forests by increasing the forest base through afforestation projects, increasing sequestration potential through reforestation (re-stocking forests), and aggressive urban tree planting programs. The urban tree element of this recommendation has an additional benefit of reducing energy demand through shading of homes and commercial buildings (producing a greater GHG benefit than the sequestration of carbon in these trees). The afforestation goal is to increase the area of forested lands in the state by 50,000 acres annually through 2025. For reforestation, the goal is to implement reforestation activity on all harvested acres by 2025. For urban forestry there are both primary (based on offsetting metropolitan GHG emissions) and secondary (tree canopy cover) goals; both of these could be met through aggressive tree planting goals of 6.7 million trees on average per year through 2025.

AFW-3 Forest Management for Carbon Sequestration

This recommendation focuses on the state's existing forested lands—both private forests and non-federal publicly-owned lands. The recommendation recognizes the significant role that Florida's forests play in lowering the state's net GHG emissions (about 20 MMtCO₂e/yr) and that management could be enhanced to achieve greater net GHG benefits. In the state's plantation forests, the 2025 goal is to increase the levels of productivity by 10 percent annually through enhanced management, thereby increasing sequestration rates and timber, pulp wood, or biomass for energy purposes. For non-federal publicly-owned forests in the state, this recommendation calls for improved management practices to be implemented on 25 percent of these lands by 2025.

AFW-4 Expanded Use of Biomass Feedstocks for Electricity, Heat, and Steam Production

This policy dedicates a sustainable quantity of biomass from agricultural crop residue, wood industry process residues, unused forestry residues, and MSW biomass resources for efficient conversion to energy and economical production of heat, steam, or electricity. This biomass should be used in an environmentally acceptable manner, considering proper facility siting and feedstock use (proximity of users to biomass, impacts on water supply and quality, control of air emissions, solid waste management, cropping management, nutrient management, soil and non-soil carbon management, and impacts on biodiversity and wildlife habitat). The objective is to create concurrent reduction of CO₂ due to displacement of fossil fuels considering life-cycle GHG emissions associated with viable collection, hauling, and energy conversion and distribution systems. The primary goal of this option is to increase the use of biomass feedstocks for energy purposes by a factor of five by 2025.

AFW-5 Promotion of Farming Practices that Achieve GHG Benefits

This recommendation addresses both agricultural soil carbon management, as well as nutrient management to achieve GHG benefits. For soil carbon management, conservation-oriented management of agricultural lands, cropping systems, crop management, and agricultural practices may regulate the net flux of CO₂ from soil. This recommendation has four separate elements:

- soil carbon management, where CO₂ reductions occur indirectly via the building of soil carbon levels;
- nutrient management, where GHG reductions occur through more efficient use of fertilizer (lowering fossil-fuel use through lower application energy requirements, as well as lifecycle GHG reductions associated with the production and transportation of fertilizers in addition to reduced nitrous oxide emissions following application);

- agricultural land conversion to reduce GHG emissions by establishing permanent cover on marginally productive lands (thereby increasing both above- and below-ground carbon stocks);
- an element covering improved harvesting methods, which seeks to produce GHG reductions through the use of more efficient harvesting technologies and practices.

AFW-6 Reduce the Rate of Conversion of Agricultural Land and Open Green Space to Development

By reducing the losses of agricultural lands and open green space, above- and below-ground carbon stocks are protected and more efficient land use is supported (as recommended in TLU-3—Smart Growth Planning). This option seeks to reduce the rates of conversion of these lands to developed use by 50 percent by 2025. Although the levels of estimated direct GHG reductions are moderate (0.5 MMtCO₂e/yr by 2025), the indirect benefits achieved through the linkage to smart growth planning and subsequent reductions in vehicle-miles traveled are expected to be substantial (see TLU Appendix C).

AFW-7 In-State Liquid/Gaseous Biofuels Production

This recommendation promotes sustainable in-state production and consumption of transportation biofuels from agriculture, forestry, and MSW feedstocks in order to displace the use of gasoline and diesel. This recommendation also promotes the in-state development of feedstocks, such as cellulosic material and production facilities to produce either liquid or gaseous biofuels with low carbon content. To achieve true gains in reducing GHGs and offsetting fossil fuel use, promoting biofuel production must be coupled with strong policies to reduce overall transportation fuel consumption. Upon successful implementation of this policy, Florida consumption of biofuels produced in-state will produce better GHG reduction benefits than these same fuels obtained from a national or international market due to lower embedded CO₂ (resulting from out-of-state fuels produced using feedstocks/production methods with lower GHG benefits, and from transportation of biodiesel, ethanol, other fuels, or their feedstocks from distant sources).

AFW-8 Promotion of Advanced Municipal Solid Waste Management Technologies (Including Bioreactor Technology)

This recommendation seeks to improve the GHG profile of MSW management in the state by promoting more efficient collection, transport, and waste management technologies and practices. There are a number of ways that the “cradle to grave” GHG profile of MSW management could be improved. The emissions include those from collection and transport of MSW and the final management of MSW, which currently occurs largely at landfills in Florida. These include more efficient collection vehicles, use of biofuels, route optimization,

management of MSW in bioreactors, more efficient landfill gas collection systems, and more efficient use of landfill methane.

AFW-9 Improved Commercialization of Biomass-to-Energy Conversion and Bio-Products Technologies

This recommendation recognizes the need for programs to “ramp up” the commercialization of promising technologies to utilize biomass for energy or to produce bio-products with lower net GHG emissions. These could be emerging technologies, including emerging biomass gasification combined cycle (BGCC) electricity production, pyrolysis, and plasma arc technologies, as well as technologies that are farther along in commercial deployment (anaerobic digestion of organic wastes). Bio-products for use as building materials or other products or bio-based chemicals have the potential for reducing the life-cycle GHG emissions associated with the bio-products’ fossil-based or higher embodied energy counterparts.

AFW-10 Programs to Support Local Farming/Buy Local

The Action Team approved this policy as a non-quantified recommendation. The recommendation seeks to enhance Florida’s food system to produce more of the agricultural products needed by the state’s consumers. When locally produced agricultural products supplant those from out-of-state or out-of-country, the embedded GHG emissions associated with transporting those items are reduced. To achieve this reduction, programs are needed to incentivize local production and consumption of fresh produce, dairy, meat, and fish. The Fresh From Florida retail campaign has achieved some success in this area in recent years through engagement with the major retail food outlets in the state. Similar programs will need to be developed and implemented. In addition, a much larger and tougher aspect of this option will be to develop new infrastructure to transport, process, package, store, and distribute locally or regionally produced food. The establishment of this enhanced infrastructure will require a significant amount of study, planning, investment, and promotion to occur.

Chapter 7

Government Policy and Coordination

Overview of Government Policy and Coordination

In Executive Order 07-128, Governor Crist directed the Action Team to develop recommendations for “strategic investments and public-private partnerships in Florida to spur economic development around climate-friendly industries and economic activity that reduces emissions in Florida” as well as “strategies and mechanisms for the long-term coordination of Florida’s public policy in the areas of economic development, university-based research and technology development, energy, environmental protection, natural resource management, growth management, transportation, and other areas as needed to assure a future of prosperity for Floridians in reducing greenhouse gas emissions.” To address this charge, the Technical Working Group (TWG) of Government Policy and Coordination was formed.

The types of policies considered for this “sector” are not as readily quantifiable in terms of greenhouse gas (GHG) reductions and cost-effectiveness calculations as other TWGs. Nonetheless, if successfully implemented, the recommendations will contribute to GHG emission reductions and enhance economic benefits associated with many other policy recommendations described in Chapters 3 through 6.

The Government Policy and Coordination TWG presented five policies that were ultimately adopted for recommendation by the Action Team. These policies are listed in Table 7-1 and fall into two categories: efforts that enable or enhance the successful implementation of policies recommended for specific sectors, and policies that foster the development and creation of technologies and businesses that mitigate GHGs and promote the creation of jobs and economic growth. Finally, the Government Policy and Coordination TWG examined the multiple planning authorities at all levels of government in Florida, and the Action Team has recommended measures to incorporate GHG considerations into government planning processes and improve coordination among entities with overlapping jurisdiction.

All five policy recommendations were adopted unanimously by the present and voting Action Team members.

Summary List of Policy Recommendations

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Status of Recommendation
		2015	2025	Total 2009–2025			
GP-1	Targets, Reporting, Funding, and Accountability Measures	<i>Not to be Quantified</i>					Approved
GP-2	Public Awareness and Education	<i>Not to be Quantified</i>					Approved
GP-3	Inter-Governmental Planning Coordination and Assistance	<i>Not to be Quantified</i>					Approved
GP-4	“Green” Business Development Policies	<i>Not to be Quantified</i>					Approved
GP-5	Introduce Core Competencies Into Professional Licensing Programs	<i>Not to be Quantified</i>					Approved

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Note: The numbering used to denote the above pending priority policy options is for reference purposes only; it does not reflect prioritization.

Key Challenges and Opportunities

One of the key challenges facing Florida is the uncertainty of future federal policy. As the state seeks to address the challenges of mitigating GHG emissions and anticipates the effects of climate change beyond the reach of achievable emissions reductions, the role that the federal government will play remains a matter of speculation. Recent actions such as those contained within the 2007 Energy Independence and Security Act provide some guidance; however, the nature, timing, and scope of more significant federal actions are not easily predicted. Of particular interest is the potential for a national market-based program limiting GHG emissions or the expansion of the Clean Air Act to incorporate GHG emissions reduction requirements.

Recent Florida actions such as the 2007 Executive Orders and House Bill 7135 passed by the 2008 Legislature put in place an array of measures to reduce emissions and build a regulatory framework for many of the policies recommended.

The Government Policy and Coordination TWG recommendations include a number of suggestions to address fragmented, overlapping, and sometimes contradictory planning and regulatory authority between levels of government and separate agencies. The success with which climate change concerns can be interwoven into planning for future land use, transportation, and water management will be critical to achieving many of the needed long-term emission reductions. Leadership by the state is critical, as demonstrated by recent executive and legislative actions and the current Action Team effort, but inter-jurisdictional cooperation is equally critical to sustain the effort in the long run.

Nearly all of the TWG's recommendations contain language speaking to the need for immediate action. Many of the recommendations address inter-jurisdictional planning and other measures that require the concurrence of entities not directly involved in the Action Team process or subject to direction from the executive branch. It is therefore expected that many of these recommendations will be implemented only through negotiation and agreement, sometimes among multiple parties, or through legislation. The potential for extended discussion and debate has caused the Action Team in some cases to cull a subset of policies and measures that could be implemented in the near-term in order to emphasize the Action Team's sense of urgency.

Overview of Policy Recommendations and Estimated Impacts

The Government Policy and Coordination TWG organized its recommendations around five major initiatives:

- targets, reporting, funding, and accountability measures;
- public awareness and education;
- inter-governmental planning coordination and assistance;
- green business development; and
- a proposal to introduce core competencies into professional licensing.

Within these five are 43 specific actions, initiatives, or programs, which, if successfully implemented, would result in the attainment of the policy goals and significantly contribute to the success of many of the recommendations.

Government Policy and Coordination-Policy Descriptions for Recommendations

GP-1 Targets, Reporting, Funding, and Accountability Measures

This policy recommends specific administrative, goal-setting, and accountability measures necessary to implement many of the policies recommended for other sectors and measure progress over time. The State of Florida is committed to significant reductions in GHG emissions and has established emissions inventory, forecasting, reporting, and registry functions in state agencies.

The following recommendations are offered as guidance on how to implement and manage these administrative, goal-setting, and accountability functions:

- (1) periodically review and revise established goals or targets for statewide GHG-emission reductions, renewable portfolio standards (RPS), and energy efficiency targets;
- (2) establish RPS and energy efficiency portfolio standard (EEPS) targets and mandatory GHG emissions reporting, inventory, and forecasting functions at state agencies;
- (3) develop an inventory and forecast system that is aligned with national protocols and tailored to specific emissions and/or "carbon sinks" found in Florida;
- (4) provide technical assistance to emissions reporters and encourage participation;
- (5) institute an accountability program to measure and report progress in reducing GHG emissions;
- (6) establish GHG reduction targets for local, state, and regional government operations and school districts;
- (7) measure and report on research and development (R&D), job creation, and new business investment resulting from related "green" economy programs and review the effectiveness of state funds used to support and/or promote those programs; and
- (8) beginning in 2010, the Florida Energy and Climate Commission (FECC) should review progress toward achieving Executive Order 07-127 GHG reduction goals, and review and affirm or propose revisions to the goals every three years, assuming the necessary resources are available to properly complete this review.

GP-2 Public Awareness and Education

Floridians "doing their part" to address climate change assumes that citizens know what can and should be done and are provided the tools and the incentives to do so. To address this need, the Action Team proposes one public awareness and education program with measures tailored to the needs of three major audiences: K-20 education; the public at large; and local, state, and regional government.

The Action Team proposes that the following programs and measures be adopted to effectively reach these audiences:

- (1) create and maintain one or more outreach coordinator positions in relevant executive agencies specifically tasked with climate change issues;
- (2) assess the level of public understanding of the impacts of climate change and of state-specific actions to deal with climate change;

- (3) create a *Florida Climate and Energy Challenge* program by June 2009 that can craft the message of how important it is for all Floridians to pitch in and reduce their energy usage;
- (4) establish a recurring awards program to recognize leadership and attainment of goals and objectives of the Florida Climate Change Action Plan;
- (5) engage and partner with the Florida business community to coordinate and leverage private sector-sponsored messages and initiatives to help implement the *Florida Climate Challenge*;
- (6) educate broadcasters, reporters, editorial boards, and others about climate change, the risks it imposes, and actions Floridians can take;
- (7) provide and advertise marketplace incentives to adopt and purchase goods with the minimum carbon footprint;
- (8) ensure performance standards for the inclusion of climate change curricula in public education (K–12), identify gaps in climate change education, and provide specific curricula to fill any gaps;
- (9) integrate best practices into public school design and construction;
- (10) organize groups of educators to identify, assemble, and employ climate change curricula appropriate to specific age groups;
- (11) integrate climate change into core college curricula, promote research into climate change and solutions at state universities, and develop university Centers of Excellence on climate issues, new approaches, and technologies;
- (12) develop assessment tools to determine the impact of climate change curricula; and
- (13) include climate change discussions especially at state-supported venues, such as science centers, zoos, and museums.

The goals of the program would be that, by January 2010, that 50 percent or more of Floridians and Florida businesses will acknowledge by survey the seriousness of climate change impacts and will have reduced their personal usage of energy from carbon-emitting sources by 10 percent, and, by the same date, all governmental agencies at the state, regional, and local levels will have reduced their usage of energy from carbon-emitting sources by 25 percent. Also, by June 2010, the *Florida Climate and Energy Challenge* will be expanded, and additional milestones and energy reduction targets will be established to meet the 80 percent reduction from 1990 levels by the 2050 goal.

GP-3 Inter-Government Planning Coordination and Assistance

Given the high priority of climate change mitigation in the State of Florida, numerous local, state, and regional government agencies are tasked with implementing climate policies or, at a minimum, integrating energy efficiency principles into their operations. Efficient coordination among agencies and between local, state, and regional government will enhance overall effectiveness, reduce overlap, and eliminate barriers to GHG mitigation efforts.

Local governments will be among the state's most vital partners in addressing climate change. Local and regional authorities have primary responsibility for land-use, development, and infrastructure planning, and have major responsibility for building code compliance.

The State of Florida is unique in that it has an existing comprehensive planning framework, which is the foundation of the state's growth management program. It provides for the coordination of state, regional, and local planning decisions. To facilitate and expedite climate change mitigation and adaptation efforts throughout the state, Florida's policymakers should work through the Florida Department of Community Affairs in conjunction with the Regional Planning Councils to use the local government comprehensive planning process to improve coordination and ensure that each level of government is working toward the same goals in a mutually supportive and consistent manner.

State government can help lead the way and build on the existing work that is in progress at local and regional levels by:

- (1) collecting and facilitating access to information about best practices;
- (2) providing cost-benefit analyses of the various approaches available to local governments in a fiscally constrained environment;
- (3) documenting the economic benefits or payoffs for local governments, their constituencies, and businesses that are considering the implementation of green practices;
- (4) eliminating state subsidies or favorable tax treatment for programs or policies that are contrary to GHG reduction efforts;
- (5) identifying and eliminating state policies that unduly contribute to the generation of GHG emissions;
- (6) finding ways to say "yes" to local and regional partnerships and solutions;
- (7) funding the Florida Green Governments Grant Program and similar programs that support local and regional government initiatives; and

- (8) expediting state-level review and decision-making processes, if applicable, to facilitate implementation of local and regional efforts. Creating a statewide process to achieve GHG reductions will allow all coordinating agencies to work in concert. In addition, determining regional GHG averages and encouraging use of a consistent system for local governments to quantitatively assess their reduction progress would facilitate their engagement in this effort and allow them to gauge their progress and efficacy.

The Action Team proposes the following goal as a measure of success in this area: Contingent upon having available funding and necessary programs in place, all counties with a population of more than 200,000 should develop current GHG emissions inventories and mitigation action plans by the end of 2010.

GP-4 "Green" Business Development Policies

Climate change impacts are likely to have significant effects on all sectors of Florida's economy. Some sectors will face acute challenges, while others will enjoy substantial growth opportunities. GHG mitigation and climate adaptation also are likely to create new economic and employment opportunities. Substantial investment is expected in energy efficiency implementation and renewable energy technologies. These investments hold the promise of diversifying and strengthening the Florida economy.

The intent of this policy is to encourage and facilitate the involvement of funding and investment sources, business interests, and entrepreneurs in quickly seizing business opportunities related to GHG reductions and climate change solutions. Florida should foster research and development associated with GHG emissions reduction, renewable energy, and energy efficient technologies. The state should also promote business, job development, and workforce training in alternative low-carbon fuels and vehicles and other alternative low-carbon technologies, such as energy efficiency.

The Action Team recommends that Florida:

- (1) Unify existing resources and entities with those created under House Bill 7135 (FECC and the Florida Energy Systems Consortium) to support businesses in greening their operations and promote business development opportunities in climate protection and adaptation, including seeking or stimulating funding investments;
- (2) undertake an analysis of potential opportunities in green industry development and target those technologies for which Florida has an advantage;
- (3) analyze targeted incentives to promote private investment in these technologies or industries, such as tax credits, investment in academic programs and research, grant funding, and investment in workforce development;

- (4) consider funding opportunities for clean energy technologies through the 33 investment funds managed by the State Board of Administration, among which is the Florida Retirement System Pension Plan Trust Fund;
- (5) promote the use of commercially ready technologies through a targeted RPS, an EEPS, building codes, appliance standards, rebates, and tax incentives;
- (6) encourage “business incubator” programs at Florida universities and colleges to attract and support new business development related to the new energy economy;
- (7) offer incentive points for competitive grant programs for state-to-business economic development for businesses that have undertaken GHG reduction and energy efficiency programs;
- (8) create or designate a clearinghouse entity to match technology developers and other climate solution entrepreneurs with necessary financing;
- (9) promote the use and development of effective water conservation plans, low-energy water treatment technologies, and water-conserving products and technologies, such as those certified through the Environmental Protection Agency’s WaterSense program or the Florida Water Star public education program initiated by the St. Johns River Water Management District;
- (10) require the use of applicable “green buildings” standards for the award of state contracts for state-owned and state-funded projects;
- (11) favor contracting with firms that undertake green standards in business operations and in proposed contract work; and
- (12) define “green jobs” and have Enterprise Florida conduct or commission a study of job opportunities and develop a targeted strategy for Florida.

GP-5 Introduce Core Competencies Into Professional Licensing Programs

Florida has more than 200,000 licensed built-environment professionals, including building contractors, architects, landscape architects, engineers, interior designers, and others involved in the design and construction of Florida’s residential and commercial sites and buildings. It is critical that Florida’s licensed professionals—who are responsible for the design, development, and construction of Florida’s built environment— incorporate climate change and energy efficient technologies, materials, and design into their projects to facilitate the reduction of GHG emissions. Therefore, the state needs to establish core competency provisions for licensed professionals who provide site and architectural design, site engineering, site construction, building construction, and building operations efficiencies services. The state also needs to require professional organizations, in support of their respective professional membership, to

develop and administer continuing education programs that address new technologies, standards, and materials designed to reduce GHG emissions and promote energy efficiency.

Additionally, within Florida's State University System, design and engineering programs should establish required courses of study that focus on the issues and importance of climate change mitigation and energy efficiency toward establishing a sustainable Florida. Targeted professions should include architecture, interior design, civil engineering, environmental engineering, building inspectors, code compliance officers, building trades (plumbing and HVAC), general contractors (site and building), real estate, building operators, landscape architecture, and in the training for those pursuing state certification to become teachers.

Specific climate change-related questions would be added to the respective state licensure examinations. To maintain professional licenses within the designated design professions, the state would require the respective professional organizations to develop and administer continuing education programs that reinforce the importance of reducing GHG emissions and promoting energy efficiency.

In addition, the state should develop a Florida Green Building certification program for licensed professionals involved in the design and construction of residential and commercial buildings and development sites.

Chapter 8

Adaptation Strategies

Among the topics considered by the Governor's Action Team on Energy and Climate Change, adaptation is quite distinct from mitigation. Not only is adaptation about coping with the consequences of climate change rather than trying to prevent or limit them, but adaptation itself is a very broad topic, covering the many sectors that may be affected by global climate change. This includes infrastructure; the built environment; coastal resources; water resources; extreme climate events (and emergency response); marine, freshwater, and terrestrial ecosystems; and human health. Adaptation to climate change will be addressed by many state agencies, regional and local entities, non-profit organizations, the private sector, and individuals, thus making adaptation diffuse and diverse. This complicates adaptation policy development and implementation. Accordingly, the approach taken by the Action Team was to review the myriad resources and associated policies that are affected or could be affected by climate change to ensure their robustness and resilience in the face of climate change.

The Adaptation Technical Work Group (TWG) addressed a wide variety of topics in its deliberations. The work of the TWG also is unique among the six TWGs because there is no common metric for measuring success of adaptation measures. GHG reductions can be compared based on such common metrics as dollars per ton of carbon dioxide equivalent. There is no parallel outcome on adaptation. Some adaptations concern human life, others property, and still others are about reducing impacts of climate change on ecosystems and threatened or endangered species.

Science and Impacts of Climate Change¹

Florida, because of its low-lying topography and geographical location in the sub-tropics, is especially vulnerable to sea level rise and extreme weather.

The Intergovernmental Panel on Climate Change (IPCC) projected a warming in the southeastern United States of approximately 4 to 6°F (2 to 3°C) for a medium scenario of greenhouse gas emissions². Higher emissions scenarios, which are quite possible, would result in larger temperature increases. Temperatures are projected to rise more in the summer than in the winter.

¹ This section is a summary of Florida Atlantic University, "Florida's Resilient Coasts" (Murley et al., 2008)

² Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, et al. 2007. "Regional Climate Projections." In: Solomon, S., D. Qin, M. Manning, M. Marquis, K. Averyt, M.M.B. Tignor, et al., eds. Intergovernmental Panel on Climate Change (IPCC). 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. New York: Cambridge University Press.

The IPCC also projected that precipitation patterns will change. It is difficult to confidently predict precipitation changes on a scale as small as Florida, but the climate models tend to project decreased precipitation over the Southeastern United States. The models show a tendency toward reductions in summer precipitation³.

The IPCC also projected a sea level rise (SLR) of at least 9 inches to 23 inches by the end of the 21st Century⁴. This projection was based on published reports through 2005 and did not account for dramatically increased rates of land-based glacial melting observed in Greenland and Antarctica since the publication of the latest IPCC assessment⁵. Many scientists have stated that increases in melt rates in Greenland and Antarctica will make significant contributions to sea level rise beyond that projected in the IPCC Assessment⁶. For example, the Science and Technology Committee of the Miami-Dade County Climate Change Advisory Task Force projected a SLR of at least 1.5 feet in the coming 50 years and at least 3-5 feet by the end of the century⁷.

In general, elevations of barrier islands are only minimally above sea level and much of Florida's barrier islands have been subject to extensive development of high value oceanfront real estate. These areas are at significant risk from SLR and increased intensity of hurricanes. Beach erosion, which already costs Florida more than \$600 million per year,⁸ is likely to increase. Coastal wetlands could be inundated by sea level rise. The Everglades represent the largest and most important of Florida's coastal wetlands. As sea levels rise, brackish waters will extend further inland and dramatically change these and other freshwater ecosystems. Unconfined coastal aquifers, such as the Biscayne Aquifer in South Florida, will become more saline because of sea level rise.

Florida was hit by 10 named storms in 2004 and 2005 and, to date, has been hit by several large hurricanes and tropical storms in 2008. The intensity of hurricanes is projected to increase,⁹ although there is disagreement in the scientific community about whether the hurricane intensity has changed as a result of climate change. It is documented that wind speeds in the most powerful hurricanes have increased since the mid-1980s.¹⁰

³ Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, et al. 2007. "Regional Climate Projections."

⁴ Solomon, S., D. Qin, M. Manning, M. Marquis, K. Averyt, M.M.B. Tignor, et al., eds. 2007. (IPCC). Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. New York: Cambridge University Press.

⁵ Pfeffer, W.T., J.T. Harper, and S. O'Neil. 2008. "Kinematic Constraints on Glacier Contributions to 21st Century Sea-Level Rise." *Science*. 321:1340-43.

⁶ Oppenheimer, M., B.C. O'Neil, M. Webster, and S. Agrawala. 2007. "The Limits of Consensus." *Science* 317: 1505-06.

⁷ Murley, J., N. Bolman, and B. Heimlich. 2008. "Florida's Resilient Coasts." Florida Atlantic University.

⁸ *Ibid.*

⁹ *Ibid.*

¹⁰ Elsner, J. B., J.P. Kossin, and T.H. Jagger. 2008. "The increasing intensity of the strongest tropical cyclones." *Nature* 455: 92-95.

Even if hurricanes do not change, higher sea levels alone will result in higher storm surges. More intense hurricanes will likely lead to even higher storm surges and more damaging wind speeds.

According to Florida Atlantic University's study "Florida's Resilient Coasts," Murley et al. 2008 states:

In addition to sea level rise and hurricanes, there are numerous other potential effects of global warming that could affect Florida's communities and environment physically, economically and socially, including:

- Prolonged drought affecting water supplies, agriculture, and habitat;
- More wildfires due to excessive drought and heat;
- More flooding due to more torrential rains;
- More frequent and lengthy heat waves creating increased energy demands and health hazards to young children, elderly, and infirm;
- Potential insect infestation and insect-borne diseases resulting from increased temperatures combined with increased flooding due to storms;
- Bleaching of coral reefs and adverse effects on marine life and fisheries;
- Ecological changes in the Everglades and other natural systems affecting plant ecology, wildlife, the marine estuaries and coast, and tourism; and
- Economic, environmental, and social impacts.

Framework for Action and Goals

Based on the knowledge about the risks from climate change, the TWG developed a framework of adaptation topics and identified goals and strategies to address each topic. The framework and major objectives are:

ADP-1. Advancing Science Data and Analysis for Climate Change

Scientific data, analyses, and predictive modeling are needed to understand how Florida's climate is likely to change, the consequences of change, and possible solutions.

ADP-2. Comprehensive Planning

Florida's local, state, and regional comprehensive plans should be amended based on the best available data, include goals, objectives, and policies that will prepare the state for adapting to the future impacts of climate change, such as SLR. Future policies should use

incentives to encourage desired actions, including encouragement not to repeat past decisions that will leave new development exposed to SLR and other climate change consequences.

ADP-3. Protection of Ecosystems and Biodiversity

Florida's ecosystems should be managed for resiliency by enhancing their ability to naturally adapt to the stresses of climate change and other pervasive threats, including invasive exotic species. In addition, climate change should be incorporated into all aspects of the beach management and coastal construction regulatory programs.

ADP-4. Water Resources Management

In order for Floridians to have adequate water supply available to meet their basic reasonable and beneficial needs while meeting the requirements of natural systems, state and local governments need to pursue intense conservation of all water uses and alternative water sources, and include stakeholder involvement in statewide and regional water supply planning processes. Climate change may impact existing sources due to many factors including altered rainfall patterns and salt water intrusion into coastal aquifer systems. Methods to quantify and plan for uncertainties and risks related to population growth, climate change, and environmental regulations will be needed.

ADP-5. Built Environment, Infrastructure and Community Protection

The reduction of potential damage to the built environment from the impact of natural hazards, especially from those hazards caused or exacerbated by climate change, should be a high priority for all levels of government and the private sector in Florida.

ADP-6. Economic Development

Policies, programs, and implementation mechanisms should be developed to support the ability of Florida's economy to adapt to climate change.

ADP-7. Insurance

Insurance rates should reflect risks from climate and climate change and be equitable and affordable. In addition, policies should discourage high risk development, particularly along the coast.

ADP-8. Emergency Preparedness and Response

Florida's future emergency preparedness and response functions should build on the excellence gained through past experience to ensure sufficient capacity and efficacy in protecting public health and welfare against the risks from climate change such as more intense hurricanes and floods and potential spread of disease and heat stress.

ADP-9. Human Health Concerns

Florida's health plan should incorporate considerations of climate change to protect the health of its citizens.

ADP-10. Social Effects

Issues of social justice should be addressed. Food, water, and housing security should be protected and behavioral responses to extreme events and climate change need to be better understood.

ADP-11. Organizing State Government for the Long Haul

A single point of focus within state government should be created that can continue assessing the risks posed by climate change, develop increasingly informed adaptation planning, and adjust adaptation planning in Florida as events on the ground change. The Legislature created the Florida Energy and Climate Commission, which appears at present to have sufficient scope, powers, and resources to accomplish the intent of this element of adaptation planning. However, it will be important to assess the effectiveness of the commission in addressing adaptation.

ADP-12. State Funding and Financing

Florida should be prepared to fund the protection of human health and critical infrastructure, as well as address other impacts of climate change, where feasible, within a framework of protection, accommodation – and, in some cases, retreat.

ADP-13. Coordination with Other Regulatory and Standards Entities

Functional collaborative relationships between the State of Florida and selected federal government agencies entities, other states and countries, and key professional societies should be developed on climate change issues of mutual interest. Research agendas and funding sources should be aligned to address common interests and priorities.

ADP-14. Education

Florida should become a national and international leader in the dissemination of climate change information in the process of educating a broad diversity of constituents with cutting-edge and successful public education programs.

Recommended Early Action Items

The following recommendations were identified as Early Action Items for consideration by Florida's policymakers:

- Research
 - Foster and support a climate science research agenda for Florida with broad priorities. Institute a scientific advisory council on climate change to advise state government on this research agenda. Identify and establish long-term funding to support research. Funding should be protected from short-term economic or political cycles.
 - Conduct research needed to support incorporation of climate change into the protection of Florida's ecosystems and biodiversity.
 - Enhance support for mapping, monitoring, and modeling, all of which will be necessary to provide information to support policy-making. In addition, effective monitoring programs are needed to detect impacts of climate change; modeling is also needed to project impacts with more accuracy.
- Comprehensive Planning
 - State and regional agencies should provide financial and technical assistance to local governments to ensure timely updates of local plans.
 - Local governments should review their coastal management elements to determine necessary amendments to make their coastal areas (especially the coastal high-hazard area) resilient to the future impacts of climate change, including sea-level rise.
 - Florida statutes, regulations, policies, and the Florida Administrative Code should be reviewed by the Florida Attorney General to determine potential conflicts between private property rights and the state and local governments' responsibility to protect communities.
- Protection of Ecosystems and Biodiversity
 - Ensure that a representative portfolio of Florida's terrestrial, freshwater, and marine natural communities with redundant representation of habitats and species and connecting corridors is protected and managed in a manner that maximizes the health and resilience of these communities when facing climate change impacts.
 - Reduce and discourage future reliance on bulk-heading/hardening to stabilize estuarine and beach shorelines. Shoreline hardening should be considered only after a full and cumulative assessment of short- and long-term impacts to coastal resources and coastal ecosystems. Establish policies and regulations that clearly define when, how, where, and under what circumstances emergency beach stabilization is allowed.
 - The vulnerability of Florida's fish and wildlife to climate change impacts should be assessed, the most vulnerable species should be identified, and plans prepared to enhance their chances of survival where there is a reasonable likelihood that the species will survive over the next 50 years.
- Water Resources Management

- Identify and quantify the potential effects of differing climate change scenarios on the vulnerabilities and reliability of existing water supplies with emphasis on source water availability and quality.
- Built Environment
 - Require that the Florida Building Code incorporate building design criteria for resisting future loads that may result from the impact of climate change-exacerbated hazards during a minimum service life of 50 years.
 - Develop required training provisions to educate professionals in relevant fields (such as architecture, engineering, and construction management) on the need to incorporate adaptation to climate change as a basis for establishing design criteria for new infrastructure. Completion of such required training provisions would be a condition for licensing.
- Public Education and Outreach
 - Provide immediate training on climate change adaptation.
 - Initiate a major public education campaign.