

Katie Ely

080413-EG

From: Katie Ely on behalf of Records Clerk
Sent: Monday, January 11, 2010 8:42 AM
To: 'lorenlw@aol.com'
Subject: RE: Power

FPSC, CLK - CORRESPONDENCE
Administrative Parties ~~Consumer~~
DOCUMENT NO. 09892-09
DISTRIBUTION: _____

Loren Wieland,

We are in receipt of the attached document. Please note that the below stated comments are not considered a public request for information.

A copy of this e-mail will be placed in the consumer correspondence of Dockets Nos. 080407-EG, 080408-EG, 080409-EG, 080410-EG, 080411-EG, 080412-EG and 080413-EG

If you would like to make additional comments to the Public Service Commission please e-mail: contact@psc.state.fl.us or call 1-800-342-3552.

Katie Ely
Staff Assistant - Office of Commission Clerk
Florida Public Service Commission
850-413-6304

Please note: Florida has a very broad public records law. Most written communications to or from state officials regarding state business are considered to be public records and will be made available to the public and the media upon request. Therefore, your e-mail message may be subject to public disclosure.

From: lorenlw@aol.com [mailto:lorenlw@aol.com]
Sent: Friday, January 08, 2010 5:24 PM
To: Records Clerk
Subject: Power

I want clean, sustainable renewables for the money. No more handouts to criminals to produce dirty power.

Loren Wieland
19021 Acorn Rd.
Ft. Myers, Fl
33967

RECEIVED-FPSC 12-3-09

Public Service Commission
09 DEC -7 AM 10:03

COMMISSION
CLERK

What is this stronger ~~concentrations~~ goals set.
I thought the public service commission worked for us (the general public). It seems that the environmentalist has more of a lobby in Tallahassee that speaks to the politician than the politicians listens to us. These environmentalist are nothing but the rich.

Go solar is the new thing. we have daylight only about 10 hours.

we can't drill, it will mess up the world situation cap and trade. Here we go the rich again.

Go wind if it blows.

Go electric. Electricity must be free.

I will vote every politician out that is in there now. Even the governor, Crist is in for a surprise.

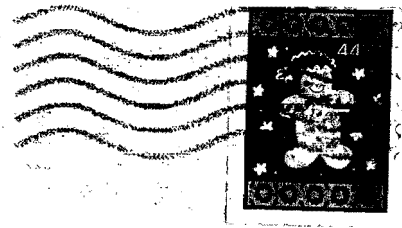
your voter
Mr. Bassett

FPSC, CLK - CORRESPONDENCE
 Administrative Parties Consumer
DOCUMENT NO. 0989209
DISTRIBUTION:

W Barrett

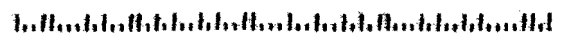
JACKSONVILLE FL 322

04 DEC 2009 PM 3:7



*Public Service Commission
Tallahassee Fla.*

32399/0850



080413

Ann Cole

From: Ann Cole
Sent: Tuesday, December 01, 2009 3:33 PM
To: Office of Commissioner Klement
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: RE: comment on discussion re energy efficient residential upgrades

Thank you for this information, which will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos. 080407-EI through 080413-EI.

From: Office of Commissioner Klement
Sent: Tuesday, December 01, 2009 12:28 PM
To: Ann Cole
Cc: Lorena Holley
Subject: FW: comment on discussion re energy efficient residential upgrades

Ann, please put this in the files for DN 080407-EG - 080413-EG. The Commissioner has not seen this e-mail.

From: Rhonda Roff [mailto:marshmaid@gmail.com]
Sent: Tuesday, December 01, 2009 10:51 AM
To: Office of Commissioner Argenziano; Office Of Commissioner Edgar; Office of Commissioner Skop; Office of Commissioner Klement; Office of the Chairman
Cc: Saveitnowglades
Subject: comment on discussion re energy efficient residential upgrades

Dear Public Service Commissioners, I am watching today's meeting online and think one consideration is missing from the current discussion on energy efficient appliances, roof insulation, CFLs, etc. That is payback time. Yes, Commisisoner Argenziano and Chairman Carter, you are both correct that most people cannot make this up front investment, at least not easily, and the suggestion that they be given the upgrades is not necessarily unreasonable. At some point the customer will be saving money on their electric bills. Is there no way to finance a bold intitiative like this by utilizing the eventual savings to the customers? I am not very good at financial analyses, but it seems this must be possible. Thank you, Rhonda

--
Rhonda Roff, President Save It Now, Glades! PO Box 1953 Clewiston, FL 33440 www.saveitnowglades.org "It is difficult to get a man to understand something, when his job depends on his not understanding it." Upton Sinclair

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 0989209		
DISTRIBUTION: _____		



RECEIVED-FPSC

09 NOV 16 PM 3:12

COMMISSION
CLERK

Public Service Commission

CAPITAL CIRCLE OFFICE CENTER • 2540 SHUMARD OAK BOULEVARD
TALLAHASSEE, FLORIDA 32399-0850

-M-E-M-O-R-A-N-D-U-M-

DATE: November 13, 2009
TO: Ann Cole, Commission Clerk - PSC, Office of Commission Clerk *AC*
FROM: Cristina Slaton, Executive Secretary to Commissioner Skop
RE: Docket Correspondence

Ann,

This office has received the attached e-mail from Diane Sitzer, President, Building Owners and Managers Association Orlando, regarding docket numbers 080407-EG through 080413-EG.

The correspondence has not been viewed or considered in any way by Commissioner Skop. Under the terms of the advisory opinion from the Commission on Ethics (issued July 24, 1991 as CEO 91-31-July 19, 1001), the attached e-mail does not constitute an ex parte communication by virtue of the fact that it was not shown to the Commissioner. Because it is not deemed to be an ex parte communication, it does not require dissemination to parties pursuant to the provisions of section 350.042, Florida Statutes. However, in such cases Commissioner Skop has requested that a copy of the correspondence be placed in the docket files.

Attachment

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. <u>09892-09</u>		
DISTRIBUTION: _____		

P.O. Box 568156

Orlando, FL 32856

407-380-3320

FAX 407-380-1265

<http://www.bomaorlando.com>

November 9, 2009

Mr. Nathan A. Skop, Esq.
Commissioner
Florida Public Service Commission
2540 Shumard Oak Blvd.
Gerald Gunter Building
Tallahassee, FL 32399

RE: Utility Data Collection – Whole Building

Dear Commissioner Skop:

On behalf of the Building Owners and Managers Association (BOMA) International and the commercial office building industry, I'd like to take a moment of your time to introduce our organization and ask for your help in solving a problem that has hindered our industry for some time. To achieve our energy efficiency goals, we seek access to our building data. This will enable us to effectively participate in the U.S. EPA Energy Star Portfolio Manager program and allow us to effectively measure, validate and benchmark our respective buildings' energy usage in order to become more energy efficient.

Our Organization

BOMA International's 16,500-plus members are building owners, managers, developers, leasing professionals, medical office building managers, corporate facility managers, asset managers, and the providers of the products and services needed to operate commercial properties. Collectively, BOMA members own or manage more than nine billion square feet of office space, which represents more than 80 percent of the prime office space in North America.

BOMA International was founded in 1907; today it is a primary source of information on office building development, leasing, building operating costs, energy consumption patterns, local and national building codes, legislation, occupancy statistics and technological developments.

Throughout BOMA International's 100-year history, its goal has always focused on actively and responsibly representing and promoting the interests of the commercial



real estate industry through effective leadership and advocacy, through the collection, analysis and dissemination of information, and through professional development.

BOMA Orlando represents Building Owners and Managers in the Central Florida area representing millions of square feet. We have 220 active members.

BOMA Orlando is one of the founding members of the Central Florida Energy Efficiency Alliance and our goal to have as many building owners benchmark their buildings by accepting the 7-Pt Challenge.

Our Problem

Simply put, many commercial office buildings cannot easily access their buildings' usage data in a cost-effective and timely manner in order to effectively participate in the EPA Energy Star Portfolio Manager (PM). The PM requires "whole building" consumption data which in many cases includes accessing tenant energy consumption data as well as building load data. Absent some exceptions, this data acquisition process is overly costly and time-consuming. Without the requisite data, building owners cannot effectively measure how our buildings are performing. As a result, by not having access to this national tool, we simply cannot efficiently manage our operations or implement efficiency and capital project upgrades into buildings.

Accordingly, we seek your assistance in acquiring simple access to whole building consumption data on a monthly basis. The information must include all meter data totalized and supplied as a single number for use in the EPA Energy Star PM. Without this whole building data, we cannot effectively use the EPA Energy Star PM and cannot compare against the Department of Energy database to provide a rating on the building's overall efficiency.

BOMA's 7-Point Challenge

In a substantive effort to achieve greater energy efficiency in our buildings, BOMA has fully supported and endorses the use of the EPA Energy Star Portfolio Manager tool as our standard for measuring energy efficiency in all buildings. BOMA has developed the 7-Point Challenge - a voluntary program for all members to commit to significant reductions in energy. Below are the first two points of the challenge. The entire challenge can be viewed by clicking on the link below.

1. Continue to work towards a goal to decrease energy consumption by 30 percent across your portfolios by 2012 – as measured against an "average building" measuring a 50 on the ENERGY STAR® benchmarking tool.
2. At least once a year, benchmark your energy performance and water usage through EPA's ENERGY STAR benchmarking tool (and share your results with BOMA).

<http://www.boma.org/getinvolved/7pointchallenge/Pages/default.aspx>

Many states have enacted or are considering enacting some form of benchmarking requirement. Without a standardized whole building data process, any legislative or regulatory efforts will only create additional burdens for the utilities and building owners. The whole building data process must be developed and functional before any local, state or federal benchmarking requirements take effect.

Our Solution

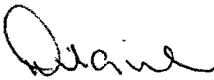
BOMA believes that the National Association of Regulatory Utility Commissioners (NARUC) is in a unique position to work with BOMA, EPA and the commercial office building industry to help drive efficiency through measurement and we look forward to further discussions on how to resolve this issue nationally.

In Illinois, BOMA/Chicago, Commonwealth Edison Company and the Illinois Commerce Commission worked cooperatively to demonstrate that the whole building data collection process can be implemented to allow building owners the ability to utilize EPA Energy Star. We believe this can serve as a valuable model for the rest of the country.

Representatives from BOMA and EPA will be participating in the upcoming NARUC conference in Chicago and would welcome the opportunity to discuss this issue in person with you.

Thank you for your time. If you have any questions or need any additional information, please don't hesitate to contact Karen Penafiel at BOMA International (202-326-6323; kpenafiel@boma.org).

Sincerely,



Diane Sitzer, RPA, FMA
President BOMA Orlando

Cc: Karen Penafiel, BOMA International

Ann Cole

080413

From: Ann Cole
Sent: Friday, November 13, 2009 11:43 AM
To: Office of Commissioner Skop
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: RE: Energy Conservation Goals for Local Utilities

Thanks Cristina. This information will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos. 080407-EG through 080413-EG.

From: Office of Commissioner Skop
Sent: Friday, November 13, 2009 11:34 AM
To: Ann Cole
Cc: Bill McNulty
Subject: FW: Energy Conservation Goals for Local Utilities
 Ann,

Please place the e-mail below in the docket correspondence folders for docket numbers 080407-EG through 080413-EG.

Thank you,
 Cristina

From: LeJeune, Carisse [mailto:LeJeuneC@bbfl.us]
Sent: Thursday, November 12, 2009 11:14 AM
To: Office of Commissioner Skop
Subject: Energy Conservation Goals for Local Utilities

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 09892.09		
DISTRIBUTION: _____		

Dear Commissioner Skop,

On behalf of the City of Boynton Beach, I would like to thank you and the rest of the Public Service Commission for postponing a decision on energy conservation goals. You are absolutely correct in that there needs to be a "more robust" strategy.

Here in Boynton, we are in the process of completing our Greenhouse Gas Emission Inventory to target emission reductions, and writing a long-term Climate Action Plan that will be incorporated into our city's Comprehensive Plan. We are researching strategies to implement Revolving Energy Funds to assist our residents with energy efficient retrofits to their homes. We feel very strongly that it is imperative for our local Energy Supplier (FP&L) to reward and offer substantial rebates to homeowners.

In this economy, I doubt you will see many "free riders" since most homeowners are trying to keep their jobs, pay their mortgages, and still put food on the table. Paying outright for energy efficiency retrofits is not high on their priority list, even though they know it will reduce their electric bills in the long-term. Household budgets just simply cannot handle those type of infrastructure investments right now. Especially not the low and moderate-low income homeowners.

The Utility Company's should be working collaboratively with the local governments to achieve energy efficiency and sustainable communities. As a local government entity, we already partner with the state's Weatherization Program and the federal government's Energy Star Rebate Program. Homeowners today need as much help as we can provide and we assist our residents by making these programs known to them. Additional assistance from

11/13/2009

the local energy provider would tip the scales in their favor, making it economically feasible for them to go forward with needed improvements. Local governments cannot turn the tide on their own.

Also, please consider energy efficiency in street lighting as well. At this point in time, FP&L does not have an energy efficient program made available to counties and municipalities in Palm Beach County (or anywhere that I am aware of). LED lighting for street lights along city and county roads would improve energy efficiency on a larger scale and reduce costs for our financially struggling local entities. FP&L currently does not offer LED options affordable to these local entities. Through the U.S. Department of Energy's ARRA Stimulus funding, there would be opportunity for regional retrofits, if FP&L offered affordable LED street lighting options in Palm Beach County.

Thank you so much for taking the time to consider this matter. I appreciate everything you are doing to promote energy efficiency.

Sincerely,

Carisse LeJeune

Assistant to the City Manager/Sustainability Coordinator
City of Boynton Beach
100 E. Boynton Beach Blvd.
Boynton Beach, FL 33425
Ph: (561) 742-6012
Fx: (561) 742-6011
e-mail: lejeunec@ci.boynton-beach.fl.us

Carisse LeJeune


080413

State of Florida



Public Service Commission
 CAPITAL CIRCLE OFFICE CENTER • 2540 SHUMARD OAK BOULEVARD
 TALLAHASSEE, FLORIDA 32399-0850

-M-E-M-O-R-A-N-D-U-M-

DATE: November 9, 2009
TO: Ann Cole, Commission Clerk - PSC, Office of Commission Clerk
FROM: Cristina Slaton, Executive Secretary to Commissioner Skop 
RE: Docket Correspondence

RECEIVED-FPSC
 09 NOV 10 PM 4:21
 COMMISSION
 CLERK

Ann,

This office has received the attached e-mail from Alan Farago, Conservation Chair, Friends of the Everglades, regarding docket numbers 080407-080413-EG.

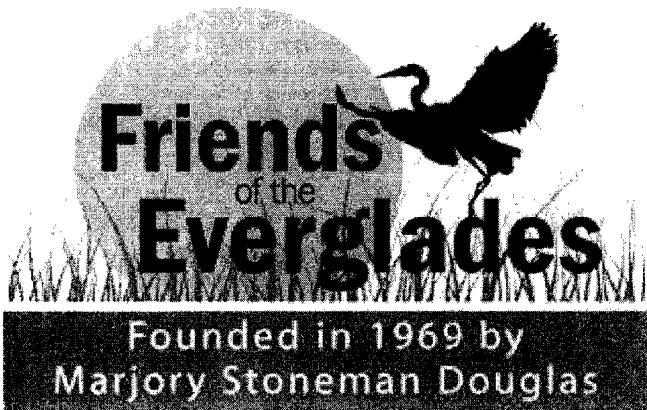
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Attachment

FPSC, CLK - CORRESPONDENCE
 Administrative Parties Consumer
 DOCUMENT NO. 09892-09
 DISTRIBUTION: _____

Cristina Slaton

From: Alan Farago [afarago@earthlink.net]
Sent: Monday, November 09, 2009 11:03 AM
To: Office of Commissioner Skop
Subject: Docket No. 080407



Dear Commissioner Skop,

On behalf of Friends of the Everglades representing the interests of thousands of Floridians, I urge you to clearly vote with the public on the issue of energy efficiency, to require true measurement of energy efficiency by Florida's utilities.

Leading states are getting 5-10 times more efficiency than Florida. Energy efficiency reduces bills. 17 states have annual energy savings goals of AT LEAST 1%. Florida utilities are meet about 0.2% of sales from efficiency. The reason why is because the PSC has not broken up the insider game played by Florida's utilities and regulators over measuring efficiency and costs of conservation.

The Rate Impact Measure (RIM) cost-effectiveness test screens out more high value efficiency measures than the Total Resource Cost (TRC) cost effectiveness test. Here's the bottom line: the TRC test includes total benefits and costs of an efficiency measures and always finds a measure cost-effective if it costs less than a supply-side option (costs of a new power plant). The Rate Impact Measure (RIM) includes the utility's "lost revenue" from utilizing energy efficiency as a "cost," therefore finds a measure NOT cost-effective if it meaningfully reduces electricity use. The utilities have been using the RIM test (with the approval of the PSC) since 1994 to screen out high-value efficiency measures - once screened out, measures can't be included in a utility program.

Rate payers can no longer afford the shell game Florida's utilities have been playing with our energy future. Please let your contribution be to vote for common sense in the application of real cost efficiency to conservation. The devil is in the details and so far the details inflict massive costs on our vulnerable state.

Sincerely,

Alan Farago
Conservation Chair



Public Service Commission
CAPITAL CIRCLE OFFICE CENTER • 2540 SHUMARD OAK BOULEVARD
TALLAHASSEE, FLORIDA 32399-0850

-M-E-M-O-R-A-N-D-U-M-

DATE: November 9, 2009
TO: Ann Cole, Commission Clerk - PSC, Office of Commission Clerk
FROM: Kay Posey, Executive Secretary to Commissioner Klement *KP*
RE: Communication Received in Dockets No. 080407-080413

RECEIVED-FPSC
09 NOV 10 AM 10:24
COMMISSION
CLERK

This office has received the attached e-mail from Mr. Alan Farago, Conservation Chair, Friends of the Everglades, regarding the above-noted dockets.

The e-mail has not been viewed or considered in any way by Commissioner Klement. Under the terms of the advisory opinion from the Commission on Ethics (issued July 24, 1991 as CEO 91-31-July 19, 1991), the following e-mail does not constitute an ex parte communication by virtue of the fact that it was not shown to the Commissioner. Because it is not deemed to be an ex parte communication, it does not require dissemination to parties pursuant to the provisions of section 350.042, Florida Statutes. However, in such cases Commissioner Klement has requested that a copy of the e-mail be placed in the record of the above-noted dockets.

cc: Advisors to Commissioners

Attachment

FPSC, CLK - CORRESPONDENCE
 Administrative Parties Consumer
DOCUMENT NO. 09892-09
DISTRIBUTION: _____

Kay Posey

From: Alan Farago [afarago@bellsouth.net]
Sent: Monday, November 09, 2009 11:12 AM
To: Office of Commissioner Klement
Subject: Docket No. 080407

Subject: Docket No. 080407



Dear Commissioner Klement,

On behalf of Friends of the Everglades representing the interests of thousands of Floridians, I urge you to clearly vote with the public on the issue of energy efficiency, to require true measurement of energy efficiency by Florida's utilities.

Leading states are getting 5-10 times more efficiency than Florida. Energy efficiency reduces bills. 17 states have annual energy savings goals of AT LEAST 1%. Florida utilities are meet about 0.2% of sales from efficiency. The reason why is because the PSC has not broken up the insider game played by Florida's utilities and regulators over measuring efficiency and costs of conservation.

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Rate payers can no longer afford the shell game Florida's utilities have been playing with our energy future. Please let your contribution be to vote for common sense in the application of real cost efficiency to conservation. The devil is in the details and so far the details inflict massive costs on our vulnerable state.

Sincerely,

Alan Farago
Conservation Chair

11/9/2009

Katie Ely

080413

From: Katie Ely
Sent: Wednesday, October 28, 2009 4:45 PM
To: Ruth McHargue
Subject: FW: Docket 080407

Thank you for this information. This attachment has been printed and will be placed in Docket Correspondence - Consumers and their Representatives, in Dockets 080407-080413

Katie Ely
Staff Assistant - Office of Commission Clerk Florida Public Service Commission
850-413-6304

Please note: Florida has a very broad public records law. Most written communications to or from state officials regarding state business are considered to be public records and will be made available to the public and the media upon request. Therefore, your e-mail message may be subject to public disclosure.

-----Original Message-----

From: Ruth McHargue
Sent: Wednesday, October 28, 2009 3:42 PM
To: Katie Ely
Cc: Dorothy Menasco; Ann Cole
Subject: Docket 080407

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 09892.09		
DISTRIBUTION: _____		

Customer correspondence

-----Original Message-----

From: Consumer Contact
Sent: Tuesday, October 27, 2009 11:52 AM
To: Ruth McHargue
Subject:

Copy on file, see 899492. DH

-----Original Message-----

From: Webmaster
Sent: Tuesday, October 27, 2009 8:14 AM
To: Consumer Contact
Subject: RE: My contact

-----Original Message-----

From: contact@psc.state.fl.us [mailto:contact@psc.state.fl.us]
Sent: Tuesday, October 27, 2009 7:45 AM

To: Webmaster
Cc: akara@comcast.net
Subject: My contact

Contact from a Web user

Contact Information:

Name: Arrthur Kara
Company:
Primary Phone: 305 294 2653
Secondary Phone:
Email: akara@comcast.net

Response requested? No
CC Sent? Yes

Comments:

Please require efficiency goals that call for at least 1% of demand to be met through efficiency each year. Living in the a low state surrounded by water that's high and rising we must do at least as well as 17 other states to mitigate global warming.

Katie Ely

080413

From: Katie Ely
Sent: Wednesday, October 28, 2009 4:45 PM
To: Ruth McHargue
Subject: FW: Docket 080407

Thank you for this information. This attachment has been printed and will be placed in Docket Correspondence - Consumers and their Representatives, in Dockets 080407-080413.

Katie Ely
Staff Assistant - Office of Commission Clerk Florida Public Service Commission
850-413-6304

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-----Original Message-----

From: Ruth McHargue
Sent: Wednesday, October 28, 2009 3:45 PM
To: Katie Ely
Cc: Dorothy Menasco; Ann Cole
Subject: Docket 080407

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 09892.09		
DISTRIBUTION: _____		

Customer correspondence

-----Original Message-----

From: Diane Hood
Sent: Tuesday, October 27, 2009 11:44 AM
To: Ruth McHargue
Subject: FW:

-----Original Message-----

From: Consumer Contact
Sent: Tuesday, October 27, 2009 11:43 AM
To: Ruth McHargue
Subject:

Copy on file, see 090122. DH

-----Original Message-----

From: Webmaster
Sent: Tuesday, October 27, 2009 9:39 AM

To: Consumer Contact
Subject: FW: My contact

-----Original Message-----

From: contact@psc.state.fl.us [mailto:contact@psc.state.fl.us]
Sent: Tuesday, October 27, 2009 9:37 AM
To: Webmaster
Cc: philkolt@aol.com
Subject: My contact

Contact from a Web user

Contact Information:

Name: Philip Koltun

Company:

Primary Phone: 954 501 6630

Secondary Phone:

Email: philkolt@aol.com

Response requested? Yes

CC Sent? Yes

Comments:

google RNK CAPITAL for solution to utility request for funds.

call 212 419 3966 or e-mail

robkoltun@rnkcapital.com and contact

Robert Koltun and he will show you a less expensive and longer lasting fix to producing more electricity

Katie Ely

080413

From: Katie Ely on behalf of Records Clerk
Sent: Tuesday, October 27, 2009 8:41 AM
To: Commissioners Advisors; Administrative Assistants - Commission Suite
Cc: Stephen Garl; Katherine Fleming
Subject: FW: Docket #s 080407-, 080408-, 080409-, 080410-, 080411-, 080412-, and 080413-EG
Attachments: e072 June07edit.pdf

Thank you for this information. This attachment has been printed and will be placed in *Docket Correspondence - Consumers and their Representatives*, in Dockets 080407, 080408, 080409, 080410, 080411, 080412 & 080413.

This has also been forwarded to lead staff should a response be needed.

Katie Ely
 Staff Assistant - Office of Commission Clerk
 Florida Public Service Commission
 850-413-6304

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 09892.07		
DISTRIBUTION: _____		

Please note: Florida has a very broad public records law. Most written communications to or from state officials regarding state business are considered to be public records and will be made available to the public and the media upon request. Therefore, your e-mail message may be subject to public disclosure.

From: Rhonda Roff [mailto:marshmaid@gmail.com]
Sent: Monday, October 26, 2009 4:24 PM
To: Records Clerk
Cc: Office of the Chairman; Office of Commissioner Argenziano; Office Of Commissioner Edgar; Office of Commissioner Skop; Office of Commissioner Klement
Subject: Docket #s 080407-, 080408-, 080409-, 080410-, 080411-, 080412-, and 080413-EG

26 Oct 09

Re:

Docket No. 080407-EG – Commission review of numeric conservation goals (Florida Power & Light Company).

Docket No. 080408-EG – Commission review of numeric conservation goals (Progress Energy Florida, Inc.).

Docket No. 080409-EG – Commission review of numeric conservation goals (Tampa Electric Company).

Docket No. 080410-EG – Commission review of numeric conservation goals (Gulf Power Company).

Docket No. 080411-EG – Commission review of numeric conservation goals (Florida Public Utilities Company).

Docket No. 080412-EG – Commission review of numeric conservation goals (Orlando Utilities Commission).

Docket No. 080413-EG – Commission review of numeric conservation goals (JEA).

10/27/2009

Dear Public Service Commissioners and Staff,

I am writing on behalf of Save It Now, Glades! and southwest Florida Sierra (Calusa group) to express our dire concern about the above referenced dockets. Florida is "ground zero" for the negative impacts of climate change, and we hold the belief that greenhouse gas emissions contribute to climate change. The economic burden we will share is detailed in the Swiss Reinsurance Group recent report, **Shaping climate-resilient development: a framework for decision-making**, which may be found at:

http://www.swissre.com/pws/research%20publications/risk%20and%20expertise/partner_publications/economics_of_climate_adaptation_report.html?contentIDR=d668ad804f931e96beb1ffeed39f829d&useDefaultText=0&useDefaultDesc=0

Implementing the strongest possible efficiency and conservation from all sectors (residential, commercial, municipal and industrial power generation) should not be delayed. By possible, we do not mean "status quo", but closer to the 29% goal for Florida that the ACEEE demonstrates possible in their 2007 report, a copy of which is attached as "e072 June07edit.pdf".

It may be in the economic interest of the investor-owned utilities, that is, their shareholders and the corporation itself, to minimize cost to them; however, they are not your only constituents. As a representative of some very concerned members of the public, I strongly encourage you to consider this issue's broadest implications and your power and responsibility therein.

Thank you in advance for your prompt and serious attention to this urgent matter,

Rhonda Roff, President
Save It Now, Glades!
PO Box 1953
Clewiston, FL 33440

Energy Co-Chair, Sierra Calusa Group

**Potential for Energy Efficiency
and Renewable Energy
to Meet Florida's Growing Energy Demands**

**R. Neal Elliott, Maggie Eldridge, Anna M. Shipley,
John "Skip" Laitner, and Steven Nadel;¹
Philip Fairey, Robin Vieira, and Jeff Sonne;²
Alison Silverstein;³ and Bruce Hedman and Ken Darrow⁴**

June 2007

Report Number E072

**©American Council for an Energy-Efficient Economy
1001 Connecticut Avenue, N.W., Suite 801, Washington, D.C. 20036
(202) 429-8873 phone, (202) 429-2248 fax, <http://aceee.org> Web site**

¹ American Council for an Energy-Efficient Economy

² Florida Solar Energy Center

³ Independent consultant

⁴ Energy and Environmental Analysis, Inc.

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ABOUT THE AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY (ACEEE)

ACEEE is a nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. For more information, see <http://www.aceee.org>. ACEEE fulfills its mission by:

- Conducting in-depth technical and policy assessments
- Advising policymakers and program managers
- Working collaboratively with businesses, public interest groups, and other organizations
- Organizing conferences and workshops
- Publishing books, conference proceedings, and reports
- Educating consumers and businesses

Projects are carried out by staff and selected energy efficiency experts from universities, national laboratories, and the private sector. Collaboration is key to ACEEE's success. We collaborate on projects and initiatives with dozens of organizations including federal and state agencies, utilities, research institutions, businesses, and public interest groups.

ACEEE is not a membership organization. Support for our work comes from a broad range of foundations, governmental organizations, research institutes, utilities, and corporations.

EXECUTIVE SUMMARY

Florida is among the fastest growing states in the country, and the state's electricity demand is growing even faster than the state's population. To sustain this rapid economic and population growth, Florida needs to take action to meet the resulting increases in energy needs. A particular challenge is peak demand (those times when extreme heat or extreme cold crank up air conditioners and heaters), which is growing slightly faster in recent years than regular day-to-day electricity demand, and is the most expensive type of electricity.

Florida's unique energy vulnerabilities have also become apparent during the past several years. Florida is one of the most natural-gas-dependent states in the country, with more than a third of its electricity generated by natural gas. In December 2005, the natural gas "crisis" drove utility prices from less than \$3 per thousand cubic foot to over \$14, a price that hurt Floridians' pocketbooks. The pain intensified when Hurricane Katrina disrupted natural gas supplies and jeopardized electricity generation. While the price of natural gas has fallen over the past year, it still costs over two and a half times more than it did when many of the state's new natural gas power plants were planned. It is not the bargain we once thought. To meet the growing electricity needs, Florida's utilities project the need for both more natural-gas- and coal-powered plants.

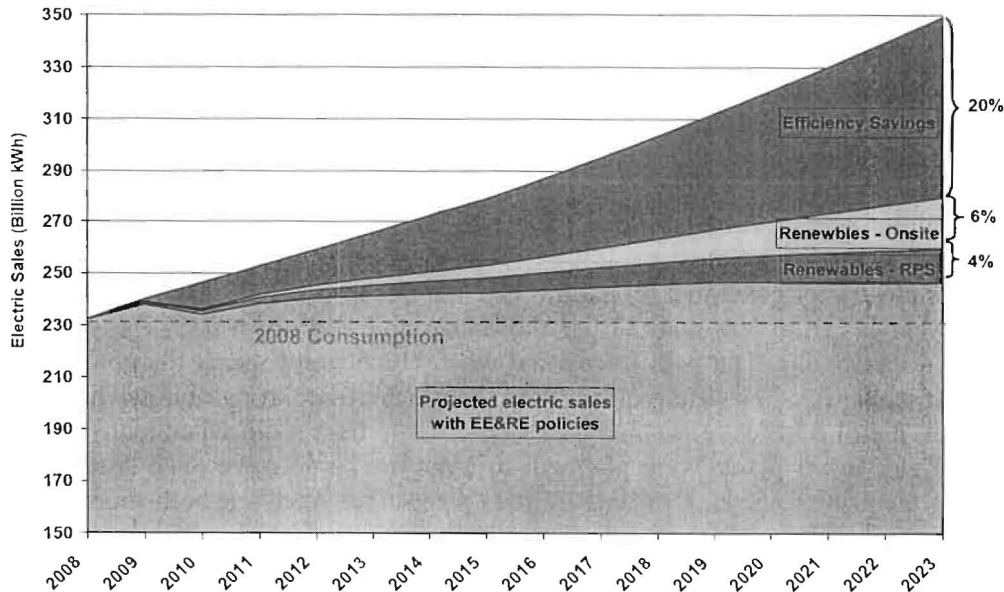
Opportunities for Energy Efficiency and Renewable Energy

Fortunately, another suite of energy resource options is available—slowing energy demand growth with energy efficiency resources and demand response, and diversifying the supply resources with renewables. This report explores the magnitude of the efficiency and renewable resources that are available to the state, and suggests some specific policies that could be implemented to reduce future energy demands. If all the policies we recommend were implemented, the state could reduce its projected future use of electricity from conventional sources (i.e., natural gas, coal, oil, and nuclear fuels) by about 29% in the next 15 years (see Figure ES-1). Energy efficiency accounts for about two-thirds of the 2023 total 102,513 million kWh electricity reductions, with the renewable energy provisions accounting for the balance.

To make these energy efficiency and renewable energy resources a reality, we recommend eleven specific policies that the state should consider adopting:

1. Utility-Sector Energy Efficiency Policies and Programs (EERS)
2. Appliance and Equipment Standards
3. Building Energy Codes
4. Advanced Building Program
5. Improved Combined Heat and Power (CHP) Policies
6. Industrial Competitiveness Initiative
7. State and Municipal Buildings Program
8. Short-Term Public Education and Rate Incentives
9. Expanded Research, Development, and Demonstration Efforts
10. Renewable Portfolio Standard (RPS)
11. Onsite Renewables Program

Figure ES-1. Share of Future Electricity Consumption that Can Be Met with Energy Efficiency and Renewable Energy Resources
 2023 Savings = 102,513 Million kWh



We believe these policies would establish a foundation upon which the state could build a sustainable energy future, while improving the state's economic health. The most significant energy efficiency recommendation is for a Utility-Sector Energy Efficiency Program, specifically an Energy Efficiency Resource Standard (a utility savings target similar to the RPS concept), which accounts for 30% of the total savings in 2023 (see Table ES-1). As would be anticipated because of the importance of buildings-related electric loads, buildings policies (including an improved building energy code and advanced buildings policies) would contribute another 19% toward the total electricity savings in 2023.

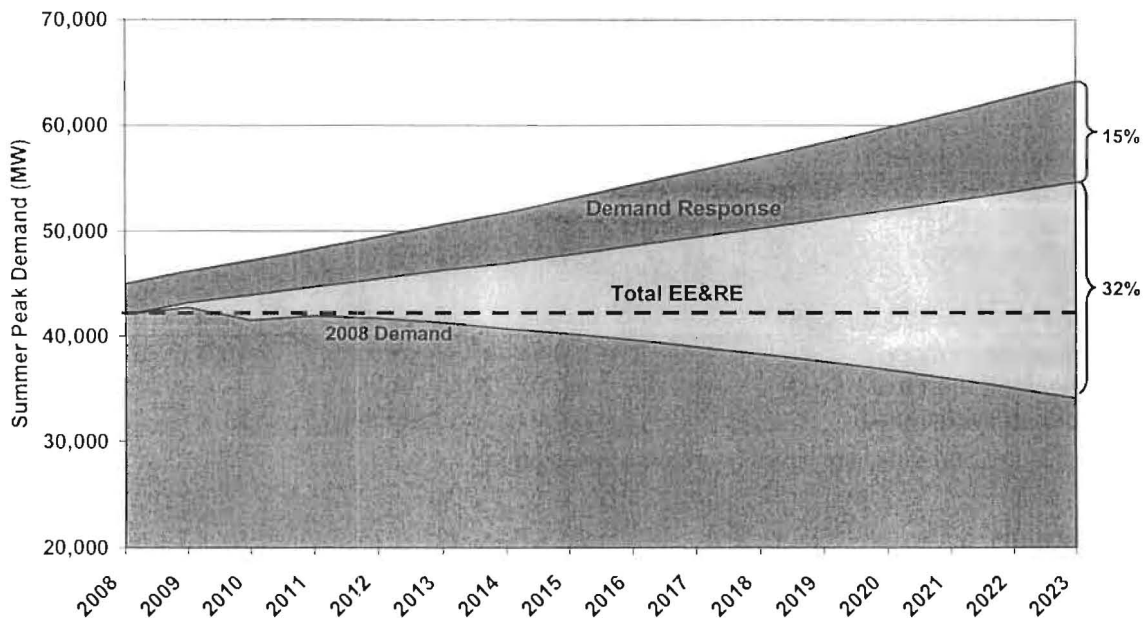
Our calculations show that these energy efficiency and renewable energy policies can also reduce peak demand for electricity by over 20,000 MW in 2023, or 32% of projected peak demand. In addition, we also recommend that the state consider implementing a robust demand response effort, which could reduce peak demand by an additional 4,353 MW in 2013 and 9,637 MW in 2023, or 9% and 15% of projected peak demand, respectively (see Figure ES-2). While the utilities in the state have had various curtailable tariffs for many years, there is much more that could be done to reduce peak electrical loads. Demand response programs combined with energy efficiency and renewable energy policies could slow the rapid growth in peak demand projected by the state's utilities.

Our study asserts that energy efficiency, coupled with renewable energy, can slow future electricity demand. It would also diversify the state's energy resources, making Florida less vulnerable to global markets and volatile energy prices. The study shows that implementing energy efficiency policies alone (such as efficient windows, compact fluorescent light bulbs, and ENERGY STAR new homes and appliances) can almost offset the future growth in electric demand.

Table ES-1. Summary Results from Analysis of Recommended Policies

		Annual Savings in 2013 and 2023			
		2013		2023	
		Electricity Savings (million kWh)	Demand Savings (MW)	Electricity Savings (million kWh)	Demand Savings (MW)
Energy Efficiency (EE) Policies					
1	Utility savings target	7,183	1,375	30,962	5,828
2	More stringent building codes	1,760	336	12,286	2,302
3	Public buildings program	1,536	293	4,608	847
4	Improved CHP policies	1,097	172	3,291	517
5	Short-term public ed. & rate incentives	4,582	873	3,549	653
6	Appliance & equipment standards	776	233	3,680	990
7	Advanced buildings program	458	336	7,503	2,302
8	Industrial competitiveness initiative	232	44	676	124
9	Expanded RD&D efforts	23	6	2,800	756
	<i>Subtotal</i>	<i>17,647</i>	<i>3,668</i>	<i>69,354</i>	<i>14,319</i>
Renewable Energy (RE) Policies					
10	Onsite renewables policy package	2,542	486	20,183	3,775
11	Renewable portfolio standard	4,090	779	12,976	2,386
	<i>Subtotal</i>	<i>6,631</i>	<i>1,265</i>	<i>33,159</i>	<i>6,161</i>
Total		24,278	4,933	102,513	20,480

Figure ES-2. Impact on Summer Peak Demand of Expanded Demand Response, Energy Efficiency, and Renewable Energy



Economic and Jobs Impacts

Increased investments in energy efficiency rather than construction of new conventional power generation would result in significant reduction in consumer energy expenditures over the next 15 years, while promoting robust job growth in the state (see Table ES-2). The energy efficiency policies would reduce consumer energy savings by over \$28 billion relative to constructing new power plants, and would result in the creation of more than 14,000 new jobs—many trade jobs related to the implementation of the energy efficiency measures. The direct and indirect total jobs mean that the efficiency strategy would be equivalent to nearly 100 new manufacturing plants relocating to Florida, but without the demand for infrastructure and other energy needs. And, in light of recent volatility in energy prices, the efficiency strategy would have an added benefit of balancing the fuel supply and therefore stabilizing energy prices.

The state's environment would benefit as well, with reductions in conventional power plant operations reducing sodium dioxide (SO₂) by more than 16 thousand tons and nitrogen oxides (NO_x) by almost 11 thousand tons. With concern growing about global warming, these efficiency measures would reduce carbon dioxide (CO₂) by over 37 million metric tons in 2023, making a down payment of reducing the state's carbon signature.

Table ES-2. Economic Impact on the State of Florida of Expanded Energy Efficiency

Financial Impacts (Millions of \$2004)	2008	2013	2018	2023
Annual Consumer Outlays	1	1,585	2,172	2,584
Annual Electricity Savings	3	1,174	2,679	4,674
Electricity Supply Cost Adjustment	(1)	(894)	(1,867)	(2,975)
Net Consumer Savings	3	484	2,375	5,065
Net Cumulative Energy Savings	2	840	8,652	28,250
Macroeconomic Impacts	2008	2013	2018	2023
Jobs (Actual)	(33)	366	7,557	14,264
Wages (Million \$2004)	(2)	(168)	(62)	64
GSP (Million \$2004)	(4)	(1,134)	(1,857)	(2,745)
Estimate of Avoided Emissions *	2008	2013	2018	2023
SO ₂ (thousand short tons)	0.0	5.9	10.8	16.3
NO _x (thousand short tons)	0.0	3.7	6.7	10.9
CO ₂ (million metric tons)	0.0	11.1	21.8	37.1

* Note: Emissions are based on average emission rates.

Conclusions

Based on this analysis, we are confident that energy efficiency and renewable energy can change Florida's energy future for the better. Energy efficiency resource policies can offset the majority of projected load growth in the state over the next 15 years. Expanded development of renewable energy resources in the state would further reduce future needs for conventional generation. Combined, these policies can meet nearly 30% of projected needs

for electricity in 2023, deferring the need for many new electric power generation projects in the state.

The economic savings from the recommended energy efficiency policies alone in this report can cut Florida consumers' electricity bills by about \$840 million by 2013 and \$28 billion by 2023. While these savings will require substantial investments, they cost less than the projected cost of electricity from conventional sources. In addition, the investments would save consumers money while creating new jobs for the state.

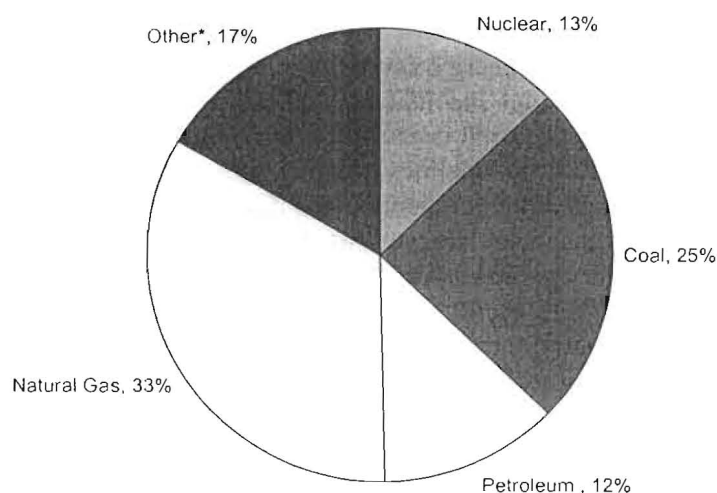
Reducing demand for electricity with efficiency and renewables will also reduce emissions from the combustion of fossil fuels at utility power plants, offering the state a more sustainable environmental future at an affordable cost and allowing the state to start on a path to reducing its global warming emissions.

Florida faces important decisions regarding its energy future. The current course calls for investments in new coal, gas, and potentially nuclear generation to make sure that the state has enough electricity to sustain its economic prosperity. Energy efficiency and renewable energy resources would offset some of that growth in demand, offering a lower cost, cleaner, and more stable energy path, without sacrificing Florida's quality of life or its economic growth.

INTRODUCTION

The past decade has seen fundamental shifts in national energy markets. Low prices and surplus capacity for both natural gas and electricity in the 1990s have been replaced by high natural gas prices and rising electric prices, resulting from tight natural gas markets and constraints in other generating fuels markets (Elliott 2006). Florida has been particularly hard hit by this shift because of its dependence on natural gas for electric power generation. The state generates 32.5% of its electricity (see Figure 1) from natural gas (FPSC 2006a), in contrast to a national average of 13.7% (EIA 2006a). By 2015, natural gas-fired electricity is expected to comprise 43.7% of Florida's generation mix (FPSC 2006a).

Figure 1. Florida 2005 Utility Energy Generation by Fuel Type (%)



* "Other" includes Non-Utility Generation (3.3%), Wholesale (7.1%), Hydro (0.1%), and Non-Specified (6.3%).

Tightening natural gas markets in the early years of this decade began to create problems for the state as rapidly growing demand for electricity exceeded deliverability of the natural gas supply system. The resulting market tightness has amplified natural gas price volatility (Elliott 2006). The hurricanes of 2005⁵ were felt particularly strongly in Florida as disruptions in natural gas production and transmission imperiled temporarily electricity system reliability for the state. These problems have led to calls to diversify the state's fuel mix while adding new capacity to meet growing demand. The Florida Public Service Commission (FPSC) projects summer peak demand to grow at 2.39% per year and winter peak to grow at 2.36% annually over the next ten years (FPSC 2006a). This means that the state will need to find additional energy resources (Economy.com 2007).

According to FPSC, the utility industry's response to the challenge of meeting the growth has been to propose construction of about 10,500 MW of new natural gas and 5,200 MW of new coal capacity (FPSC 2006a). The FPSC has also called for greatly increased resource

⁵ For more information, see Energy and Environmental Analysis, Inc. (2005) on the effect of the hurricanes.

commitments in fuel diversity, energy efficiency, demand response, and renewable generation (FPSC 2006a).

The state took some initial steps, as evidenced by the passage of the *2006 Florida Energy Act* (SB 888), that focused some attention on both renewable energy and energy efficiency as resource options, rather than relying on conventional power supply resources. The legislation established a solar rebate program, grant and tax credit opportunities, and a sales tax holiday for ENERGY STAR® appliance purchases. The Public Service Commission must review the state's need for new generation, and any proposed steam generator larger than 75 MW is subject to a Commission need determination; as part of that proceeding, the proposing utility must show that "all cost-effective conservation and demand-side management (DSM) opportunities have been exhausted in order to obtain a need determination order for new electric generating capacity" (FPSC 2006a).

Although total peak demand and energy saved by Florida's investor-owned utilities have increased over the past decade, total expenditures in DSM recovered by utilities fell steadily between 1995 and 2004. This occurred because Florida requires energy efficiency programs to meet a cost-effectiveness test, but declines in the capital and fuel costs of new generating units lowered the potential cost reduction benefits from deferring generating capacity. At the same time, changes in appliance standards and building codes to increase energy efficiency left less opportunity for utility-sponsored efficiency programs to make a substantive, cost-effective impact (FPSC 2006c). Recently, investor-owned utilities have filed significant new DSM plans, though the focus of the plans remains largely focused on demand reductions rather than energy savings as a result of the direction provided by the FPSC (IOU 2007).

Scope and Purpose of this Project

This report estimates the capacity for energy efficiency and renewable energy resources in Florida and suggests a suite of policy options that the state should consider to realize their achievable potential. As the report will show, energy efficiency resources are available at a fraction of the cost of new conventional generation, slowing the rate of energy demand growth while offering greater resource diversity and system reliability compared with construction of major new conventional generation. Expanded energy efficiency policies will also result in energy cost savings to consumers, creation of new jobs in the state as a result of the investments and substantial reduction in emissions from electric power generation. Expanded investment in renewable energy resources would reduce emission even more and place the state on the path for a sustainable energy future.

The remainder of this report is divided into five sections:

1. Overview of the reference case used for this analysis and how the results should be used;
2. An assessment of the economic potential for energy efficiency, combined heat and power, renewable energy, and demand response;
3. Suggestion of a portfolio of policy recommendations that could help realize the resource potential identified in the economic assessment, and projected impacts of these policies;

4. Suggestions on how these policies might be implemented in Florida; and
5. The assessment of the economic impacts of the suggested policies on the economy of the state, employment and consumer energy bills, and reduction in emissions.

Details on the analyses and assumptions are included in appendices along with the detailed results tables.

OVERVIEW OF ANALYSIS

Methodology

We approached this analytical effort by building upon other state resource potential analyses that ACEEE has undertaken over the past two decades. During these years, we have developed a general approach as follows:

1. We began the analysis by developing reference projections for electric consumption and demand, disaggregated by end-user category (e.g., residential, commercial, and industrial) based on available data, along with estimates of energy prices and utility avoided costs (as discussed in the next section).
2. We then assessed the potential for energy savings and demand reduction in each sector, based on available technology performance and cost.
3. We applied the savings projections to the reference case to estimate the impact that efficiency and renewable resources could have on the state's energy future.
4. We developed a set of policy proposals that have achieved results reliably in other states' energy markets, and we estimated the fraction of the potential savings that would be realized if these policies were implemented.

ACEEE's research has identified three general types of energy efficiency and renewable energy resource potential: technical, economic, and achievable.

- The technical potential represents what can be saved from available or emerging efficiency and renewable technologies and practices without considering the cost of the measures.
- The economic potential represents the fraction of the technical potential that is cost-effective under a set of technology costs and avoided costs developed for the analysis period.
- The achievable potential represents the fraction of the economic potential that can plausibly be realized in the marketplace given market constraints (e.g., equipment turnover rates) and the impacts of programs and policies that could be implemented. For purposes of this study, we have elected not to develop an entirely new set of technical potential data, because numerous studies conducted by ACEEE and others have largely characterized the potential measures that are available in Florida. This allowed us to focus on the more important economic potential and achievable potential estimates (see Nadel, Shipley, and Elliott 2004 for a more detailed discussion of these issues and past research).

With respect to the achievable potential estimates, we have relied upon results from the best-practice programs and policies that have been implemented in other states in recent years; these are discussed in the section on policy recommendations. While the economic potential reported here represents the overall size of the resource, for policy-making decisions, the appropriate focus should be on achievable potential results.

Energy Demand Reference Case

In order to determine energy efficiency potentials for Florida, it was first necessary to establish disaggregated reference case energy consumption and demand forecasts. There are currently no publicly available long-term energy consumption forecasts that include both statewide and end-use sector (residential, commercial, and industrial) breakdowns. We used short-term electricity sales and summer peak demand forecasts (through 2015) from the Florida Reliability Coordinating Council (FRCC) and applied an average growth rate to project to the year 2023 (FRCC 2006) (see Tables 1 and 2). For electricity consumption data, we used FRCC’s total and end-use sector data, which accounts for conservation in each sector. For peak demand forecast, we used FRCC’s “Summer Net Firm Peak Demand,” which accounts for demand reduction from conservation and load management. Sector-specific forecasts of peak summer demand, however, were not included in FRCC data.

We also used publicly available data from the U.S. Department of Energy’s Energy Information Administration (EIA) and purchased data from economy.com for other economic information to produce sector-specific data for the electricity consumption reference case forecast.

Table 1. Florida Reference Case Electricity Consumption Forecast by End-Use Sector

Sector	Million kWh			2008–2023
	2008	2013	2023	Average Growth Rate
Electricity Consumption—All Sectors (million kWh)*	232,396	265,566	349,059	2.8%
Residential	120,011	137,401	179,259	2.7%
Commercial	83,456	96,572	131,960	3.1%
Industrial [†]	22,541	24,306	31,412	2.2%
Peak Summer Demand—All Sectors (MW)	45,029	50,611	64,184	2.4%

* Total electricity sales also include street and highway lighting and unspecified “other” sales, which are not specified here.

[†] Note that the FRCC estimates for industry are used for the policy estimates, but that a more detailed disaggregated forecast discussed below is used for the economic analysis.

Figure 2. Reference Forecast for Electricity Consumption by Sector

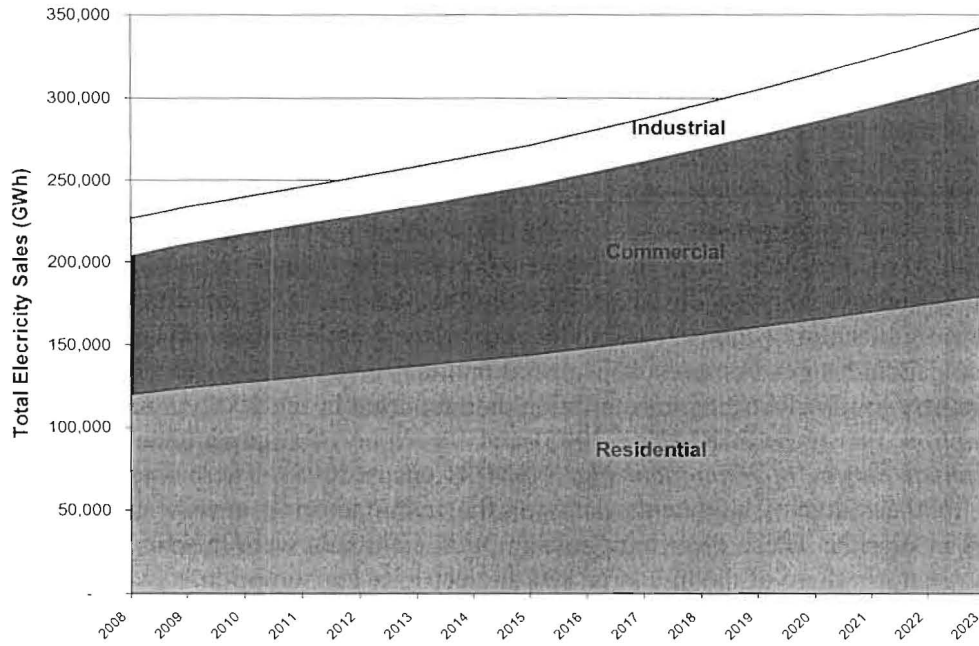
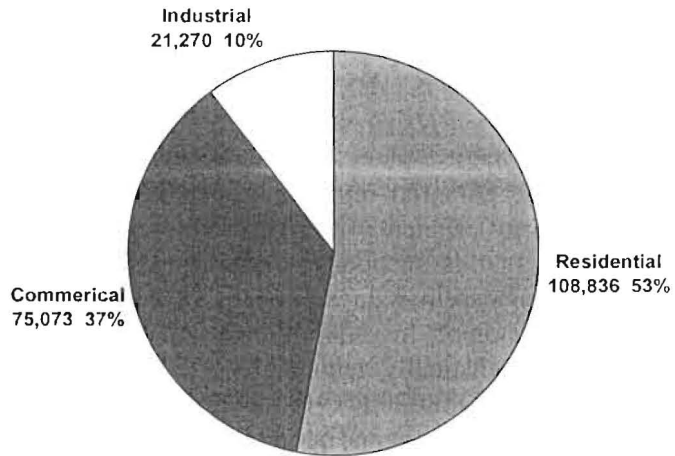


Figure 3. 2005 Florida Electricity Consumption (Million kWh)



Source: FRCC 2006

Industrial Sector

Comprehensive, highly disaggregated electricity data for the industrial sector is not available in the state-level FRCC forecast. To estimate the electricity consumption, this study drew upon a number of resources, all using the same classification system⁶ and sample methodology. Fortunately, a conjunction of the various economic censuses for each state allows us to use a common base year of 2002. The major data source available for Florida was *2002 Economic Census Subject Series for Mining and Manufacturing* (Census 2006).

Unfortunately, disaggregated state-level electricity consumption data was not reported for the sub-sectors (such as chemical, paper, primary metals industries, etc.). Because of the magnitude and diversity in this manufacturing sub-sector, it is important to disaggregate beyond the sub-sector or industry group level (e.g., the fraction of pharmaceutical products in the chemicals industry). As a result, we used national industry electricity intensities derived from industry group electricity consumption data reported in the *2002 Manufacturing Energy Consumption Survey* (MECS) (EIA 2005) and the value of shipments data reported in the *2002 Annual Survey of Manufacturing* (ASM) (Census 2005). These intensities were then applied to the value of shipments data for the manufacturing energy groups (three-digit NAICS) in Florida. These electricity consumption estimates were then used to characterize each sub-sector's share of the industrial sector electricity consumption.

Because state-level disaggregated economic growth projections are not publicly available, data was used from the *Annual Energy Outlook 2006* (AEO) (EIA 2006b). The growth rate of industrial electricity consumption from the 2006 AEO was applied to the base year (2002) disaggregated electricity consumption. These values were then calibrated to the 2005 industrial electric sales as stated in the *2005 Electric Power Annual* (EIA 2006c).

ECONOMIC POTENTIAL: COST-EFFECTIVE ENERGY SAVINGS FROM EFFICIENCY AND RENEWABLE ENERGY

As noted above, the economic potential represents an assessment of the overall resource potential that exists from energy efficiency and renewable energy, given an assessment of full benefits and full costs. In this section, we evaluate energy resources that are cost-effective, i.e., the dollar savings from reduced energy consumption or demand outweighs implementation costs to the customer. In general, experience with actual programs suggests that only a portion of this is realistically achievable in the real world from programs and policies (see Nadel, Shipley, and Elliott 2004). In the next section, we explore the fraction of this economic resource potential that can be realistically achieved through a suite of suggested policies, limiting our analysis to full policy and investment costs, but only direct electricity bill impacts or savings. This analysis does not take into consideration any externalities, such as avoided emissions, avoided future carbon control risks, health implications, or other indirect benefits of this deployment of these resources. If these costs were included, energy efficiency and renewable energy resources would be even more cost competitive with conventional fossil-fueled generation.

⁶ ACEEE's industrial analyses use the North American Industrial Classification System (NAICS) to disaggregate industrial sector economic activity and energy use.

Residential Efficiency

In 2005, Florida's residential sector consumed about 50% of the state's electricity use. There is a large potential for cost-effective electricity savings in the state from energy efficiency improvements in both existing and new homes. To estimate this potential for homes in Florida, detailed building energy use analysis was conducted for both new and existing residential buildings. The analyses were conducted using the EnergyGauge® software suite.⁷ This software suite uses the DOE-2.1E building energy simulation engine, with simulation enhancements and a user-friendly front-end and report preparation functions written by the Florida Solar Energy Center (FSEC), to simulate energy use.

Baseline homes were created for both existing and new building prototypes and then efficiency improvement measures for these baselines were compared on a measure-by-measure basis to determine the energy and demand savings potential for each measure. For residential buildings, a table of costs was prepared using a combination of the R.S. Means database (RSMMeans 2005) and the best judgment and experience of the authors. The detailed cost data used for this analysis are given in Appendix A.

For residential buildings, the existing baseline prototype was configured using a process that "calibrated" the home's characteristics against a large data set of monitored existing home energy end-use characteristics that were measured in central Florida homes (Parker 2002). For new homes, the baseline prototype was configured to reflect the minimum code compliance characteristics of the latest edition of the Florida Building Code, which became effective December 8, 2006. These new Florida building code requirements are closely aligned with the minimum requirements of the 2006 International Energy Conservation Code (IECC). The detailed characteristics of the new and existing baseline homes along with the individual efficiency improvements considered by the analysis are provided in Appendix A.

Using the simulated energy savings, the cost data, and a capital recovery discount rate of 4.5%, a levelized cost of conserved energy (CCE) was calculated for each efficiency measure (Meier, Wright, and Rosenfeld 1983). Using the CCE, sets of efficiency "packages" were then created by selecting non-competing single efficiency measures that produced CCEs of less than \$0.11/kWh.⁸ These packages were then simulated to determine the energy and demand savings and the levelized cost for each package. For new homes, an ENERGY STAR new home and a federal tax credit package were also created and analyzed by combining the most cost-effective efficiency measures from the measures list that qualified the homes for these programs. To estimate the statewide potential for energy savings in both existing and new homes, the savings from each package of efficiency measures were then applied to a percentage of homes to which the cost-effective measures would be applicable.

Existing homes can achieve significant energy savings through more efficient air conditioners, insulation improvements, and more efficient lighting and appliances. Efficiency measures in Package EHI includes six replacement measures: SEER 15 air

⁷ EnergyGauge is a registered trademark of the Florida Solar Energy Center. See <http://energygauge.com/>

⁸ The cut-off of \$0.11/kWh was selected as a reasonable value in light of the fact that the average retail residential cost of electricity in Florida is currently running at about \$0.12/kWh.

conditioner and 9.0 HSPF heat pump; efficient air ducts (reducing air leakage from 10% to 3%); ceiling insulation improvement from R-18 to R-30; solar hot water system; 50% fluorescent lighting replacement; and programmable thermostats. At a levelized lifecycle cost of about \$0.10 or less per kWh saved, homeowners can reduce electricity consumption by up to 28% by implementing these measures. We assume that 50% of homes can cost-effectively implement Package EH1 measures by 2023, for a total savings of 15,681 GWh statewide by 2023. Package EH2 achieves even greater savings: about 47% electricity savings per home at a cost of about \$0.07 per kWh saved. In addition to the measures included in Package EH1, Package EH2 also includes the replacement of an old refrigerator with an ENERGY STAR unit, selection of ENERGY STAR ceiling fans, the replacement of a standard roof with a cool roof (high performance roofing materials), the replacement of regular windows with high-efficiency windows, and a change of wall color to white. We assume that by 2023, 20% of homes can cost-effectively achieve Package 2 efficiency measures, resulting in statewide savings of 11,628 GWh.

New homes built in the 15-year period between 2008 and 2023 can achieve significant additional savings. A total of 30 new home measures and measure packages are analyzed by this study (see Figure 4 for cost and savings information for these measures). The acronyms and descriptions of the single measures and measure packages are given in Appendix Table A-1. New homes that achieve 50% savings of heating and cooling energy (or about 25% savings of total home energy use), which are currently eligible for a \$2,000 federal tax credit, are achievable at a levelized cost of \$0.03 per kWh saved when the tax credit is used. A second package reaches the Energy Star level of performance (15% savings) and results in a levelized cost of \$0.06 per kWh saved. A third option for new homes is a more aggressive package of measures (Package NH1) that reaches 40% total energy savings at a cost of about \$0.06–0.07 per home.

A high level of adoption of efficiency measures in new buildings is achievable through building energy codes. We assume that 50% of new homes in 2008 can meet the cost-effective ENERGY STAR specifications and that new Florida building codes mandating 15% savings above today's code go into effect in 2009, resulting in savings of 5,764 GWh by 2023. We assume that 50% of new homes built between 2008 and 2023 can achieve the Tax credit eligible homes level of savings, resulting in additional savings of about 3,894 GWh. We assume that 10% of new homes can achieve the Package NH1 savings cost-effectively, resulting in an additional 838 GWh of electricity savings by 2023. Using these assumptions, we estimate that there is an economic potential (i.e., potential for cost-effective energy efficiency measures) of 40,293 GWh statewide electricity savings by 2023, or 22% of the projected electricity consumption of 179,259 GWh in the same year. See Table 2 for the breakdown of potential savings.

Figure 4. Annual Energy Savings and Levelized Cost of Conserved Energy for Energy Savings Measures and Packages for New Homes in South Florida (Miami)

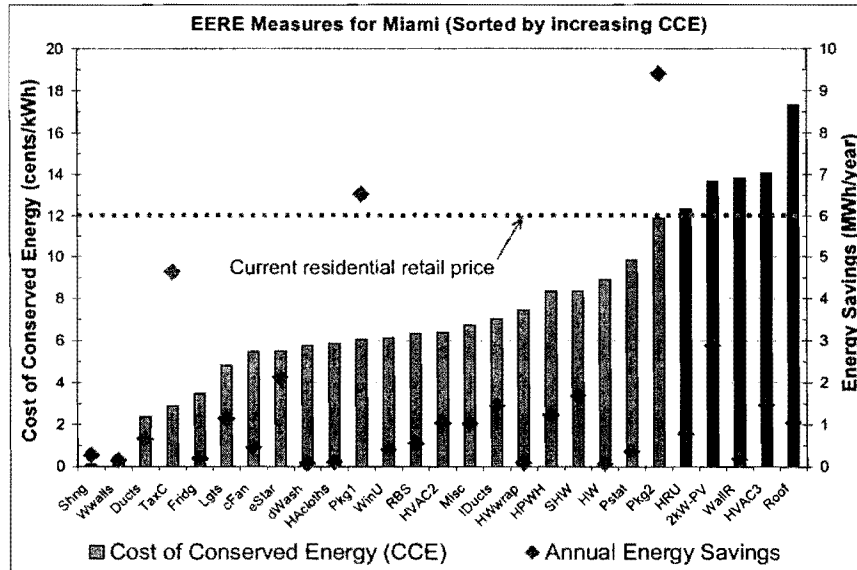


Table 2. Residential Energy Efficiency Measures

Existing Homes Efficiency Measures	kWh Saved per Home per Year (Statewide Average)	2023 Statewide Savings (GWh)	Economic Savings Potential (% of Total Residential Electricity Potential)	Cost per kWh Saved
Package EH1	3504	15,681	39%	\$ 0.10
High-efficiency air conditioner (SEER-15; HSPF-9)	977			\$ 0.09
Ducts: Normalized leakage 0.10 to 0.03	589			\$ 0.08
Ceiling insulation: R-18 to R-30	560			\$ 0.06
Solar hot water system	1780			\$ 0.08
50% fluorescent lighting replacement	803			\$ 0.06
Programmable thermostat with 2°F setup/setback	403			\$ 0.08
Package EH2^a	6,497	11,628	29%	\$ 0.07
Cool roof	353			\$ 0.00
ENERGY STAR refrigerator	157			\$ 0.04
ENERGY STAR ceiling fans	560			\$ 0.03
Miscellaneous load reduction (30%)	717			\$ 0.09
Window replacement (U=0.39; SHGC=0.40 vinyl)	1257			\$ 0.04
White walls (alpha = 0.40)	233			\$ 0.00
New Construction				
ENERGY STAR Home (15% savings)	2,021	8,252	20%	\$ 0.06
Tax Credit Eligible Home (25% savings) ^b	1,857	3,894	10%	\$ 0.03
Package NH1 (40% savings) ^c	1,998	838	2%	\$ 0.07
Total Savings (GWh)		40,293	100%	\$ 0.056
% Savings (% of 2023 Projected Sales)		22%		

^a Package EH2 efficiency measures also include all measures in Package EH1.

^b Savings are incremental to ENERGY STAR Homes.

^c Savings are incremental to both ENERGY STAR homes and Tax Credit Eligible Homes.

Commercial Efficiency

In 2005, Florida's commercial sector consumed about 40% of the state's electricity use. To estimate the potential for energy efficiency in commercial buildings in Florida, we defined baseline characteristics of the existing and new commercial buildings stock and then analyzed cost-effective packages of efficiency improvements in eight prototypical building types. We used the 1993 vintage Florida code requirements to define the baseline characteristics of the existing commercial building stock and the 2006 version of Florida's code to define the baseline characteristics of new commercial buildings. The 1993 vintage Florida code is equivalent to ASHRAE Standard 90.1-1989 and the 2006 version of the Florida code is equivalent to ASHRAE Standard 90.1-2004.

A total of eight commercial building types were simulated and analyzed by this study. These prototypes were developed by LBNL (Huang & Franconi 1999) based on the Commercial Buildings Energy Consumption Survey (EIA 1995). These prototypes represent building types, which cover 85% of the commercial building stock surveyed by CBECS. See Table 3 for a breakdown of potential savings by building type. The building types and sizes are:

- Large office (90,000 ft²)
- Small office (6,600 ft²)
- Large retail store (80,000 ft²)
- Small retail store (6,400 ft²)
- School (16,000 ft²)
- Hospital (155,800 ft²)
- Large hotel (250,000 ft²)
- Restaurant (5,200 ft²)

For the small existing building prototypes, the energy efficiency improvements included T-8 lighting retrofits and occupancy sensors, window film retrofit, cool roof retrofit, EER 12.5 air conditioning replacement, and variable speed drive blowers. For the large existing building prototypes, improvements included the same measures as for the small existing prototypes, except that chiller plant efficiency was improved to COP=4.7 rather than air conditioning replacement.

For the small new building prototypes, the energy efficiency improvements included improved wall and roof insulation (R-13 and R-30, respectively), a cool roof, daylighting and occupancy sensors, and high-efficiency cooling (EER-12.5) with variable speed drive blowers. For the large new building prototypes, the measures were the same except that the chiller plant efficiency was improved to COP=6.0.

According to our analysis, the economic efficiency potential for the commercial sector is roughly 30%, or 39,495 GWh, by 2023. The majority of the savings come from energy efficiency improvements in existing buildings (20,765 GWh), while significant additional savings can be achieved through advanced new buildings (18,730 GWh). See Table 3 for a breakdown of savings by building type and Appendix Tables A-11s and A-11b for more detailed efficiency measure savings information by region.

Table 3. Economic Potential for Energy Efficiency in Commercial Buildings

Existing Building Measure Savings	Sm. Office kWh/yr	Lg Office kWh/yr	Lg. Hotel kWh/yr	Sm. Retail kWh/yr	Lg. Retail kWh/yr	Restaurant kWh/yr	School kWh/yr	Hospital kWh/yr
<i>Baseline Energy Use:</i>	87,468	1,544,634	4,694,226	114,970	1,564,765	275,782	176,372	8,991,263
Roof Absorptivity	1,865	6,388	5,315	1,827	14,837	3,038	2,340	7,863
Window Shading Coefficient	3,365	108,195	234,397	6,542	31,495	4,362	7,159	91,310
Lighting Watts per SF*	14,135	176,429	571,484	18,094	271,341	31,969	25,056	935,102
Cooling System EER=12.5	10,054	n/a	n/a	14,454	n/a	22,702	n/a	n/a
Cooling Plant COP=4.7	n/a	81,700	283,843	n/a	68,284	n/a	10,858	458,080
Fan Watts per CFM (VSD fans)	n/a	41,019	110,832	n/a	34,090	n/a	3,691	205,024
Existing Buildings Package	27,378	388,518	942,976	37,708	394,513	58,560	46,230	1,622,504
Package savings (%)	31.3%	25.2%	20.1%	32.8%	25.2%	21.2%	26.2%	18.0%
New Building Measure Savings								
<i>Baseline Energy Use:</i>	60,318	1,121,008	3,484,331	90,149	1,431,837	241,115	119,957	8,795,278
R-Value of External Walls	4,138	36,722	76,250	1,610	11,876	5,270	1,617	33,940
R-Value of Roof	756	1,928	3,272	600	5,155	1,556	1,019	1,990
Roof Absorptivity	1,275	3,377	4,316	1,093	10,540	2,235	1,394	5,240
Lighting Watts per SF	11,514	197,810	552,650	31,855	536,599	56,402	23,130	1,727,534
Cooling System EER	5,790	n/a	n/a	8,165	n/a	13,336	n/a	n/a
Cooling Plant COP	n/a	104,292	386,938	n/a	133,476	n/a	14,488	921,319
Fan Watts per CFM (VSD)	n/a	72,712	242,729	n/a	94,020	n/a	9,126	632,462
New Package	21,630	319,091	957,498	41,355	643,377	75,046	42,837	2,526,488
Package savings (%)	35.9%	28.5%	27.5%	45.9%	44.9%	31.1%	35.7%	28.7%
Statewide Savings in 2023 (GWh)								
Existing Buildings	4,098	3,293	3,045	2,869	2,205	2,434	1,457	1,362
<i>Total Existing Buildings</i>	<i>20,765 GWh, 16% of projected electricity sales in 2023</i>							
New Buildings	2,979	2,365	2,758	2,559	2,504	2,284	1,362	1,324
<i>Total New Buildings</i>	<i>18,730 GWh, 14% of projected electricity sales in 2023</i>							
Total Savings in 2023	39,495 GWh, 30% of electricity sales in 2023							

* Daylighting

** T-8 and Occupancy Sensors

Industrial Efficiency

In 2004, Florida's industrial sector consumed 19,518,051 MWh of electricity. Within the manufacturing sector, chemical manufacturing (NAICS 325) dominated at 18.4% of the electricity use, with phosphate fertilizer production the state's largest industrial electric energy user. Nonmetallic mineral products, food, paper, and computer and electronics followed at 12.7%, 9.8%, 9.7%, and 9.0%, respectively, of electricity use.

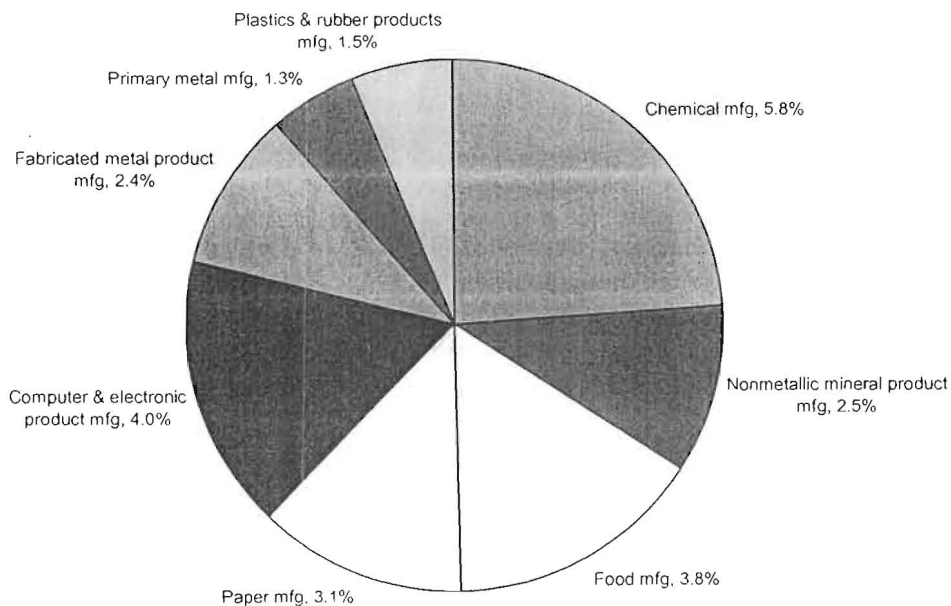
We accomplished our analysis of electricity savings potential in a series of steps. First, the project team characterized the industrial electricity market in Florida. Then energy-saving technologies were selected for analysis based on prior ACEEE analyses, and we estimated the economic potential based on these measures. Twenty-one distinct measures and measure bundles were analyzed (13 of which were cost-effective, with a cost of saved energy under \$0.07/kWh saved) across 22 industrial sub-sectors for the Florida industrial sector. The measure bundles are presented in Table 4.

Table 4. Industrial Energy Efficiency Measure Bundles

Measure	Cost of Saved Energy (\$/KWh saved)	Percent Savings Attributable to each Individual Measure	Economic Savings Potential (% of Total Industrial Electricity Potential)
Sensors and controls	0.02	1.4%	5.8%
Pipe insulation	0.065	4.1%	16.7%
Electric supply improvements	0.01	4.0%	16.5%
Lighting	0.03	3.4%	13.7%
Motor design	0.03	3.8%	15.6%
Motor management	0.02	0.7%	2.7%
Lubricants	—	0.6%	2.3%
Motor system optimization	0.01	0.4%	1.5%
Compressed air management	—	2.1%	8.6%
Compressed air—advanced	0.00	0.1%	0.4%
Pumps	0.01	2.9%	11.7%
Fans	0.03	0.7%	3.0%
Refrigeration	0.00	0.4%	1.4%
TOTAL		24.4%	100%

According to our analysis, the economic efficiency potential for the industrial sector is roughly 24%. The savings can be broken down by industry type as presented in Figure 5.

Figure 5. Fraction of Potential Savings by Industry Type



Combined Heat and Power Systems

Combined heat and power (CHP), also known as cogeneration, involves co-production of two or more usable energy outputs (e.g., electricity and steam) from a single fuel input. By harnessing much of the energy normally wasted in power-only generation, significant improvements in efficiency can be realized relative to separate production of power and thermal energy (see Elliott and Spurr 1999).

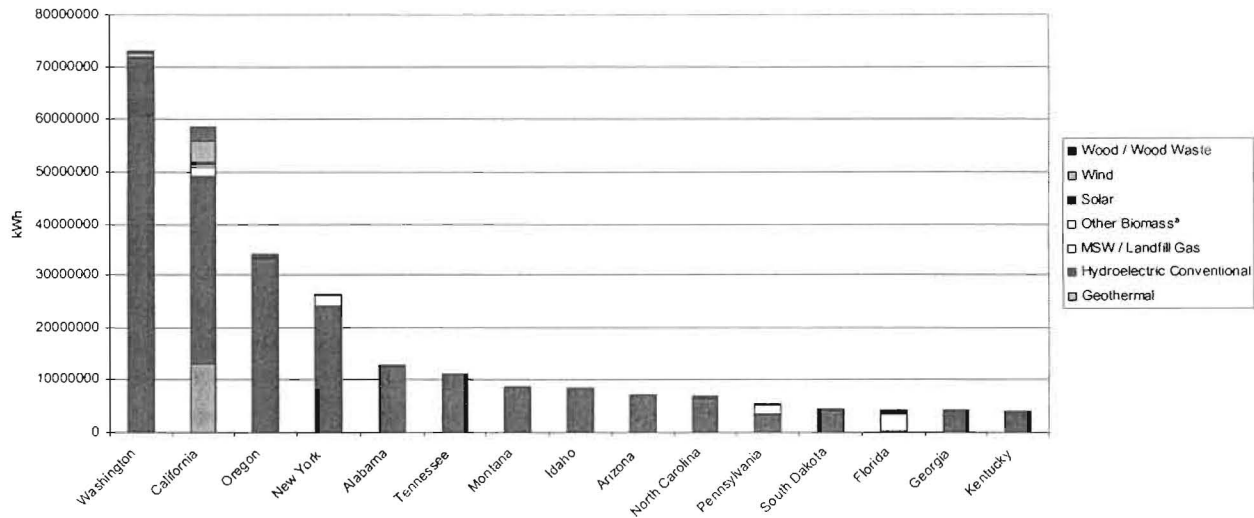
While Florida has some installed CHP, most of the capacity is PURPA QF, since utility policies have significantly discouraged expansion of this capacity (Brooks, Eldridge, and Elliott 2006; Davis 2007). The state also lacks standard retail interconnection policies, creating significant uncertainty and costs for potential Facilities considering installing CHP in the state. There are also no net metering rules where CHP is eligible (DSIRE 2007), which serves to severely limit the economic feasibility of any new projects. Although Florida is certainly not the only state where this is the case, the lack of net metering and uniform interconnection standards for CHP makes for a particularly harsh environment for the development of this important resource.

One important application of CHP is in the production of power and cooling through the use of thermally activated technologies such as absorption refrigeration. This application has the benefit of producing electricity to satisfy onsite power requirements and displacing electrically generated cooling, which both reduce demand for electricity from the grid, particularly at periods of peak demand (see Elliott and Spurr 1999). We estimate that a technical potential of almost 11,370 MW of additional CHP could be available in the state of Florida by 2023. If Florida's barriers to CHP adoption were to be effectively addressed, our analysis estimates that over 400 MW of additional CHP would be economically achievable at current fuel and electricity prices, without incentives, in 2023. Were incentives on the order of \$600/kW provided for the installation of CHP systems (far less than the cost of any new generation technology), the economic potential would almost double. For details on estimation of the technical and economic potential for CHP, see Appendix A.

Renewable Resources in Florida

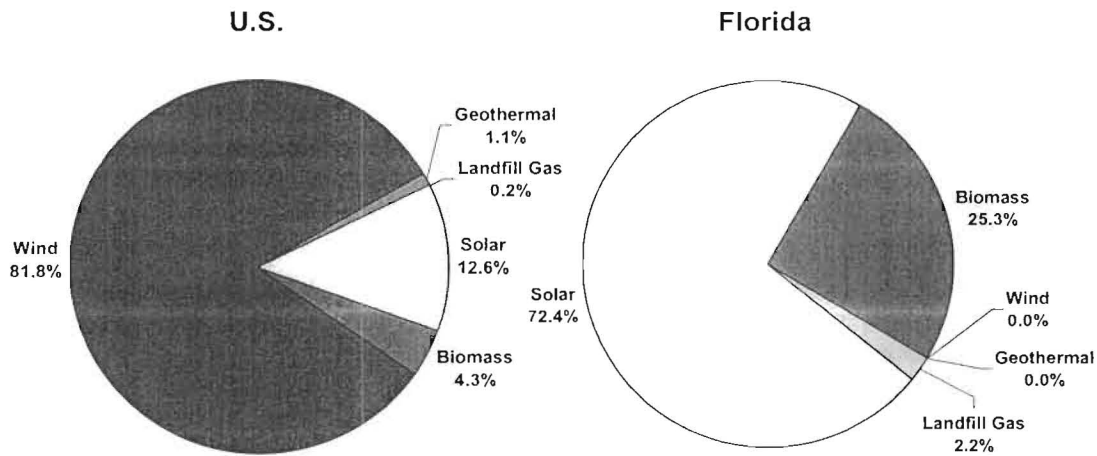
Florida ranks 13th among the states in installed renewable resources with the current base dominated by landfill gas and municipal solid waste (see Figure 6). Compared with other states, Florida is not particularly rich in renewable resources, with just 0.3% of the identified renewable resources in the United States. The available resources of about 57 Billion kWh would be able to only meet a quarter of the state's 2003 electricity need while the nation as a whole is estimated to have renewable resources of over five times its 2003 electricity need. As Figure 7 suggests, the absence of wind in Florida, which dominates the national resource, accounts for the majority of this difference (Deyette, Clemmer and Donovan 2003). Florida's resources are dominated by solar and biomass. This lack of wind resource is based on a late 1980s assessment, which may underestimate the potential based on current higher hub heights as well as significant offshore potential that were not considered in these assessments. Unfortunately, the National Renewable Energy Laboratory has not yet updated these assessments for Florida (Clemmer 2007). Individual renewable resource assessments from this study are presented in the appendices.

Figure 6. 2003 Renewable Energy Production in Florida



Source: Hartman 2007

Figure 7. Comparison between the Renewable Energy Resource Potential in Florida and U.S.



Source: Clemmer 2007

It is important that the state have a better understanding of the renewable resource available to the state, taking into account the advances in technology, particularly related to wind power, which may mean that the resources estimated here represent only a portion of the potential in fact available in the state. If the federal government is unwilling to commit the resources to complete the assessment, the state should consider funding the effort.

ACHIEVABLE POTENTIAL: ENERGY EFFICIENCY AND RENEWABLE ENERGY POLICIES

As noted in a report prepared for the Department of Community Affairs (FSEC 2004), there have been limited efforts to accelerate investment in energy efficiency and renewable energy in the past. In part this results from the FPSC's focus on demand reductions in their regulatory guidance to the utilities. As a result, there are many opportunities for policies to encourage savings. We recommend the consideration of eleven specific policies that will provide a significant turn on investment and put Florida on the path to true diversity and cost savings.

1. Utility-Sector Energy Efficiency Policies and Programs
2. Appliance and Equipment Standards
3. Building Energy Codes
4. Advanced Building Program
5. Improved CHP Policies
6. Industrial Competitiveness Initiative
7. State and Municipal Buildings Program
8. Short-Term Public Education and Rate Incentives
9. Expanded Research, Development, and Demonstration Efforts
10. Renewable Portfolio Standard (RPS)
11. Onsite Renewables Program

These policies would establish a foundation upon which the state could build a sustainable energy future, while bolstering the state's economic health. This report provides an overview of the impacts that could be achieved from these policies and then discusses each of the policies in greater detail.

In addition, we also recommend that the state consider implementing a robust demand response effort to curtail energy use during times of peak demand. While the utilities in the state have had various curtailable tariffs for many years, there is much more that could be done to reduce peak electrical loads, as will be discussed in a following section. Demand response programs combined with energy efficiency and renewable energy policies could significantly slow the rapid growth in peak demand reported by the state's utilities (FPSC 2006a).

Summary of Achievable Potential

If all the recommended policies were implemented, the state could meet nearly 30% of its projected electricity consumption in 15 years with energy efficiency and renewable energy, diversifying the state's generation mix and reducing the pressure on demand for conventional energy sources (i.e., natural gas, coal, oil, and nuclear fuels) (see Figure 8).

The benefits from the recommended policies regarding the state's energy supply can be seen in the near and long term: 24,278 million kWh in 2013 and 102,513 million kWh in 2023, or 9% and 29% of the state's projected electricity consumption in the same year, respectively

(see Figure 8). As can be seen in Figure 9, a utility-sector energy efficiency program, for which we recommend an Energy Efficiency Resource Standard (EERS) (a utility savings target similar to the RPS concept), represents the largest contributor to the electricity potential at 30% of the 102,513 million kWh in 2023. Renewable energy policies, which include onsite renewables and an RPS, account for about 32% of the total 2023 electricity potential. As would be anticipated because of the importance of buildings-related electric loads, buildings policies (including an improved building energy code and advanced-buildings policies) contribute about 19% toward the total.

These policies can also reduce peak summer demand for electricity by 32%, not including demand resource programs discussed later in this report. The total impacts of each policy recommendation for 2013 and 2023 are presented in Table 5. The investments required and savings benefits from each policy recommendation are presented at the end of this section.

Figure 8. Impact of Energy Efficiency and Renewable Energy Policies on Florida Electricity Sales

2023 Savings = 102,513 Million kWh

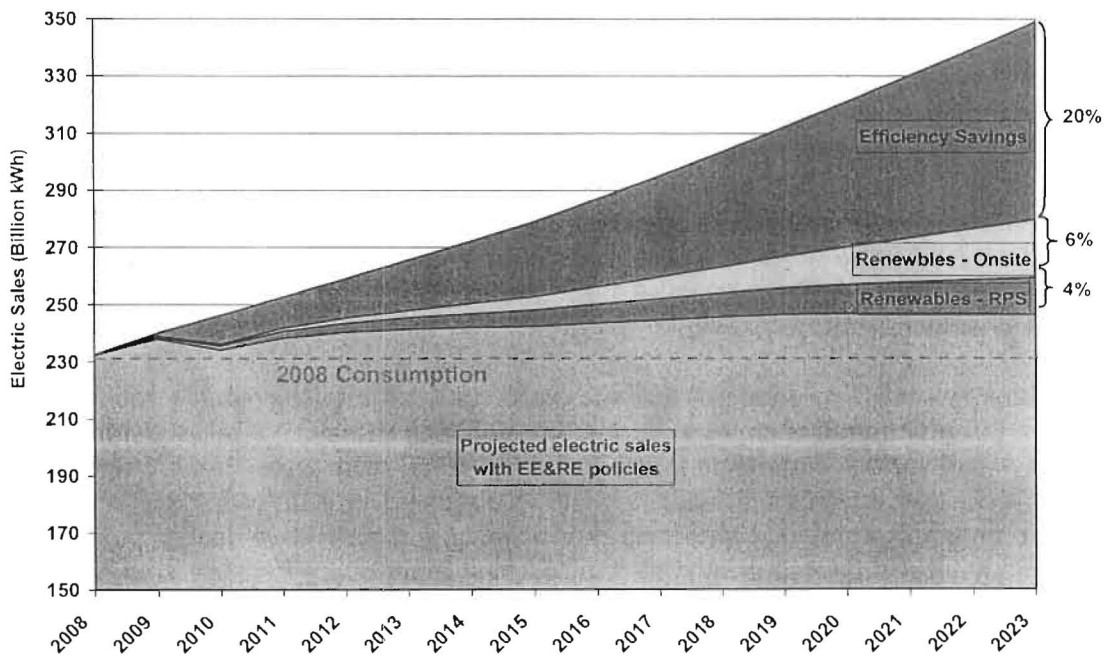


Figure 9. Electricity Savings from Policies in 2023

2023 Savings = 102,513 Million kWh

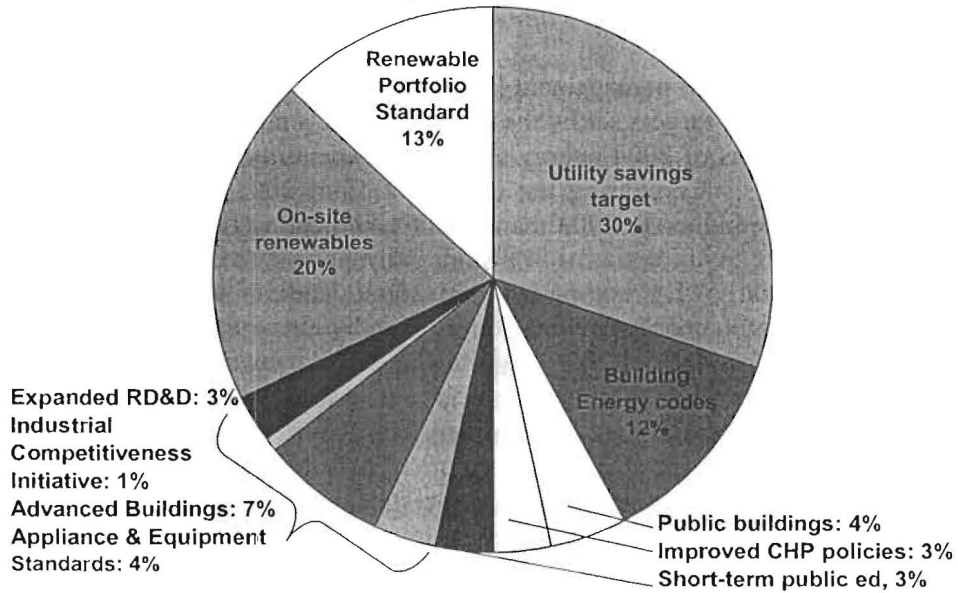


Table 5. Summary Results from Analysis of Recommended Policies

	2013		2023	
	Electricity Savings (million kWh)	Demand Savings (MW)	Electricity Savings (million kWh)	Demand Savings (MW)
<u>Energy Efficiency (EE) Policies</u>				
Utility savings target	7,183	1,375	30,962	5,828
More stringent building codes	1,760	336	12,286	2,302
Public buildings program	1,536	293	4,608	847
Improved CHP policies	1,097	172	3,291	517
Short-term public ed. & rate incentives	4,582	873	3,549	653
Appliance & equipment standards	776	233	3,680	990
Advanced building program	458	336	7,503	2,302
Industrial competitiveness initiative	232	44	676	124
Expanded RD&D efforts	23	6	2,800	756
<i>Subtotal</i>	<i>17,647</i>	<i>3,668</i>	<i>69,354</i>	<i>14,319</i>
<u>Renewable Energy (RE) Policies</u>				
Onsite renewables policy package	2,542	486	20,183	3,775
Renewable portfolio standard	4,090	779	12,976	2,386
<i>Subtotal</i>	<i>6,631</i>	<i>1,265</i>	<i>33,159</i>	<i>6,161</i>
Total	24,278	4,933	102,513	20,480

Description of Individual Policy Recommendations

Utility-Sector Energy Efficiency Policies and Programs

Florida's utilities focus on load management (shifting loads from peak to off-peak periods) as a result of the guidance and targets set by the FPSC, with less emphasis on energy efficiency (using less). In an analysis of 2004 energy efficiency expenditures by state, Florida ranked 19th among the 50 states. Comparing the increment from 2003 to 2004, energy savings achieved in Florida were higher in 2003 than in 2004, indicating that measures are wearing out quicker than they are being replaced in Florida utility energy efficiency programs (York and Kushler 2005, 2006). By comparison, in some leading states such as Vermont, California, and Connecticut, energy savings are growing by about 1% of sales each year from energy efficiency programs (Nadel 2006). While the investor-owned utilities have recently filed expanded DSM plans (IOU 2007), these efforts continue to focus on load management because of the FPSC direction. Given the energy problems facing Florida, there is an imperative for Florida to become a leader in this area. As a result, the regulatory framework for efficiency programs needs to be changed in the state, and the FPSC needs to refocus its guidance and targets for the utilities with a greater emphasis on energy efficiency.

A major reason for Florida's poor performance is that Florida still relies on the largely abandoned Rate Impact Measure (RIM) cost-effectiveness test. This test holds that if non-participating customers receive any rate increases from a program, no matter how small, the program is deemed not cost-effective, even if total system costs are reduced over the longer term. The RIM test is a very stringent test that few efficiency programs can pass as there are almost always some short-term rate impacts from efficiency programs. However, a non-participant in one year may be a participant the next year, and even chronic non-participants benefit from the fact that the long-term cost of electricity is lower because of the program. The RIM test has typically only been used for energy efficiency and has not been applied to other utility system expenditures, such as power plant resource decisions. If there were a RIM test for power plant construction, then only plants that reduce rates would be approved, few or no plants would be built, and electricity shortages could result. Energy efficiency should be considered an essential energy resource for Florida, just like new power plants. Most states recognize this and use either the Utility Cost (UC) test or the Total Resources Cost (TRC) test for assessing efficiency programs. In fact, a recent survey by ACEEE revealed that Florida was the only state among the more than 25 states with significant utility-sector energy efficiency programs that still places primary reliance on the RIM test (Kushler, York, and Witte 2006). In contrast, the other states rely on tests that compare the total costs of a program to the utility (UC), or the utility plus participating customer (TRC), with the avoided-cost benefits to the utility system of using less power. We recommend that the FPSC employ the TRC and/or UC tests as the primary vehicle(s) for assessing energy efficiency programs. If these tests were used, many more programs would be found to be cost-effective, much more energy would be saved, and total utility system costs would be reduced considerably.

In the U.S. today, three primary mechanisms are used as policies to guide utility energy efficiency efforts:

- **Traditional Demand-Side Management.** In a DSM framework, the utility plans specific programs and proposes these to the utility commission for approval. Under this approach, the level of efficiency spending and savings commonly varies from year to year depending on utility and utility commission interest in the programs. This approach was widely used in the 1980s and 1990s but is less common now.
- **Public Benefits Funds (PBF).** In a PBF framework, the legislature (or in some cases the utility commission) establishes a long-term level of funding for energy efficiency programs and the utility (or sometimes a statewide organization) plans a set of programs to optimize savings achieved within this budget. Typically funding levels are set in terms of tenths of a cent (mills) per kWh of sales. This approach is also commonly called a System Benefit Charge. This approach became popular in the late 1990s and early in this decade and is now in use in approximately 20 states (for a list, see Nadel 2006).
- **Energy Efficiency Resource Standards.** In an EERS framework, the legislature or utility commission establishes energy savings requirements and the utility develops programs to meet these goals at minimum cost. This approach is also commonly called an Energy Efficiency Performance Standard (EEPS). The advantages of this approach are that (1) the amount of savings achieved is known with some certainty and (2) the utility has an incentive to minimize costs per kWh saved. This approach has been gathering interest for the past few years. Currently, eight states have an EERS in place or in development, with more considering it. A detailed ACEEE report on this approach was published in early 2006 (Nadel 2006).

All three of these approaches could work in Florida. However, we recommend the EERS approach as the guiding framework because it has the greatest certainty of achieving energy savings goals at minimum cost. Specifically, we recommend that goals be set in 2007, that programs be planned and begun in 2008, and steadily increasing goals be in effect for 2009 and beyond. For example, goals could require electricity savings of 0.2% of sales in 2009, an additional 0.4% of sales in 2010, etc. until savings of 1% per year are being achieved. More modest goals are appropriate for gas sales (e.g., 0.1% savings in year one, 0.2% in year two, etc., rising to 0.5% savings in year five and thereafter). We used these targets to estimate savings for Florida.

Within an EERS framework, savings could be realized either through traditional DSM, with utilities funding and running the programs, or through a PBF approach, with a state funding mechanism and the choice of running the programs through utilities or other entities. Some states use a hybrid approach, such as California and Connecticut, where the EERS drives overall savings targets, and various mechanisms are used to implement the programs.

One other consideration for utility-sector programs is that for programs to be effective, the utilities running the programs need to be financially motivated for them to work. For a number of reasons related to ratemaking design, a successful utility energy efficiency program can often have a negative effect on utility profits. To address this problem, several states have adopted incentives for utilities that achieve energy savings goals, or have created

other mechanisms to assure utilities that effective efficiency programs will not cut profits. More information about these approaches can be found in an ACEEE report published in late 2006 (Kushler, York, and Witte 2006).

Appliance and Equipment Standards

Appliance and equipment efficiency standards are mandatory efficiency requirements that products must meet for sale in a state or country. Efficiency levels are set that are both technically feasible and economically justified. Typically, standards eliminate the least efficient products from the market, while leaving consumers a wide array of products to choose from. Efficiency standards for more than 40 products are now in effect in the U.S. Typically, one or more states adopt a standard and then national standards are adopted by Congress or the U.S. Department of Energy (DOE). Most recently, this process played out in the federal *Energy Policy Act of 2005* in which Congress adopted new efficiency standards on 16 products. From our review of Florida utility forecasts, it appears the state has not yet factored these new standards into its forecasts and thus we estimate savings from these standards in our policy scenario and use them to adjust the reference case. Savings and costs associated with EPA 2005 standards are not included in our results.

In addition to federally regulated products, there are a number of other products that individual states are starting to regulate. The following products may be appropriate for standards in Florida:

- Bottle-type water coolers
- Commercial hot food holding cabinets
- Compact audio products
- DVD players and recorders
- Metal halide lamp fixtures
- Portable electric spas (hot tubs)
- Residential pool pumps
- Single-voltage external AC to DC power supplies
- State-regulated incandescent reflector lamps
- Walk-in refrigerators and freezers

Eight states have already adopted standards on one or more of these products (AZ, CA, MA, NY, OR, RI, VT, and WA). More information on these products and specific standard recommendations can be found in an early 2006 ACEEE report (Nadel et al. 2006). This report is the source of our savings estimates for both the 2005 federal standards and new Florida state standards.

More Stringent Building Energy Codes

Florida recently updated its building code to reflect new commercial building lighting limits and to incorporate the new federal residential air conditioner efficiency standard (the inclusion of the SEER 13 air conditioner standard in the state's building code will significantly increase stringency). The likely next opportunity to upgrade the Florida code

will come around 2010. At that time, upgrades to both the residential and commercial codes should be considered. For new homes, the code should be amended to require significantly increased whole-house energy efficiency, with the goal of increasing the whole-house efficiency by 30% by the 2010 code cycle. Using whole-house energy use, and perhaps the HERS Index methods, as the basis for these code changes will provide additional cost-effective solutions to builders, such as efficient lighting and appliances, which have not been available in codes up through the present. For commercial buildings, the national reference code is developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). It has recently announced an effort to update its code so that the 2010 version reduces energy use by 30% relative to the 2007 version. Florida should adopt this new code as soon as it becomes available. For our savings analysis, to be conservative, we assume 10% savings in new homes and 20% savings in new commercial buildings, starting in 2012.

Advanced Building Program

As discussed in the earlier section on buildings, there is the economic potential to reduce energy use in new Florida homes and commercial buildings by as much as 40% compared with 2007 code standards. New technologies should make 50% savings realistic in the next few years. If building codes in 2012 are updated to save 10–20%, this leaves an additional 20–40% savings still to be captured. One way to do this is to create an advanced building program that combines training and technical assistance for architects, engineers, and builders on ways to achieve these savings at modest cost, with financial incentives to help defray the extra costs, particularly on the first energy-efficient homes and buildings an architect or builder designs. The U.S. Department of Energy has developed many materials on how to reach these targets for new homes.⁹ For commercial buildings, a good information source is the New Buildings Institute, which has a Web site on “Getting to Fifty” [percent savings].¹⁰ Leveraging federal tax incentives can also be a key ingredient in an advanced building program. The Energy Policy Act of 2005 included \$2,000/home tax credits to home builders and \$1.80/square foot tax deductions for commercial building owners for each home or commercial building they build that uses 50% less energy than a new home or building designed to a national model reference code. An advanced building program for Florida should be run by an organization with extensive experience with advanced building design and construction techniques. Funding for such a program could come through the Florida state budget, or as part of the DSM programs currently operated by the state's utilities.

For our savings analysis, we assume 2.5% of new buildings participate in the first year, 5% in the second year, 10% in the third year, and so on until 50% are participating in the eleventh year. After 50% participation is reached, we assume that the Florida building code is upgraded to 30% above the current code, achieving 100% participation.

⁹ See <http://www.eere.energy.gov/buildings/highperformance/>

¹⁰ See <http://www.advancedbuildings.net/>

Improved CHP Policies

There are several policies that could be implemented to improve the adoption rate of CHP in the state. The following bullets describe the current environment for CHP adoption in the state.

- In Florida, new grid-interconnected CHP projects (non-PURPA qualifying facilities) are illegal unless they are owned by a regulated utility.
- There are no statewide net metering rules, and no net metering rules anywhere where CHP is eligible (DSIRE 2007).
- The FPSC has adopted interconnection rules only for photovoltaic (PV) systems up to 10 kW. The rules apply to all IOUs in Florida, but not to municipal utilities or rural electric cooperatives (DSIRE 2007).
- In June 2006, a renewable energy production tax credit was established in Florida (SB 888) to encourage the development and expansion of renewable energy facilities in the state. This annual corporate tax credit is equal to \$0.01/kWh of electricity produced and sold by the taxpayer to an unrelated party during a given tax year. CHP/cogeneration is eligible for this tax credit (DSIRE 2007).
- The Renewable Energy Technologies Grants Program was established in June 2006 (SB 888) to provide renewable energy matching grants for demonstration, commercialization, research, and development projects relating to renewable energy technologies. Eligible recipients (must be in-state) include municipalities and county governments, businesses, universities and colleges, utilities, not-for-profit organizations, and other qualified entities as determined by the Department of Environmental Protection (the program administrator). CHP/cogeneration is eligible for this program (DSIRE 2007).

We propose the following policy mechanisms for encouraging the adoption of CHP.

- **Interconnection:** Florida should allow non-utility-owned CHP systems to interconnect to the grid following IEEE standards. Interconnection should be fast and streamlined, especially for smaller units. The state should develop and disseminate “model” utility regulatory principles, tariffs, and legislative provisions for distributed energy generation and CHP projects.
- **Permitting:** Florida should modify its permitting language towards an output-based (i.e., lb/MWh) system. Credit should be given for both the electrical and thermal output of the system.

Two recent reports are available that can serve as resources as Florida considers specific policies (Banerjee 2006; EPA 2005).

Industrial Competitiveness Initiative

In contrast to other consuming sectors, the majority of the opportunities for energy efficiency in the manufacturing sector are site specific and related to the production and ancillary processes specific to an individual facility. As a result, prescriptive programs that offer

rebates or other fixed forms of incentives are not particularly effective. Rather, programs that bring industry-specific expertise to manufacturing facilities to identify efficiency opportunities have proven effective. One long-running example is the Industrial Assessment Center (IAC) program run by the DOE that makes use of engineering university faculty and students to conduct audits of manufacturing facilities. These assessments have typically found over the past 25 years about 10% savings potential and achieved an implementation rate approaching 50% (Shipley, Elliott, and Hinge 2002; Shipley and Elliott 2006). Florida is blessed with two of these centers at the University of Florida and University of Miami (DOE 2007a). Some states, including Texas and New York, have supplemented federal funding for IACs in their states to expand the number of facilities that they can serve. We recommend that Florida follow suit.

More recently, the DOE has begun a new program called *Save Energy Now* (DOE 2007b). This program uses a network of industry energy experts to provide more extensive energy savings assessments of major manufacturing facilities. In the first year (calendar 2006), the program surveyed 200 facilities, finding an average of over 7% savings per facility with a payback of less than 2 years. The DOE has expressed an interest in partnering with states and utilities to make the network of expertise and tools available to a broader range of facilities across the country (Scheihing 2007). We recommend that Florida partner with DOE to make *Save Energy Now* assessments available to the state's manufacturers.

State and Municipal Buildings Program

State and municipal governments and school districts have large energy bills that strain budgets, but typically have limited access to capital or expertise to make major efficiency investments. Efficiency investments can reduce energy bills, freeing up taxpayer money. In addition, if government provides leadership by demonstrating these technologies, it will provide a useful example to the private sector. To address these opportunities, a major program to help state agencies, municipalities, and school districts identify and implement energy savings measures would be an excellent investment. We recommend that Florida establish a program based on the Texas LoanStar revolving loan program. In LoanStar, the state energy office set aside funds into a revolving loan fund to finance energy-saving improvements to public buildings. Funding was also provided to Texas A&M University to provide technical assistance.¹¹ We recommend the Florida legislature establish such a program. Our savings analysis assumes state and municipal buildings in Florida can achieve an average of about 15% energy savings, with about 50% of public buildings participating in the program (Haberl et al. 2002, Verdict 2006).

Short-Term Public Education

It will require several years before many of the other initiatives discussed in this report fully taken effect. So to jump-start efficiency in the state, we recommend that Florida consider undertaking a public education initiative to encourage energy-saving practices. This could be done through a wide array of media to promote calls by the governor for investments in energy efficiency and conservation. In 2001, California and other western states used such

¹¹ For information on the *LoanSTAR Revolving Loan Program*, see <http://www.seco.cpa.state.tx.us/ls.htm>.

programs to achieve substantial savings and help weather their energy crisis with minimum disruptions. For example, an evaluation of the California program found that it reduced energy use by 6.7% in the summer of 2001 and peak demand by about 11% relative to the year before (Global Energy Partners 2003). And significant benefit persisted for multiple years, especially as approximately 60 percent of the actions involved technology investments with a two-year payback. We use the California experience to project impacts in Florida, except that we conservatively assumed a Florida program is only half as effective (e.g., 3% energy savings and 5% peak demand savings). The California programs produced impressive near-term savings; however, these public action programs are by their nature of limited duration, being effective for a few years at best. While the direct impacts of these efforts may have limited longer-term impact, they can play an important role in sensitizing consumers to the efficiency message, enhancing the impacts of other programs.

Public education should also be an ongoing part of any long-term efficiency program suite. The states with the most effective programs typically invest in significant communications efforts, in which leaders including the governor appear prominently in public media. The value of leadership in this regard cannot be overstated.

Expanded Research, Development, and Demonstration (RD&D) Programs

Energy issues will confront Florida for many decades. To help address these issues, new technologies and practices need to be developed. Currently the utilities in the state have formed a consortium to pool research needs and funds. Also, the state of Florida through the Florida Technology, Research and Scholarship Board has established Centers of Excellence focused on particular technologies such as the Florida Atlantic University's Center of Excellence in Ocean Energy Technology and the University of Central Florida has the Florida Solar Energy Center. The state should look to expand its programs to similar levels as states such as New York, Wisconsin, Iowa, and California that have major RD&D programs to help develop these new technologies, with a focus on technologies that will address important local needs and help local businesses to develop products they can sell in and out of state.

For example, New York established the New York State Energy Research and Development Authority (NYSERDA), with an annual RD&D budget of \$17 million per year. Since its inception in 1975, NYSERDA estimates that its RD&D program has helped develop products and services with sales of more than \$65 million and with benefits (energy savings and other benefits) of more than \$30 million. A total of 50 new products have been developed, including seven start-up companies. NYSERDA estimates that these projects together have produced more than 4,000 jobs in the state (Douglas 2007). Funding comes out of a very small surcharge on electric and gas rates enacted by the legislature and included in the state budget. Based on the New York program and relative population of the two states, an annual budget of no less than \$16 million per year would be appropriate for Florida. We use this budget, and estimates of the savings of the New York program per dollar spent, to estimate savings for Florida. We would encourage the state to consider an even higher funding level at least for the near term to jump-start energy research in the state.

Renewable Portfolio Standard and Onsite Renewable Energy Policies

This section provides a brief overview of RPS and onsite renewable energy incentives, based on the estimates of the available renewable resources in the state as discussed above, and suggests specific policy recommendations that the state should consider that would expand the share of the state's future energy requirements met from renewables resources.¹²

According to the 2006 FPSC's 10-year site plan review, Florida's current renewable capacity represents 2.2% of present statewide capacity (56,914 MW) and 0.1 % of generation (FPSC 2006a). Adding the future renewable capacity projected by Florida's utilities results in a drop in the renewable energy generation share to 2.05% as total capacity requirements are projected to increase to 73,318 MW by 2015.

A report to the FPSC from the Renewable Energy Policy Project (REPP 2002) concluded that a cost comparison between photovoltaics and electric service costs per kilowatt-hour will be pivotal to how attractive consumers will see photovoltaics as an option. An analysis performed for this study indicates that with the current \$2,000 federal tax credit and \$4/peak watt Florida rebate, the levelized cost for a 2 kW residential photovoltaic array is \$0.1367/kWh while Florida's typical residential retail rate is currently \$0.12/kWh. A relatively small increase in electric rates would erase the remaining cost difference.

Twenty other states and the District of Columbia have mandated that utilities meet goals for renewable electricity, generally referred to as renewable portfolio standards. States define renewables differently, administer programs differently, and offer various incentives. Most of the states passed their RPS legislation under Republican governors. It is important to note that Colorado's RPS was enacted by a voter-initiated state ballot petition, overcoming considerable, well-funded utility opposition.

California set one of the highest RPS targets, meeting 20% of its electricity needs with eligible sources by 2017. A more recent state energy action plan has set the goal of accelerating this to 2010. California's utility commission has developed a process for verifying that targets are met—something the legislation was silent about. This process includes important steps for any successful renewable program:

- Establishing each utility's initial baseline
- Establishing an annual procurement target
- Approving or rejecting contracts executed to procure RPS-eligible electricity
- Determining whether the utility is in compliance with the commission's rules
- Imposing penalties for non-compliance [CEC_300-2006-002-CMF, Feb. 2006]

Most states have revised their utility interconnection and net-metering laws for small-scale systems to better accommodate and encourage onsite, grid-connected power sources.

¹² Details on Florida's current renewable production and the policies that other states have pursued in the realm of RPS are given in Appendix C.

Our cost analysis for an RPS assumes that about 49% of the renewable energy requirements will be generated from biomass, 49% from PV, and the remaining 2% from Land-fill gas (LFG) (Deyette et al. 2003). To estimate both the levelized and investment costs of the RPS requirements, we calculated a weighted average using this technology mix and projected cost estimates from *Assumptions to the Annual Energy Outlook 2007* (EIA 2006e).¹³

We recommend the following policies to support renewable energy development in Florida. As noted in the resource discussion, this resource estimate is conservative, so assuming a significant share of the resource can be realized over the next 15 years appears reasonable.

1. *Renewable Portfolio Standard*—The RPS should be designed to require utilities to generate or acquire 5% of their total electricity supply in 2023, after accounting for efficiency savings, from qualified renewable sources. This level of renewables would account for about 4% of the total identified potential from energy efficiency and renewable energy in 2023. Because of the dominance of the solar resource, it is anticipated that a significant share of the implemented renewables would be solar. The state should set penalties for missing a target in any tier in any year, at levels at least twice as large as the prevailing prices for qualifying resources in that year. Such funds should be used to increase incentives for renewables.
2. *Net Metering*—Florida should establish net metering laws that allow customer-owned, interconnected renewable energy systems to receive credit for electrical power supplied to the utility at full retail tariff value. This is typical practice for the many states with net metering and is an essential policy for making customer-owned solar electric systems attractive.
3. *Incentives for Onsite Solar*—Florida should provide incentive funding for customer-owned solar electric and solar thermal energy systems. Total funding should be provided starting at the current \$2.5 million level, increasing to \$10 million annually by 2010, \$50 million annually by 2013, and \$100 million annually by 2016, and should be maintained at the \$100 million level through 2023. We estimate that these incentives would realize an additional 35% of the available renewable resource. The current commercial solar thermal cap shall be removed or increased to \$100,000 to encourage large hot water users such as lodging, dormitories, and prisons to receive the benefit.

As shown in Table 5 above, the recommended renewable energy policy initiatives result in significant new energy resources to meet almost 10% of the state's 2023 energy requirements. The onsite solar incentives would meet 5.8% of the 2023 energy needs and the RPS would meet 3.7%. Combined, these two policy options offer over 33 billion kWh in cumulative energy resources and more than 6,000 MW in demand savings in 2023.

¹³ Based on weighted averages, these costs are assumed be \$0.157/kWh in 2008 and decline steadily to \$0.116/kWh by 2023 as a result of greater technology advances and experience in the production of these systems.

Current Florida policy, while offering a substantial rebate of \$4 per peak-watt for solar photovoltaic applications, has a very limited pool of funds to support this rebate. The fund for all onsite solar renewable applications (PV and solar hot water) is limited to \$2.5 million per year; at this level, it would support typical 2 kW systems on only 300 homes per year. Unless this fund is substantially expanded—to the range of \$100 million per year, Florida will not develop a competitive solar energy market that can compete with other states that have both aggressive RPS and well-funded PBF to support these standards. Unless this fund is substantially increased, Florida will fall far short of the policy goals for renewable solar energy that is supported by the analysis presented in this report. A recent poll finds that an overwhelming majority of Florida citizens supports investment in solar energy in Florida (90% of respondents) and also would support a one dollar charge on utility bills to finance the investment (78% of respondents) (Mason-Dixon 2007). About 40% of respondents who opposed the one dollar utility bill increase *would* support a charge of 50–99 cents. This evidence supports the creation of aggressive renewable energy standards and the PBF funds to support them.

INVESTMENTS, COSTS, AND BENEFITS OF POLICIES

If implemented, the policies detailed in this report will spur investments in energy efficiency and renewable energy that will result in energy expenditure savings to the consumers making these investments. Of the cumulative investments, a small portion would come from public programs and policies, with the majority coming from the private sector. In addition to the actual investments required to realize the savings, there will be costs associated with administrating these programs and policies as well as with the measurement and verification required to assure policymakers that Florida and its citizens are receiving the promised benefits. Table 6 presents the 2013 and 2023 cumulative investment and administrative costs for each of the policy measures, grouped by efficiency and renewables.

Table 6. Cumulative Investment and Administrative Costs

Policy	Cumulative Cost from 2008 (Million \$)			
	2013		2023	
	Investment Costs	Policy Costs	Investment Costs	Policy Costs
<i>Energy Efficiency</i>				
Utility savings target	2,183	327	10,909	1,636
Appliance & equipment standards	186	2.2	651	10
More stringent building codes	682	44	4,226	634
Advanced building program	164	102	2,121	318
Public buildings program	194	29	2,917	438
Short-term public ed. & rate incentives	976	443	976	443
Expanded RD&D efforts	79	12	237	36
Improved CHP policies	102	5	306	15
Industrial competitiveness initiative	8	1	23	3
<i>Efficiency Subtotal</i>	4,574	965	22,366	3,533
<i>Renewable Energy</i>				
Renewable portfolio standard	13,659	6	99,930	22
Onsite renewables policy package	4,277	9	32,532	31
<i>Renewable Subtotal</i>	17,936	15	132,462	53
Total	22,511	980	154,827	3,585

As can be seen from Table 6, the renewable investment required is far greater than that required for efficiency. This required investment results in the levelized¹⁴ cost of saved energy for renewables being an order of magnitude greater than the efficiency costs (see Table 7). This higher cost results from the apparently limited low-cost renewable energy resources in the state. As noted earlier, however, there is significant uncertainty in the renewable resource potential and cost projections. It is anticipated that an updated renewable resources study would identify additional low-cost resources, and therefore lower costs for the total renewable resource mix. There is additional uncertainty in future costs for renewable resources. As investments are made toward these resources, costs will likely come down.

¹⁴ Levelized cost involves dividing a lump sum investment into equal payments over period of time. This costing approach is commonly used in utility ratemaking to allow the recovery of capital costs over time.

Table 7. Levelized Cost of Saved Energy

Policies	Total Investment including Prog. & Admin. Costs (Mill.\$)	Total 2023 Savings (Mill. kWh)	Levelized Cost of Saved Energy (\$/kWh)*
Efficiency	25,898	69,354	0.035
Renewables	132,514	33,159	0.307
Total	158,412	102,513	0.144

* Assumes a 15-year measure life and 4.5% discount rate

It should be pointed out that the savings from many of the energy efficiency and renewable energy resource investments made during this analysis period will continue to return energy savings long after 2023, and the benefits of these savings are not captured in these benefit calculations. In addition, this analysis does not consider the impact of reduced natural gas consumption in the electric power sector—the state’s major consumer—that would likely reduce prices of natural gas and electricity for all customers (see Elliott and Shipley 2005).

Environmental Impacts

In addition to the economic gains, the state’s environment would benefit, with reductions in conventional power plant operations reducing SO₂ by more than 16 thousand tons and NO_x by nearly 11 thousand tons (see Table 8). In light of growing concern over global climate change, these efficiency measures would reduce CO₂ by over 37 million metric tons in 2023, making an important down payment toward reducing the state’s carbon signature.

Table 8. Estimate of Avoided Air Emissions from Energy Efficiency Policies

Category of Pollutant*	2008	2013	2018	2023
SO ₂ (thousand short tons)	0.0	5.9	10.8	16.3
NO _x (thousand short tons)	0.0	3.7	6.7	10.9
CO ₂ (million metric tons)	0.0	11.1	21.8	37.1

* Note: Emissions are based on average emission rates.

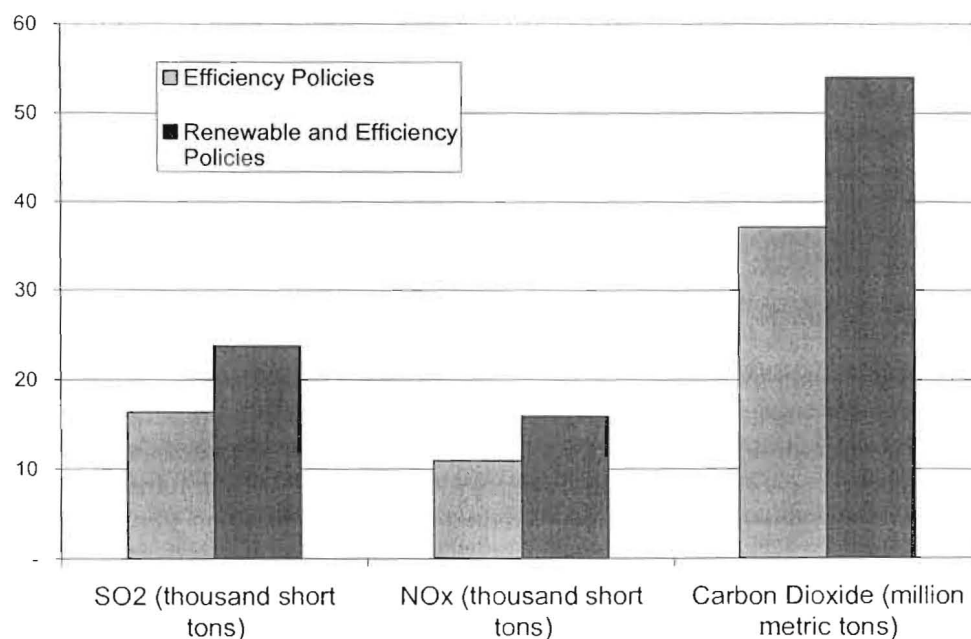
As would be expected, expanding the policies to include renewable energy as well as efficiency increases the emissions reductions by 47% relative to reductions from energy efficiency only when compared to the reference case (see Table 9 and Figure 10). These reductions represent an almost 30% reduction from the projected 2023 levels.

Table 9. Estimate of Avoided Air Emissions from Combined Energy Efficiency and Renewable Energy Policies

Category of Pollutant *	2008	2013	2018	2023
SO ₂ (thousand short tons)	0.0	7.7	15.1	23.8
NO _x (thousand short tons)	0.0	4.8	9.4	15.9
CO ₂ (million metric tons)	0.1	14.4	30.5	54.0

* Note: Emissions are based on average emission rates.

Figure 10. Avoided Emissions in 2023 from Efficiency Policies and Combined Renewable and Efficiency Policies



Macroeconomic Analysis: Impact of Policies on Florida’s Economy, Employment, and Energy Prices

In this section of the report we evaluate these macroeconomic impacts of the energy efficiency policy recommendations. We have elected not to undertake an assessment of the combined renewable energy and energy efficiency policies because of the significant investment cost uncertainty that exists for renewable energy in Florida.

The recommended energy efficiency policies result in an increase in the number of new jobs and a substantial reduction in consumer energy expenditures. As noted earlier, this analysis understates the benefits of the investments in energy efficiency and renewable energy, however, because the analysis does not capture the full benefits that would accrue after the analysis period. Investments would continue to yield energy resource benefits for many years into the future. More appropriately, this period should be viewed as a transition in the Florida energy markets from a central generation model to a more distributed, sustainable energy market.

Methodology

In this economic evaluation we follow three steps. First, we calibrate an economic assessment model called DEEPER (Dynamic Energy Efficiency Policy Evaluation Routine) to reflect the economic profile of the Florida economy (Laitner 2007a) and also the anticipated investment patterns that are assumed in the reference case (e.g., construction of new electric power plants projected in the FRCC forecast). Second, we apply the set of key scenario results from the policy analysis above and transform them as inputs for the economic model. The resulting inputs include such things as:

1. The level of annual program spending that drives the policy scenario;
2. The electricity savings that result from the various energy efficiency policies or the level of alternative electricity generation from onsite renewable and combined heat and power technologies; and
3. The capital and operating costs associated with those technology investments.

Finally, we run the model to check both the logic and the internal consistency of the modeling results. See Appendix D for a detailed description of the economic model.

Impacts of Recommended Energy Efficiency Policies

The investment and savings data from the efficiency scenario were used to estimate three sets of impacts for the five-year periods of 2008, 2013, 2018, and 2023. For each benchmark year, each change in a sector's spending pattern for a given year—relative to the reference or business-as-usual scenario—was matched to the appropriate sectoral impact coefficient. These negative and positive changes were summed to generate a net result shown in the series of tables that follow.

Table 10 summarizes, for selected years, two sets of key changes in the Florida electricity production patterns that are driven by the energy efficiency policy initiatives outlined in the policy analysis. The table also summarizes the initial financial impacts from these two sets of changes as then estimated by the Investment and Spending module within the DEEPER model. It is this combined set of three financial impacts that are then further evaluated by DEEPER's macroeconomic module to estimate the larger net gains to the Florida economy.

Starting with very small impacts in 2008, the set of energy efficiency policies spur both program costs and technology investments that, in turn, begin to change the production patterns of electricity consumption and production. Program spending of \$199 million in 2013 leverages \$1,405 million or \$1.4 billion in efficiency technology investments in that same year. The initial impacts on electricity production are quite small in 2008, reducing electricity demand by only 37 GWh. However, both program spending and technology investments rise to 281 and 1.9 billion dollars, respectively, by 2023. The cumulative impact of activities over the 15-year time horizon steadily reduces the demand for conventional electricity generation so that by 2023 energy efficiency displaces the forecasted electricity production by about 20%.

Table 10. Changes in Florida Electricity Production and Financial Impacts from Energy Efficiency Policy Scenario

	2008	2013	2018	2023
Implied Program Spending (Millions of 2004 Dollars)				
Annual Policy and Program Costs	0	199	240	281
Annual Technology Investments	1	1,405	1,677	1,948
Changes in Electricity Production Patterns				
Efficiency Gains (GWh)	37	17,647	40,135	69,354
Change from Reference Case	0.0%	6.6%	13.2%	19.9%
Financial Impacts (Millions of \$2004)				
Annual Consumer Outlays	1	1,585	2,172	2,584
Annual Electricity Savings	3	1,174	2,679	4,674
Electricity Supply Cost Adjustment	(1)	(894)	(1,867)	(2,975)
Net Consumer Savings	3	484	2,375	5,065
Net Cumulative Energy Savings	2	840	8,652	28,250

As might be expected, the program spending and changed investment patterns have a distinct financial impact within Florida. The third set of information in Table 10 highlights the key financial impacts for the same years. For example, program costs and technology investments are only part of the expenditures paid by consumers (including both households and businesses). Notably, the utility customers will likely borrow money to pay for these investments. Thus, consumer outlays, estimated at \$1 million in 2008 and rising to \$2.6 billion in 2023, include actual “out-of-pocket” spending for programs and investments, but also money borrowed to underwrite the larger technology investments. Annual electricity savings is a function of reduced electricity purchases from the Florida utilities at the initial electricity prices in a given year. This starts with a savings of \$3 million in 2008 and rises quickly to \$4.7 billion in 2023.

The analysis also explored the impact of reduced consumption on electricity prices. Previous research has shown that in tight markets, small changes in energy demand can have large impacts on energy prices, particularly for natural gas (see Elliott and Shipley 2005; Elliott 2006). The changed electricity production patterns, including both reduced electricity demands and efficiency technology investments, forces a negative adjustment in the electricity supply costs (see Table 10) due to the lower capital and operating expenditures associated with the energy efficiency policy scenario. This means that efficiency policies actually reduce electricity costs to consumers starting with an estimated savings of \$1 million in 2008 and rising to nearly \$3 billion in 2023.

The category of net consumer savings shows consumers' total savings from both lower electricity consumption and lower costs, minus consumer outlays. In 2008, businesses and households save \$3 million in reduced electricity consumption, \$1 million in reduced electricity prices, and spend \$1 million in outlays for a net savings of \$3 million. As electricity savings increases and as costs further decline, the net consumer savings quickly

risers to a net gain of about \$484 million by 2013 and \$5.1 billion by 2023. Cumulative net savings in the last row of Table 8 suggests a net gain to consumers of \$28.3 billion by 2023.

With the set of program spending, investment changes, and financial impacts identified in Table 10, and given the other modeling assumptions described earlier in this section, the macroeconomic module of the DEEPER model then traces how each set of changes works or ripples its way through the Florida economy in each year of the assessment period. Table 11 summarizes the estimated change in sector spending within Florida, given the policy and program expenditures for the same benchmark years.

Table 11. Changes in Sector Spending (Millions of 2004 Dollars)

Sector	2008	2013	2018	2023
Agriculture	\$0.0	\$1.7	\$12.0	\$26.8
Oil and Gas Extraction	\$0.1	\$7.1	\$107.2	\$251.0
Coal Mining	\$0.0	\$0.0	\$0.6	\$1.5
Other Mining	\$0.0	\$0.1	\$2.1	\$5.0
Electric Utilities	-\$3.6	-\$2,049	-\$4,500	-\$7,572
Natural Gas Distribution	\$0.0	\$1.4	\$6.0	\$12.5
Construction	-\$3.9	\$10.3	\$215.8	\$284.8
Manufacturing	\$0.5	\$55.5	\$428.3	\$961.0
Wholesale Trade	\$0.1	\$17.0	\$79.1	\$167.5
Transportation, Other Public Utilities	\$0.0	\$8.7	\$40.2	\$85.0
Retail Trade	\$0.2	\$40.5	\$187.1	\$395.7
Services	\$1.0	\$184.1	\$842.3	\$1,778.6
Finance	\$0.0	\$54.8	\$29.8	-\$21.2
Government	\$0.2	\$164.2	\$217.0	\$278.6

Once each of the net sector spending changes has been evaluated for a given year, the DEEPER model then evaluates the sector-by-sector jobs and wages. It also evaluates their contribution to the state's GSP. Table 12 highlights the net impacts, again by the benchmark years.

Table 12. Net Economic Impacts for Benchmark Years

Category of Impact	2008	2013	2018	2023
Jobs (Actual)	-33	366	7,557	14,264
Wages (Million \$2004)	-\$2	-\$168	-\$62	\$64
GSP (Million \$2004)	\$-4	-\$1,134	-\$1,857	-\$2,745

The first of the three impacts evaluated here is the net contribution to the Florida employment base as measured by full-time jobs equivalent. In other words, once the gains and losses are sorted out in each year, the analysis provides the net annual employment benefit of the policies as they impact the larger Florida economy. In 2008, the impact starts small with a net loss of 33 jobs, rising to a net gain of 14,300 jobs. The second impact is the net gain to the state's wage and salary compensation, measured in millions of 2004 dollars.

Showing a similar pattern as job impacts, wages rise from a net loss of \$2 million in 2008 to a gain of \$64 million in 2023.

The impact on the Florida GSP might suggest a somewhat counterintuitive result, however. While job and wage benefits are small but net positive, the impact on GSP is small but negative. By 2023, for example, GSP is down by about \$2.7 billion. The reason is that the electric utilities are a capital-intensive sector, but one that is also generally non-labor intensive. Movement away from greater capital intensity to a more labor-intensive energy policy shifts the composition of GSP away from utility plant investment toward more productive and more labor-intensive spending. As it turns out, this generates a small but negative impact on GSP compared to how the changed spending patterns impact jobs and wages.

DEMAND RESPONSE

Demand Response Background

Although several Florida utilities have been offering substantive demand response programs for a decade or longer, many significant opportunities remain. There are a number of demand response programs offered at present:

- Direct load control (DLC)—six utilities offer programs that pay participating customers a rebate or bill credit to allow the utility to cycle off their air conditioners, water heaters, and/or pool pumps during peak periods. The most extensive programs are offered by Florida Power & Light and Progress Energy, which together have over 1.1 million residential customers and 18,500 commercial customers enrolled. Three cooperative utilities (over 68,000 customers enrolled) and one municipal utility (over 3,000 customers enrolled) also operate direct load control programs (FERC 2006, Appendix I-5, Figures IV-6 and IV-7).
- Interruptible and curtailable load—Three cooperatives, two investor-owned utilities, and one municipal utility offer interruptible and curtailable load options for larger commercial and industrial customers, receiving a reduced rate in exchange for turning off a portion of their load at short notice when needed for grid support (FERC 2006, Figure IV-8).
- Time-of-use rates—Five utilities offer rate options designed to discourage on-peak energy use by charging higher prices during peak hours, but very few customers are actually signed up under the time-of-use tariffs (FERC 2006, Figures IV-10 and IV-11).
- In addition, the investor-owned utilities are involved with demonstrations of smart thermostats that could be significantly expanded in coming years (IOU 2007).

The Florida Reliability Coordinating Council reports that they have enough demand response potential to meet 7% of peak demand, with 2,264 MW potential but 1,297 MW actually delivered to meet summer 2006 demand (FERC 2006, Figure V-5). The limited usage of load management results in part from the high reserve margins that the state's utilities have been

able to maintain, and in part because of their successful demand response programs. Florida resource plans project 3,504 MW of interruptible load and residential, commercial, and industrial load management to meet winter peak demand for 2006–2007; however, since they report only 164 MW of actual demand reduction for the winter of 2005–2006 (0.4% of peak) and 446 MW for the summer of 2005 (0.9% of peak) (FRCC 2006, pps. 3–4), and several of these programs have been closed to new participants, it will be a challenge for them to deliver the significantly higher demand response levels forecast.

Cost-Effectiveness and Investment in Demand Response

Most of the measures recommended here are already in use in Florida, as in other locations across the nation, and have been consistently cost-effective for both participants and all ratepayers in many jurisdictions; however, this analysis proposes expanding the penetration of these measures. Much of this expansion would be accomplished through mandatory requirements placed upon new residential and commercial construction, placing the burden of device acquisition and installation upon builders and buyers rather than utilities and their ratepayers. Additionally, since many of Florida's demand response programs have been in place for many years, it is likely that they can now be improved by modifications to program design and technology that will lower costs and increase impact for each new installation. Last, this analysis proposes that the burden of delivering demand response be expanded beyond the investor-owned utilities to the cooperatives and municipal utilities through a mandatory minimum demand response portfolio requirement for all load-serving entities in Florida.

While we believe that it would be valuable to place more Florida electricity users under time-of-use rates, that is not recommended here for the short term because it will require several additional steps that will increase costs and delay peak reduction impacts. Those steps will include revising existing time-of-use rates to send more distinct signals about the value of electricity across season and time of day, acquiring and installing many more advanced meters and associated communications and information processing systems, educating and recruiting customers about the rates, and conducting studies to determine the load-shifting and efficiency impacts of the time-of-use rates on customer energy use decisions. Therefore, while we advocate expansion of time-of-use rates—even potentially requiring that all customers with loads over 500 kW be served under such rates, we recommend that this measure be delayed until one or more Florida utilities makes a significant commitment to advanced metering infrastructure investment for other purposes, and then piggy-backing time-of-use rate expansion upon that investment.

Savings Impact

Most demand response measures save on capacity (kW) but not energy (kWh). Therefore their impact should be valued at the cost of capacity avoided, which should be measured over time at the marginal cost of a new power plant—presently coal or natural gas. Since the current value of avoided marginal capacity is \$59/kW-year (Chernick 2007); Florida policymakers do not presently add a premium for transmission and distribution avoidance because they believe energy efficiency and demand response have been so geographically diffuse that they do not avoid or defer any transmission or distribution. However, if Florida

chooses to commit to the higher levels of efficiency and demand response recommended here, the greater levels of peak avoided as Florida’s population grows will quickly make a substantive impact on the rate of new transmission and distribution requirements (see Table 13).

Table 13. Savings in Demand Cost for Demand Response Program

Avoided Cost	Benefits (1000 \$)	
	2013	2023
Generation @ \$59 per avoided kW-year	257	569
Generation and T&D @ \$120 per avoided kW-year	522	1,156

Demand Response Recommendations

Verify Demand Response Resource

Given how little demand response the FRCC recognized as available at the summer and winter peaks in 2004–2006, and the large amount forecast for 2007 and future years, the FPSC and FRCC should consider requiring formal audits and testing of the current demand response mechanisms, programs, and participants. Many demand response programs in other states require regular testing to be sure that the equipment works and the customers understand and accept their obligations and opportunities under the various rate and program offerings. This will help to determine how much of the demand response presently claimed and funded is valid and available when needed to assure future grid reliability and generation capacity avoidance.

Accelerate DSM Goals under Florida Energy Efficiency and Conservation Act

The FPSC approved its regulated utilities’ demand-side management plans, including program approvals and specific MW and MWh savings goals and cost recovery mechanisms, between mid-2004 and early 2006. It is presently scheduled to “reset” those goals in 2009, to be effective in 2010. However, conditions have changed significantly since 2004–2005—there is now a wide gap forecast between demand and available generation, a number of new power plants have been proposed, and there have been significant increases in the capital costs of generation and transmission and in the fuel costs of both coal and natural gas. These factors have materially changed the cost-effectiveness of demand-side resources and should justify reconsideration of the utilities’ demand-side management goals and recalculation of the value of avoided energy and capacity (including transmission as well as generation) in 2007 rather than 2009.

Furthermore, since energy efficiency and demand response offer significant risk management benefits to both the electric industry and to the state’s citizens relative to Florida’s vulnerability to fuel and electricity supply interruptions (as due to coal train delays, gas pipeline accidents, or hurricane-caused damages to transmission and distribution systems), the FPSC should consider adding a benefit premium to these resources in its cost-effectiveness methodology.

Set Mandatory Demand Response Targets for all Florida Utilities

Although several cooperatives and municipal utilities provide direct load control and interruptible or curtailable rates, most of the existing demand response programs and peak reduction comes from investor-owned utility programs. The legislature should consider setting a demand response portfolio requirement upon every Florida utility, making each responsible for delivering dispatchable demand response (from its own customers, or secured from another utility) for at least 5% of its next year's forecast peak load plus reserve margin by 2010 and 10% by 2017, with the demand response measures verified by actual performance. Since this would be a mandate to maintain reliability and reduce vulnerability to fuel import interruptions for the state, the Commission could encourage the utilities to choose the most cost-effective programs possible (including out-sourcing) to meet the mandates.

Require Direct Load Control Devices on All New Residential and Commercial Buildings

Given the high growth rate in Florida's population and the resulting high rates of building construction, the legislature should consider requiring every new residential building to have direct load control devices (such as programmable communicating thermostats) installed on every air conditioner, water heater, space heater, and pool pump in those buildings, with the new residents automatically enrolled in the local utility's direct load curtailment program. Very high proportions of the residential customers of Florida Power & Light, Progress Energy, and three cooperatives were placed in the direct load control programs in the past, so those programs are clearly widely understood and accepted already and this requirement should not impose an inordinate cost or other burden.

New commercial buildings should be required to have an energy management and control system with communications capability installed, connected to the utility's direct load curtailment system and placed on the DLC tariff. Such requirements could be put in place as early as 2009.

FRCC Should Use DLC for Spinning Reserve

The Florida Reliability Coordinating Council should include all resources under direct load control as both operating and planning reserves.

Redesign Programs for Greater Impact and Penetration

There is some variation in the demand response programs now offered within Florida (FPSC 2006c, Section 3; EEI 2006). However, it is likely that Florida's demand response programs could become lower in cost and higher in impact, which would improve their impact and cost-effectiveness. This could happen by charging the state's utilities and interested stakeholders to jointly evaluate the most effective demand response programs in place across the state and nation, develop a common suite of program designs (with greater customer segmentation) and terms that will work across Florida (including agricultural offerings), and set those in place for an extended period of time. After the start-up investment, this would lower administrative and program development costs for all utilities, enable statewide

marketing and education plans about the value and importance of demand response, enable more third-party vendors to support the programs across a near-statewide market, and simplify equipment and communications protocols. This would also simplify the FPSC’s review and approval process.

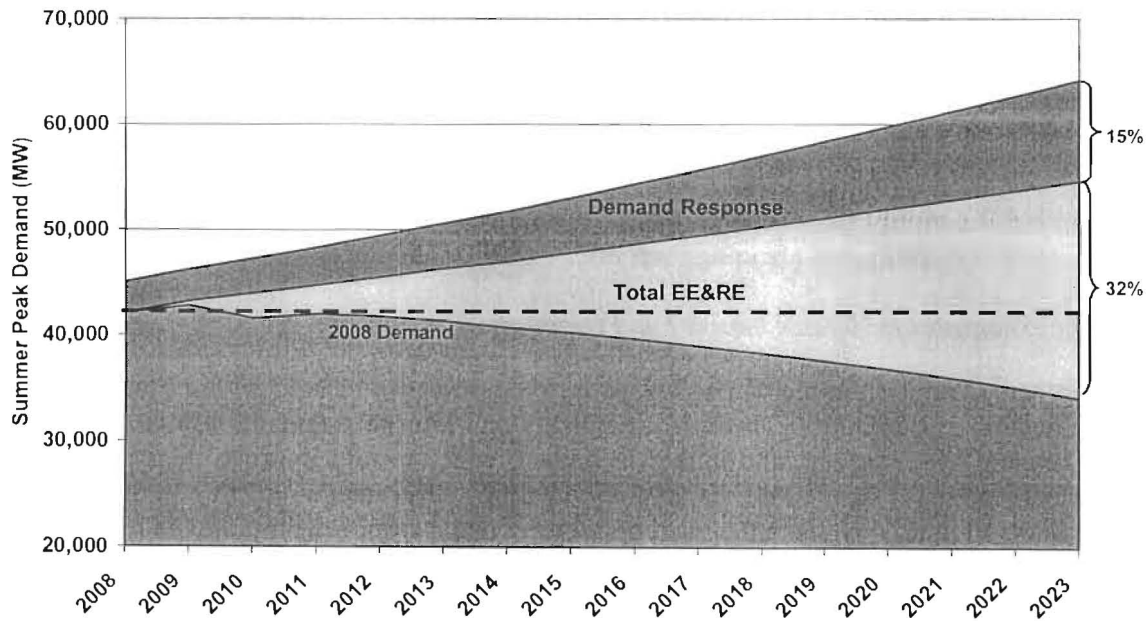
Advanced Meters and Time of Use Rates

The Florida PSC should encourage the utilities to expand their offerings and marketing of time-of-use rates to residential and commercial customers, and assure cost recovery for utility investments in advanced metering and communications systems. The Commission should consider requiring that every industrial customer and commercial customers over a stated consumption level (say 500 kW) be given an advanced meter and a well-designed time-of-use rate, to grow the amount of price-responsive load within the state. For smaller commercial loads, the FPSC should also encourage the utilities to establish programs for automated demand response using building controls, which has great potential to deliver high levels of energy and demand savings on a sustained, predictable basis.

Estimated Impacts of Demand Response

We estimate that these demand response policies would reduce the summer peak by 9% in 2013 and 15% in 2023. When combined with the load reductions from energy efficiency and renewable energy, we can reduce the peak by 18% in 2013 and 47% in 2023, as can be seen in Figure 10.

Figure 11. Impacts on Summer Peak Load from Energy Efficiency, Renewable Energy, and Demand Response



SUMMARY AND CONCLUSIONS

Based on this analysis, we are confident that we have demonstrated that energy efficiency and renewable energy can change Florida's energy future for the better. Energy efficiency resource policies can offset the majority of projected load growth in the state over the next 15 years. Expanded development of renewable energy resources in the state would further reduce future needs for conventional generation. Combined, these policies can serve nearly 30% of projected needs for electricity in 2023, deferring the need for many new electric power generation projects in the state.

The economic savings from the recommended energy efficiency policies alone in this report can cut Florida consumers' electricity bills by about \$840 million by 2013 and \$28 billion by 2023. While these savings will require substantial investments, they cost less than the projected cost of electricity from conventional sources. In addition, the investments would save consumers money while creating new jobs for the state.

Reducing demand for electricity with efficiency and renewables will also reduce emissions from the combustion of fossil fuels at utility power plants, offering the state a more sustainable environmental future at an affordable cost and allowing the state to start on a path to reducing its global warming emissions. Together, energy efficiency and renewable energy can reduce the state's emissions by 54 million metric tons of carbon dioxide in 2023—almost 30% of the state's projected emissions.

Florida faces important decisions regarding its energy future. The current course calls for investments in new coal, gas, and potentially nuclear generation to make sure that the state has enough electricity to sustain its economic prosperity. Energy efficiency and renewable energy resources offset some of that growth in demand, offering a lower cost, cleaner, and more stable energy path, without sacrificing Florida's quality of life or its economic growth. What is needed is leadership to put the state on this alternative path.

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APPENDIX A: ECONOMIC POTENTIAL ASSESSMENT APPROACH AND DETAILED TABLES

Residential Efficiency

Table A-1. Description of Energy Efficiency and Renewable Energy (EERE) Measures Studied

Acronym	Description of Measure
HVAC1:	SEER-13; HSPF-7.7 replacement heat pump (existing homes only)
HVAC2:	SEER-15; HSPF-9.0 high efficiency heat pump (\$300 federal tax credit)
HVAC3:	SEER-17; HSPF-9.2 ultra high efficiency heat pump (\$300 federal tax credit)
RBS:	Attic radiant barrier system
Ducts:	Tight ducts (normalized leakage from 0.10 to 0.03)
Roof:	White metal roof (solar reflectance = 70%)
SHW:	Solar hot water system* (closed loop; 40 ft ² -80 gal; PV pumped—30% federal tax credit + \$500 Florida rebate)
Lgts:	50% fluorescent lighting
eStarLgts:	3 fluorescent lights
eStarHP:	SEER-14; HSPF-8.2
eStarWin:	U = 0.55; SHGC = 0.35
Infil:	Annual average natural infiltration = 0.35 ach
IDucts:	Entire forced air distribution system inside conditioned space boundary
Fridg:	ENERGY STAR refrigerator (~80% of baseline energy use)
WinU:	Window upgrade to vinyl frame; U=0.39; SHGC=0.28
Wtint:	Add window tint to bring SHGC-0.65 to 0.45 (existing homes only)
WinR:	Window replacement with U=0.39; SHGC=0.40 vinyl (existing homes only)
Pstat:	Programmable thermostat with 2 °F setup/setback
cFans:	ENERGY STAR ceiling fans (Gossamer Wind—140 cfm/watt)
Misc:	Reduced miscellaneous (plug) loads (70% of baseline)
Shng:	White composite shingles (solar reflectance = 25%)
HW:	Hot water heater EF increased from 0.90 to 0.92
HW1:	Replace hot water heater with minimum standard (existing homes only)
WallR:	Increased wall insulation from R-3 to R-7.6 (new homes only)
WallU:	Add R-10 exterior insulation to CMU walls (existing homes only)
Wwalls:	White walls (solar reflectance = 60%)
HAcloths:	Horizontal axis cloths washer (1.5 gpd hot water savings)
HWwrap:	Additional R-10 hot water tank wrap
HRU:	Heat recovery water heater
HPWH:	Heat pump water heater (COP = 3.0)
dWash	Energy Star dishwasher (EF=0.58; 1.06 gpd hot water savings)
2kW-PV:	2.1 kW-peak PV system (\$2000 federal tax credit + \$4/peak watt Florida rebate)
eStar:	ENERGY STAR new home builder option package (BOP)—(eStarHP; eStarWin; Infil; eStarLgts; Ducts; Shng; Fridg; WallR; dWash)
TaxC:	Tax Credit qualified new home (\$2000 federal tax credit)—(WallR, WinU, HVAC2, Ducts, IDucts, Pstat)
Pool:	Standard pool home (pool home baseline)
effPool:	Efficient, downsized pool pump and oversized piping (40% energy savings)
NG-Base:	Natural gas baseline home (furnace AFUE=78%, hot water EF=0.59, std. gas dryer & std. gas range)
Furn1:	High-efficiency non-condensing furnace (AFUE=90%)
Furn1:	High-efficiency condensing furnace (AFUE=95%)
HW1:	Medium efficiency gas hot water heater (EF=0.63)
HW2:	High efficiency gas hot water heater (EF=0.80)
PkgEH1	HVAC2; Ducts; Ceil; SHW; Lgts; Pstat (existing homes only)

Acronym	Description of Measure
PkgEH2:	HVAC2; Ducts; Ceil; Shng; SHW; Lgts; Fridg; Pstat; cFans, Misc; WinR; Wwalls (existing homes only)
PkgNH1:	HVAC2; Ducts; RBS; SHW; Lgts, Fridg; WinU; Pstat; cFan; Shng; Wwalls; HAcloths; dWash (new homes only)
PkgNH2:	Pkg1 + 2kW-PV (new homes only)

* For solar hot water systems closed-loop systems were assumed in north Florida and open-loop systems were assumed in central and south Florida.

The results of the analysis show significant potential for cost-effective energy efficiency and renewable energy savings. Some visual analysis is helpful in understanding the results so detailed graphical analysis of the results from the Miami simulations are presented here. Figure A-1 below shows results in terms of both the levelized cost of conserved energy (CCE) and the annual energy savings for new single-family residences in south Florida.

There are four packages of measures included in the new home analysis. The eStar package consists of the minimum energy efficiency measures required by EPA's prescriptive Builder Option Package (BOP) for Florida. The TaxC package consists of the non-competing measures with the lowest CCE that will qualify the home for the 2005 EPAct federal tax credit of \$2000. PkgNH1 consists of all the non-competing measures with CCE less than \$0.10/kWh. Where measures competed (e.g., SHW and HPWH) the measure with the lowest CCE was selected. PkgNH2 comprises PkgNH1 plus the 2kW-PV solar electric measure. Note that this package did not make the \$0.10/kWh cut-off that was used in the packages reported in the main body of the report.

Figure A-1. Annual Energy Savings and Levelized Cost of Conserved Energy for Energy Efficiency and Renewable Energy Measures and Packages for New Homes in South Florida (Miami)

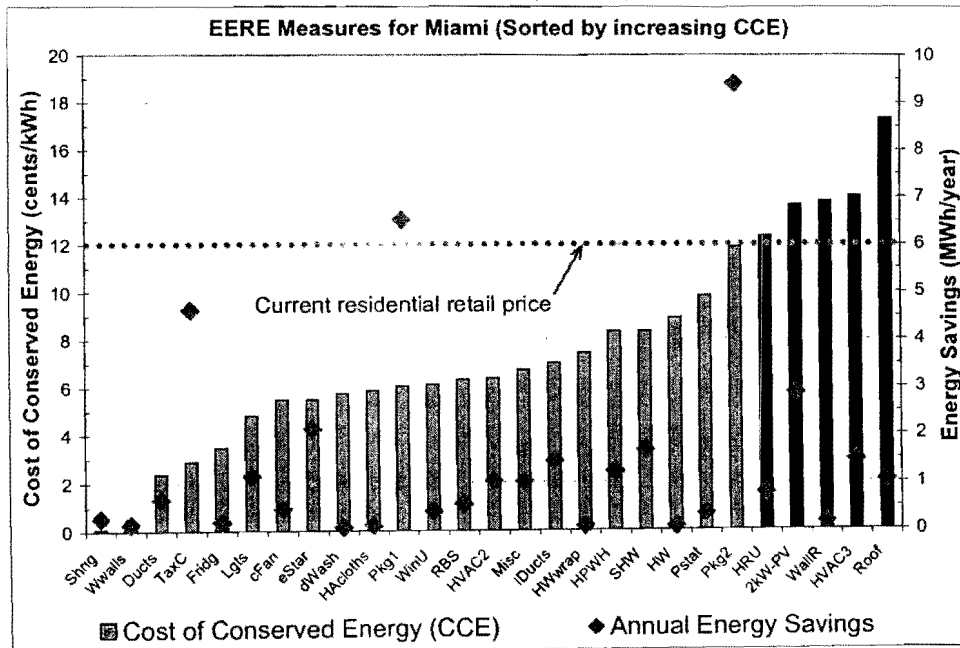


Figure A-1 is sorted by CCE with an annual energy savings overlay. Note that only 5 of the measures (darker blue on chart) have levelized costs in excess of the current typical Florida residential retail rate of \$0.12/kWh. Also note that there is no consistent relationship between annual energy savings and CCE. Some measures with relatively large savings (e.g. TaxC) result a relatively small CCE, while other measures with relatively small annual savings (e.g. WallR and Roof) result in a relatively large CCE and everything in between.

Thus, neither CCE nor annual energy savings tell the entire story. To simultaneously capture the energy benefits and their costs (and produce a more informative single metric), the authors have constructed a metric that combines annual energy savings with CCE. This metric we called the "Investment Efficacy." It is constructed simply by dividing the annual MWh saved by the CCE. Thus, the metric is quite similar to a benefit-to-cost ratio except that the benefit is measured in annual MWh savings and the cost is levelized over the lifetime of the measure. This metric substantially changes the order in which the measures are ranked.

Figure A-2, presented below, shows the results of this analysis for new single-family homes located in south Florida (Miami). The measures and packages shown with red bars in Figure A-1 are the only measures with CCE greater than Florida's prevailing typical retail residential rate of \$0.12/kWh. While these measures and packages may not pass a consumer cost-effectiveness test, one of them (2kW-PV) produces relatively large energy savings (18% compared with the baseline) and appears to be a reasonable investment from an annual energy savings to levelized cost perspective.

Figure A-2. Sorted Investment Efficacy of Energy Efficiency and Renewable Energy Measures (including packages) for New Single-Family Residences in South Florida Showing Annual MWh Savings for Each Dollar of annual Investment

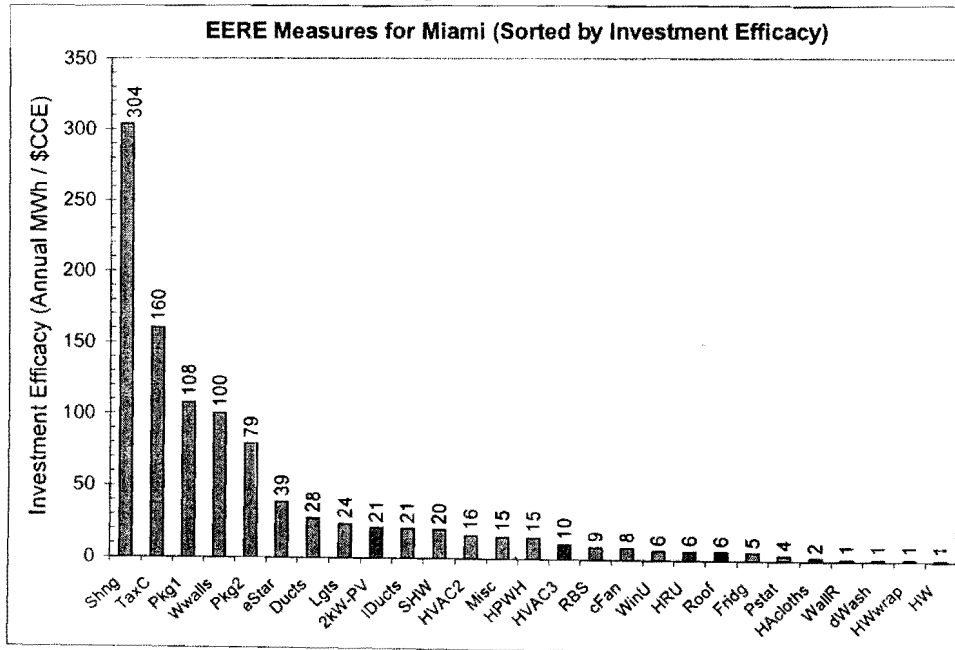


Figure A-2 clearly demonstrates that, if the goal is to reduce electricity consumption, the best overall strategy from a policy perspective may be to aggressively promote and further incent comprehensive packages of measures rather than individual measures. The individual measures of Shng (white instead of medium colored composition shingles) and Wwalls (white wall paint instead of beige wall paint) end up at the upper end of the scale with the four packages because their incremental cost is negligible (there is no incremental cost for a color choice). Excepting these two individual measures, the upper end of this ranking metric consists of the four packages considered by this analysis. Note also in Figure A-1 that the energy savings for these two highly-ranked individual measures are quite small compared with the measure packages with which they are intermingled. Thus, they only appear at this end of the scale because of their negligible cost. If, like other individual measures, they had some associated cost, they would surely rank lower than the four packages, which save significant energy.

A similar analysis has been performed for all three Florida climates. The resulting data are presented in Tables 2 through 4, below. The tabular data are sorted by Investment Efficacy (MWh/\$CCE) from high to low. Where a measure's levelized cost (CCE) exceeds the current typical Florida retail residential electricity rate, the row is highlighted. In addition, data for the measure life, first cost, federal and state financial incentive and the net cost of the measure are included in the tables.

Table A-2. South Florida New Home EERE Measure Potentials

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Shng	303.6	\$0.0009	0.27	1.7%	15	\$3		\$3
TaxC	160.2	\$0.0289	4.63	28.8%	20	\$3,737	\$2,000	\$1,737
PkgNH1	107.6	\$0.0606	6.52	40.6%	15	\$5,910	\$1,728	\$4,333
Wwalls	100.2	\$0.0014	0.14	0.9%	10	\$2		\$2
PkgNH2	79.1	\$0.1188	9.39	58.4%	20	\$25,377	\$10,700	\$14,677
eStar	38.5	\$0.0550	2.12	13.2%	20	\$1,516		\$1,516
Ducts	27.6	\$0.0236	0.65	4.1%	15	\$165		\$165
Lgts	23.6	\$0.0481	1.14	7.1%	5	\$240		\$240
2kW-PV	21.0	\$0.1367	2.88	17.9%	30	\$16,800	\$10,400	\$6,400
IDucts	20.6	\$0.0701	1.44	9.0%	30	\$1,650		\$1,650
SHW	20.1	\$0.0834	1.67	10.4%	20	\$3,242	\$1,428	\$1,815
HVAC2	16.1	\$0.0637	1.02	6.4%	15	\$1,000	\$300	\$700
Misc	15.1	\$0.0672	1.02	6.3%	5	\$300		\$300
HPWH	14.7	\$0.0833	1.22	7.6%	15	\$1,092		\$1,092
HVAC3	10.4	\$0.1404	1.46	9.1%	15	\$2,500	\$300	\$2,200
RBS	8.7	\$0.0631	0.55	3.4%	30	\$563		\$563
cFan	8.4	\$0.0548	0.46	2.9%	10	\$200		\$200
WinU	6.5	\$0.0612	0.40	2.5%	30	\$396		\$396
HRU	6.2	\$0.1234	0.77	4.8%	10	\$750		\$750
Roof	6.0	\$0.1733	1.04	6.5%	30	\$2,941		\$2,941
Fridg	5.2	\$0.0347	0.18	1.1%	10	\$50		\$50
Pstat	3.5	\$0.0982	0.35	2.2%	5	\$150		\$150
HACloths	1.8	\$0.0585	0.11	0.7%	10	\$50		\$50
WallR	1.2	\$0.1382	0.17	1.0%	30	\$376		\$376

Potential for EE/RE to Meet Florida's Growing Energy Demands, ACEEE

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
dWash	1.1	\$0.0574	0.07	0.4%	10	\$30		\$30
HWwrap	1.1	\$0.0743	0.09	0.5%	10	\$50		\$50
HW	0.8	\$0.0890	0.07	0.4%	10	\$50		\$50

Table A-3. Central Florida New Home EERE Measure Potentials

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Shng	203.0	\$0.0011	0.22	1.5%	15	\$3	\$0	\$3
TaxC	100.2	\$0.0365	3.66	24.3%	20	\$3,737	\$2,000	\$1,737
PkgNH1	78.9	\$0.0702	5.54	36.8%	16	\$5,910	\$1,728	\$4,333
PkgNH2	64.6	\$0.1310	8.47	56.2%	21	\$25,377	\$10,700	\$14,677
Wwalls	45.5	\$0.0020	0.09	0.6%	10	\$2	\$0	\$2
eStar	35.8	\$0.0571	2.04	13.6%	20	\$1,516	\$0	\$1,516
SHW	21.6	\$0.0804	1.74	11.5%	20	\$3,092	\$1,428	\$1,815
2kW-PV	21.7	\$0.1345	2.92	19.4%	30	\$16,800	\$10,400	\$6,400
Lgts	19.1	\$0.0534	1.02	6.8%	5	\$240	\$0	\$240
Ducts	18.5	\$0.0288	0.53	3.5%	15	\$165	\$0	\$165
HPWH	16.5	\$0.0785	1.30	8.6%	15	\$1,092	\$0	\$1,092
IDucts	15.0	\$0.0821	1.23	8.2%	30	\$1,650	\$0	\$1,650
Misc	12.6	\$0.0736	0.93	6.2%	5	\$300	\$0	\$300
HVAC2	9.6	\$0.0824	0.79	5.3%	15	\$1,000	\$300	\$700
WinU	6.9	\$0.0593	0.41	2.7%	30	\$396	\$0	\$396
RBS	6.5	\$0.0728	0.48	3.2%	30	\$563	\$0	\$563
HVAC3	6.4	\$0.1789	1.15	7.6%	15	\$2,500	\$300	\$2,200
cFan	4.8	\$0.0724	0.35	2.3%	10	\$200	\$0	\$200
Fridg	4.5	\$0.0374	0.17	1.1%	10	\$50	\$0	\$50
Roof	3.3	\$0.2324	0.78	5.2%	30	\$2,941	\$0	\$2,941
HRU	3.1	\$0.1746	0.54	3.6%	10	\$750	\$0	\$750
Pstat	3.1	\$0.1055	0.32	2.2%	5	\$150	\$0	\$150
HAcloths	2.0	\$0.0564	0.11	0.7%	10	\$50	\$0	\$50
HWwrap	1.4	\$0.0672	0.09	0.6%	10	\$50	\$0	\$50
dWash	1.3	\$0.0549	0.07	0.5%	10	\$30	\$0	\$30
HW	1.0	\$0.0810	0.08	0.5%	10	\$50	\$0	\$50
WallIR	0.9	\$0.1570	0.15	1.0%	30	\$376	\$0	\$376

It is interesting to note in Table A-3, above, that Pkg2 no longer meets the \$0.12/kWh threshold as it did in south Florida. Nonetheless, it only slightly exceeds this value and its annual energy savings are such that its relative position among the measures has not changed.

Table A-4. North Florida New Home EERE Measure Potentials

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Shng	77.59	\$0.0018	0.1	0.9%	15	\$3	\$0	\$3
PkgNH1	72.60	\$0.0729	5.3	34.6%	16	\$5,910	\$1,728	\$4,333
TaxC	61.51	\$0.0466	2.9	18.8%	20	\$3,737	\$2,000	\$1,737
PkgNH2	58.11	\$0.1386	8.1	52.7%	20	\$25,377	\$10,700	\$14,677
eStar	27.53	\$0.0651	1.8	11.7%	20	\$1,516	\$0	\$1,516
2kW-PV	19.39	\$0.1424	2.8	18.1%	30	\$16,800	\$10,400	\$6,400
HPWH	18.75	\$0.0736	1.4	9.0%	15	\$1,092	\$0	\$1,092
SHW	18.31	\$0.0873	1.6	10.5%	20	\$3,242	\$1,428	\$1,815
Lgts	16.33	\$0.0579	0.9	6.2%	5	\$240	\$0	\$240
Ducts	89.73	\$0.0319	0.5	3.1%	15	\$165	\$0	\$165
WinU	11.73	\$0.0455	0.5	3.5%	30	\$396	\$0	\$396
Wwalls	11.62	\$0.0040	0.0	0.3%	10	\$2	\$0	\$2
Misc	11.10	\$0.0785	0.9	5.7%	5	\$300	\$0	\$300
IDucts	11.01	\$0.0959	1.1	6.9%	30	\$1,650	\$0	\$1,650
HVAC2	9.36	\$0.0835	0.8	5.1%	15	\$1,000	\$300	\$700
HVAC3	5.46	\$0.1936	1.1	6.9%	15	\$2,500	\$300	\$2,200
RBS	4.22	\$0.0905	0.4	2.5%	30	\$563	\$0	\$563
Pstat	3.75	\$0.0954	0.4	2.3%	5	\$150	\$0	\$150
Fridg	3.61	\$0.0418	0.2	1.0%	10	\$50	\$0	\$50
cFan	2.86	\$0.0940	0.3	1.8%	10	\$200	\$0	\$200
WallR	2.82	\$0.0905	0.3	1.7%	30	\$376	\$0	\$376
dWash	2.53	\$0.0387	0.1	0.6%	10	\$30	\$0	\$30
HAcloths	2.13	\$0.0545	0.1	0.8%	10	\$50	\$0	\$50
HRU	1.75	\$0.2329	0.4	2.7%	10	\$750	\$0	\$750
HWwrap	1.58	\$0.0632	0.1	0.7%	10	\$50	\$0	\$50
Roof	1.29	\$0.3746	0.5	3.2%	30	\$2,941	\$0	\$2,941
HW	1.09	\$0.0761	0.1	0.5%	10	\$50	\$0	\$50

The importance of climate becomes more evident in Table A-4 where increased wall insulation has moved substantially up in the ranking order and its levelized cost is now below the \$0.12/kWh threshold, where it was not in either south or central Florida. In addition, it is interesting to note how far down in the rankings Wwalls has dropped between central and north Florida. One may also note in the tables that the highest ranked measure (Shng) is dramatically impacted by climate, with Investment Efficacies ranging from a high of 304 in south Florida to low of 78 in north Florida. The reasons for this are fairly straightforward. First, the measure has negligible costs because there is not incremental cost for a color decision (that is why it and Wwalls rank near the top to begin with). And second, solar reflectance measures are beneficial for cooling but detrimental for heating. Thus, as we move from south Florida where there is virtually no heating load and where the Shng measure is literally “off the charts” to north Florida where heating is a consideration, the Investment Efficacy of this measure (and the Wwalls measure) drops substantially. However, the four packages of measures (Pkg1, Pkg2, eStar and TaxC) remain relatively constant in ranking order across all climates, with all four of them consistently ranked within the top five or six measures.

Existing Homes

Existing homes are significantly different than new homes.

Table A- 5a. South Florida Existing Home EERE Measure Potentials (Full Costs)

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
PkgEH0	52.0	\$0.0770	4.01	22.0%	16	\$4,890	\$1,575	\$3,465
PkgEH2	38.4	\$0.1820	6.99	45.6%	16	\$16,302	\$2,075	\$14,377
HVAC2	24.9	\$0.1253	3.12	17.2%	15	\$4,500	\$300	\$4,200
2kW-PV	21.0	\$0.1367	2.88	15.8%	30	\$16,800	\$10,400	\$6,400
SHW	19.6	\$0.0908	1.78	9.8%	20	\$3,650	\$1,550	\$2,100
PkgEH1	19.5	\$0.1889	3.68	24.0%	16	\$9,390	\$1,875	\$7,665
Lgts	14.9	\$0.0566	0.85	4.6%	5	\$210	\$0	\$210
HVAC1	13.5	\$0.1436	1.95	10.7%	15	\$3,000	\$0	\$3,000
HPWH	10.7	\$0.1143	1.22	6.7%	15	\$1,500	\$0	\$1,500
Ceil	8.6	\$0.0599	0.52	2.8%	30	\$530	\$25	\$505
WinR	8.4	\$0.1523	1.28	7.0%	30	\$3,376	\$200	\$3,176
HRU	8.3	\$0.1066	0.89	4.9%	10	\$750	\$0	\$750
Ducts	7.9	\$0.0767	0.61	3.3%	15	\$500	\$0	\$500
HWwrap	6.5	\$0.0311	0.20	1.1%	10	\$50	\$0	\$50
Misc	6.3	\$0.1200	0.76	4.2%	5	\$400	\$0	\$400
RBS	5.8	\$0.1361	0.78	4.3%	20	\$1,388	\$0	\$1,388
Pstat	4.9	\$0.0833	0.41	2.3%	5	\$150	\$0	\$150
Roof	3.0	\$0.4655	1.40	7.7%	30	\$11,100	\$500	\$10,600
Wtint	2.7	\$0.2359	0.64	3.5%	10	\$1,200	\$0	\$1,200
HW	1.1	\$0.2042	0.22	1.2%	12	\$408	\$0	\$408
cFan	1.1	\$0.3573	0.38	2.1%	10	\$1,080	\$0	\$1,080
Wwalls	0.9	\$0.3408	0.30	1.6%	10	\$806	\$0	\$806
Shng	0.5	\$0.7697	0.38	2.1%	15	\$3,100	\$0	\$3,100
Walls	0.5	\$1.1227	0.52	2.8%	5	\$2,553	\$0	\$2,553
HAcloths	0.2	\$0.5851	0.11	0.6%	10	\$500	\$0	\$500
Fridg	0.2	\$0.9448	0.17	0.9%	10	\$1,200	\$0	\$1,200
dWash	0.1	\$0.7654	0.07	0.4%	10	\$400	\$0	\$400

**Table A-5b. South Florida Existing Home EERE Measure Potentials
(Incremental Costs)**

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Wwalls	552.7	\$0.0005	0.30	1.6%	10	\$1	\$0	\$1
HVAC1	406.3	\$0.0048	1.95	10.7%	15	\$0	\$0	\$100
PkgEH2	91.0	\$0.0769	6.99	38.5%	16	\$7,876	\$150	\$6,073
HVAC2	87.2	\$0.0358	3.12	17.2%	15	\$1,500	\$0	\$1,200
Shng	81.6	\$0.0046	0.38	2.1%	15	\$19	\$0	\$19
PkgEH0	56.7	\$0.0707	4.01	22.0%	16	\$4,482	\$150	\$3,179
HW	43.7	\$0.0050	0.22	1.2%	12	\$0	\$0	\$10
WinR	34.4	\$0.0372	1.28	7.0%	30	\$976	\$0	\$776
PkgEH1	34.1	\$0.1080	3.68	20.2%	16	\$5,982	\$150	\$4,379
SHW	22.6	\$0.0785	1.78	9.8%	20	\$3,242	\$150	\$1,815
2kW-PV	21.0	\$0.1367	2.88	15.8%	30	\$16,800	\$0	\$6,400

Potential for EE/RE to Meet Florida's Growing Energy Demands, ACEEE

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Lgts	14.9	\$0.0566	0.85	4.6%	5	\$210	\$0	\$210
HPWH	14.7	\$0.0832	1.22	6.7%	15	\$1,092	\$0	\$1,092
Misc	9.5	\$0.0800	0.76	4.2%	5	\$267	\$0	\$267
Ceill	8.6	\$0.0599	0.52	2.8%	30	\$530	\$0	\$505
HRU	8.3	\$0.1066	0.89	4.9%	10	\$750	\$0	\$750
Ducts	7.9	\$0.0767	0.61	3.3%	15	\$500	\$0	\$500
cFan	7.7	\$0.0496	0.38	2.1%	10	\$150	\$0	\$150
Roof	7.2	\$0.1932	1.40	7.7%	30	\$4,900	\$0	\$4,400
HWwrap	6.5	\$0.0311	0.20	1.1%	10	\$50	\$0	\$50
RBS	5.8	\$0.1361	0.78	4.3%	20	\$1,388	\$0	\$1,388
Pstat	4.9	\$0.0833	0.41	2.3%	5	\$150	\$0	\$150
Fridg	4.4	\$0.0378	0.17	0.9%	10	\$50	\$0	\$50
Wtint	2.7	\$0.2359	0.64	3.5%	10	\$1,200	\$0	\$1,200
HACloths	0.6	\$0.1755	0.11	0.6%	10	\$150	\$0	\$150
Walls	0.5	\$1.1227	0.52	2.8%	5	\$2,553	\$0	\$2,553
dWash	0.5	\$0.1436	0.07	0.4%	10	\$75	\$0	\$75

Table A-6a. Central Florida Existing Home EERE Measure Potentials (Full Costs)

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
PkgEH0	53.4	\$0.0751	4.01	23.4%	17	\$4,890	\$1,575	\$3,465
PkgEH2	33.8	\$0.1919	6.49	44.9%	17	\$16,302	\$2,075	\$14,377
SHW	20.9	\$0.0879	1.84	10.7%	20	\$3,500	\$1,550	\$2,100
2kW-PV	20.3	\$0.1391	2.82	16.5%	30	\$16,800	\$10,400	\$6,400
HVAC2	19.3	\$0.1424	2.75	16.0%	15	\$4,500	\$300	\$4,200
PkgEH1	18.0	\$0.1949	3.51	24.2%	16	\$9,390	\$1,875	\$7,665
Ceill	13.8	\$0.0475	0.65	3.8%	30	\$530	\$25	\$505
HPWH	13.8	\$0.1008	1.39	8.1%	15	\$1,500	\$0	\$1,500
Lgts	13.6	\$0.0593	0.81	4.7%	5	\$210	\$0	\$210
HVAC1	10.5	\$0.1764	1.85	10.8%	15	\$3,500	\$0	\$3,500
WinR	9.7	\$0.1420	1.37	8.0%	30	\$3,376	\$200	\$3,176
HWwrap	7.8	\$0.0285	0.22	1.3%	10	\$50	\$0	\$50
Ducts	6.9	\$0.0821	0.57	3.3%	15	\$500	\$0	\$500
RBS	6.3	\$0.1299	0.82	4.8%	20	\$1,388	\$0	\$1,388
Misc	5.5	\$0.1292	0.71	4.1%	5	\$400	\$0	\$400
Pstat	4.9	\$0.0833	0.41	2.4%	5	\$150	\$0	\$150
HRU	4.6	\$0.1432	0.66	3.9%	10	\$750	\$0	\$750
Walls	2.7	\$0.4638	1.25	7.3%	5	\$2,553	\$0	\$2,553
Roof	2.4	\$0.5202	1.25	7.3%	30	\$11,100	\$500	\$10,600
Wtint	2.0	\$0.2788	0.54	3.2%	10	\$1,200	\$0	\$1,200
HW	1.3	\$0.1871	0.24	1.4%	12	\$408	\$0	\$408
cFan	1.1	\$0.3500	0.39	2.3%	10	\$1,080	\$0	\$1,080
Wwalls	0.6	\$0.3980	0.26	1.5%	10	\$806	\$0	\$806
Shng	0.5	\$0.7596	0.38	2.2%	15	\$3,100	\$0	\$3,100
HACloths	0.2	\$0.5642	0.11	0.7%	10	\$500	\$0	\$500
Fridg	0.2	\$1.0182	0.16	0.9%	10	\$1,250	\$0	\$1,250
dWash	0.1	\$0.7216	0.07	0.4%	10	\$400	\$0	\$400

Table A-6b. Central Florida Existing Home EERE Measure Potentials (Incremental Costs)

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Wwalls	405.1	\$0.0006	0.26	1.5%	10	\$1	\$0	\$1
HVAC1	366.4	\$0.0050	1.85	10.8%	15	\$0	\$0	\$100
HVAC2	115.7	\$0.0237	2.75	16.0%	15	\$1,000	\$300	\$700
PkgEH2	87.3	\$0.0744	6.49	37.8%	17	\$7,376	\$1,953	\$5,573
Shng	83.8	\$0.0045	0.38	2.2%	15	\$19	\$0	\$19
PkgEH0	58.2	\$0.0689	4.01	23.4%	17	\$4,482	\$1,453	\$3,179
HW	52.1	\$0.0046	0.24	1.4%	12	\$0	\$0	\$10
WinR	39.6	\$0.0347	1.37	8.0%	30	\$976	\$200	\$776
PkgEH1	35.6	\$0.0986	3.51	20.4%	16	\$5,482	\$1,753	\$3,879
SHW	24.2	\$0.0759	1.84	10.7%	20	\$3,092	\$1,428	\$1,815
2kW-PV	19.1	\$0.1478	2.82	16.5%	30	\$16,800	\$10,000	\$6,800
HPWH	18.9	\$0.0734	1.39	8.1%	15	\$1,092	\$0	\$1,092
Ceill	13.8	\$0.0475	0.65	3.8%	30	\$530	\$25	\$505
Lgts	13.6	\$0.0593	0.81	4.7%	5	\$210	\$0	\$210
Misc	8.2	\$0.0862	0.71	4.1%	5	\$267	\$0	\$267
cFan	8.0	\$0.0486	0.39	2.3%	10	\$150	\$0	\$150
HWwrap	7.8	\$0.0285	0.22	1.3%	10	\$50	\$0	\$50
Ducts	6.9	\$0.0821	0.57	3.3%	15	\$500	\$0	\$500
RBS	6.3	\$0.1299	0.82	4.8%	20	\$1,388	\$0	\$1,388
Roof	5.8	\$0.2159	1.25	7.3%	30	\$4,900	\$500	\$4,400
Pstat	4.9	\$0.0833	0.41	2.4%	5	\$150	\$0	\$150
HRU	4.6	\$0.1432	0.66	3.9%	10	\$750	\$0	\$750
Fridg	3.8	\$0.0407	0.16	0.9%	10	\$50	\$0	\$50
Walls	2.7	\$0.4638	1.25	7.3%	5	\$2,553	\$0	\$2,553
Wtint	2.0	\$0.2788	0.54	3.2%	10	\$1,200	\$0	\$1,200
HAcloths	0.7	\$0.1693	0.11	0.7%	10	\$150	\$0	\$150
dWash	0.5	\$0.1354	0.07	0.4%	10	\$75	\$0	\$75

Table A-7a. North Florida Existing Home EERE Measure Potentials (Full Costs)

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
PkgEH0	44.40	\$0.0831	3.7	23.2%	16	\$4,890	\$1,575	\$3,465
PkgEH2	24.21	\$0.2288	5.5	40.5%	16	\$16,302	\$2,075	\$14,377
2kW-PV	19.39	\$0.1424	2.8	17.3%	30	\$16,800	\$10,400	\$6,400
SHW	17.23	\$0.0968	1.7	10.5%	20	\$3,650	\$1,550	\$2,100
PkgEH1	14.41	\$0.2190	3.2	23.1%	16	\$9,390	\$1,875	\$7,665
HPWH	13.65	\$0.1011	1.4	8.7%	15	\$1,500	\$0	\$1,500
HVAC2	12.43	\$0.1774	2.2	13.8%	15	\$4,500	\$300	\$4,200
Lgts	10.60	\$0.0672	0.7	4.5%	5	\$210	\$0	\$210
HWwrap	9.04	\$0.0264	0.2	1.5%	10	\$50	\$0	\$50
Ducts	7.66	\$0.0780	0.6	3.7%	15	\$500	\$0	\$500
Ceill	6.65	\$0.0683	0.5	2.9%	30	\$530	\$25	\$505
HVAC1	6.55	\$0.2231	1.5	9.2%	15	\$3,500	\$0	\$3,500
RBS	5.33	\$0.1415	0.8	4.7%	20	\$1,388	\$0	\$1,388
WinR	4.91	\$0.1994	1.0	6.1%	30	\$3,376	\$200	\$3,176
Misc	4.74	\$0.1387	0.7	4.1%	5	\$400	\$0	\$400

Potential for EE/RE to Meet Florida's Growing Energy Demands, ACEEE

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
Pstat	4.07	\$0.0916	0.4	2.3%	5	\$150	\$0	\$150
HRU	2.47	\$0.1958	0.5	3.0%	10	\$750	\$0	\$750
HW	1.48	\$0.1740	0.3	1.6%	12	\$408	\$0	\$408
Roof	1.28	\$0.7120	0.9	5.7%	30	\$11,100	\$500	\$10,600
Wtint	0.98	\$0.3929	0.4	2.4%	10	\$1,200	\$0	\$1,200
cFan	0.62	\$0.4707	0.3	1.8%	10	\$1,080	\$0	\$1,080
Shng	0.23	\$1.1319	0.3	1.6%	15	\$3,100	\$0	\$3,100
HACloths	0.22	\$0.5401	0.1	0.7%	10	\$500	\$0	\$500
Fridg	0.12	\$0.1994	0.1	0.9%	10	\$1,250	\$0	\$1,250
dWash	0.11	\$0.6920	0.1	0.5%	10	\$400	\$0	\$400
Wwalls	0.03	\$1.8194	0.1	0.4%	10	\$806	\$0	\$806

Table A-7b. North Florida Existing Home EERE Measure Potentials (Incremental Costs)

Measure	MWh / \$CCE	CCE (\$)	MWh saved	% saved	Measure life	First cost (\$)	Incentive (\$)	Net cost (\$)
HVAC1	229.24	\$0.0064	1.5	9.2%	15	\$0	\$0	\$100
HVAC2	74.59	\$0.0296	2.2	13.8%	15	\$1,000	\$300	\$700
PkgEH3	62.44	\$0.0887	5.5	34.8%	16	\$7,376	\$1,953	\$5,573
HW	60.23	\$0.0043	0.3	1.6%	12	\$0	\$0	\$10
PkgEH1	48.38	\$0.0763	3.7	23.2%	16	\$4,482	\$1,453	\$3,179
Shng	37.75	\$0.0068	0.3	1.6%	15	\$19	\$0	\$19
PkgEH2	28.47	\$0.1108	3.2	19.8%	16	\$5,482	\$1,753	\$3,879
WinR	20.08	\$0.0487	1.0	6.1%	30	\$976	\$200	\$776
SHW	19.94	\$0.0836	1.7	10.5%	20	\$3,242	\$1,428	\$1,815
2kW-PV	19.39	\$0.1424	2.8	17.3%	30	\$16,800	\$10,400	\$6,400
Wwalls	19.39	\$0.0029	0.1	0.4%	10	\$1	\$0	\$1
HPWH	18.75	\$0.0736	1.4	8.7%	15	\$1,092	\$0	\$1,092
Lgts	10.60	\$0.0672	0.7	4.5%	5	\$210	\$0	\$210
HWwrap	9.04	\$0.0264	0.2	1.5%	10	\$50	\$0	\$50
Ducts	7.66	\$0.0780	0.6	3.7%	15	\$500	\$0	\$500
Misc	7.11	\$0.0925	0.7	4.1%	5	\$267	\$0	\$267
Ceil	6.65	\$0.0683	0.5	2.9%	30	\$530	\$25	\$505
RBS	5.33	\$0.1415	0.8	4.7%	20	\$1,388	\$0	\$1,388
cFan	4.44	\$0.0654	0.3	1.8%	10	\$150	\$0	\$150
Pstat	4.07	\$0.0916	0.4	2.3%	5	\$150	\$0	\$150
Roof	3.09	\$0.2956	0.9	5.7%	30	\$4,900	\$500	\$4,400
Fridg	3.09	\$0.0672	0.1	0.9%	10	\$50	\$0	\$50
HRU	2.47	\$0.1958	0.5	3.0%	10	\$750	\$0	\$750
Wtint	0.98	\$0.3929	0.4	2.4%	10	\$1,200	\$0	\$1,200
HACloths	0.72	\$0.1620	0.1	0.7%	10	\$150	\$0	\$150
dWash	0.56	\$0.1298	0.1	0.5%	10	\$75	\$0	\$75

Statewide Potential

To estimate the statewide economic potential for energy efficiency in residential buildings in Florida, we combined applied weighted averages from three geographic regions: North (Jacksonville), Central (Tampa), and South (Miami). Table A-8 shows the breakdown of economic potential savings in 2023 by efficiency package and region.

Table A-8. Economic Potential for Energy Efficiency in Residential Buildings

Existing Homes Efficiency Measures	kWh Saved per Home per Year				% Applicable ²	2023 Statewide Economic Potential (GWh)	Cost per kWh Saved
	Jacksonville	Tampa	Miami	Statewide Average ¹			
<i>Package EH1</i>	<u>3155</u>	<u>3506</u>	<u>3681</u>	<u>3504</u>	<u>50%</u>	<u>15,681</u>	<u>\$ 0.10</u>
High-efficiency Air Conditioner (SEER-15; HSPF-9)	744	899	1177	977			\$ 0.09
Ducts: Normalized leakage 0.10 to 0.03	597	567	607	589			\$ 0.08
Ceiling Insulation: R-18 to R-30	454	653	517	560			\$ 0.06
Solar hot water system	1,668	1,837	1,777	1780			\$ 0.08
50% fluorescent lighting replacement	712	807	845	803			\$ 0.06
Programmable thermostat with 2 F setup/setback	373	410	410	403			\$ 0.08
<i>Package EH2³</i>	<u>5539</u>	<u>6490</u>	<u>6993</u>	<u>6497</u>	<u>20%</u>	<u>11,628</u>	<u>\$ 0.07</u>
Cool Roof	255	380	375	353			\$ 0.00
Energy Star Refrigerator	140	155	167	157			\$ 0.04
Energy Star Ceiling Fans	454	653	517	560			\$ 0.03
Miscellaneous load reduction (30%)	657	705	759	717			\$ 0.09
Window replacement (U=0.39; SHGC=0.40 vinyl)	978	1373	1280	1257			\$ 0.04
White walls (alpha = 0.40)	56	256	299	233			\$ 0.00
New Construction							
<i>Energy Star Home (15% savings)</i>	<u>1,791</u>	<u>2,042</u>	<u>2,118</u>	<u>2,021</u>	<u>100%</u>	<u>8,252</u>	<u>\$ 0.06</u>
<i>Tax Credit Eligible Home (25% savings)⁴</i>	<u>1,075</u>	<u>1,616</u>	<u>2,507</u>	<u>1,857</u>	<u>50%</u>	<u>3,894</u>	<u>\$ 0.03</u>
<i>40% Savings Home⁵</i>	<u>2,426</u>	<u>1,886</u>	<u>1,894</u>	<u>1,998</u>	<u>10%</u>	<u>838</u>	<u>\$ 0.07</u>
Total Savings (GWh)	10,649	21,579	20,827			40,293	\$ 0.06
% Savings (% of 2023 Projected Residential Sales)	7%	14%	13%			22%	

¹ Statewide average per home savings were calculated using a regional weighted average based on electricity sales: 20% for Jacksonville, 41% for Tampa, and 39% for Miami (Rose et. al. 1993).

² In existing homes, % applicable is the percent of efficiency measure savings assumed to be applied in homes statewide cost-effectively. For new homes, % applicable is the % of homes built between 2008 and 2023 that can cost-effectively achieve electricity savings from each measure.

³ Package 2 efficiency measures also include measures in Package 1.

⁴ Savings are incremental to Energy Star Homes.

⁵ Savings are incremental to both Energy Star Homes and Tax Credit Eligible Homes.

Reference Case

Table A-9 below provides a detailed list of the features of the baseline residential buildings used for the simulation and analyses reported here.

Table A-9. Detailed Characteristics of Baseline Homes

Building type: Climate:	Existing Jacksonville	Existing Tampa	Existing Miami	New Jacksonville	New Tampa	New Miami
Envelope:						
conditioned floor area (ft ²)	1600	1600	1600	2200	2200	2200
no. stories	1	1	1	1	1	1
no. bedrooms	3	3	3	3	3	3
avg. ceiling ht (ft)	8	8	8	8.5	8.5	8.5
attached garage	yes	yes	yes	yes	yes	yes
foundation type	slab on grade	slab on grade	slab on grade	slab on grade	slab on grade	slab on grade
slab area (ft ²)	1600	1600	1600	2200	2200	2200
slab insulation	none	none	none	none	none	none
slab perimeter (ft)	167	167	167	188	188	188
roof type	hip	hip	hip	hip	hip	hip
pitch	4:12	4:12	4:12	5:12	5:12	5:12
cover	comp shingles	comp shingles	comp shingles	comp shingles	comp shingles	comp shingles
color	Dark	Dark	Dark	Dark	Dark	Dark
absorptance	0.92	0.92	0.92	0.92	0.92	0.92
insulation	none	none	none	none	none	none
attic type	standard	standard	standard	standard	standard	standard
ventilation	1:300	1:300	1:300	1:300	1:300	1:300
ceiling type	flat	flat	flat	flat	flat	flat
area (ft ²)	1600	1600	1600	2200	2200	2200
insulation	R-18.0	R-15	R-15	R-30.0	R-30.0	R-30.0
wall type	Wood Frame	Concrete block	Concrete block	Concrete block	Concrete block	Concrete block
insulation	R-11.0	R-1.0	R-1.0	R-3.0	R-3.0	R-3.0
sheathing R	none	none	none	none	none	none
absorptance	0.5	0.5	0.5	0.5	0.5	0.5
door type	insulated and wood	insulated and wood	insulated and wood	insulated	insulated	insulated
area (ft ²)	39	39	39	39	39	39
window type	double, std	single, std	single, std	double, low-e	double, low-e	double, low-e
size (% CFA)	15.0%	15.0%	15.0%	18.0%	18.0%	18.0%
orientation	equal	equal	equal	equal	equal	equal
U-Factor	0.75	1.2	1.2	0.75	0.75	0.75
SHGC	0.65	0.7	0.7	0.4	0.4	0.4
overhang (ft)	2	2	2	1.5	1.5	1.5
envelope leakage rate (ach50)	standard	standard	standard	standard	standard	standard
	8	8	8	8	8	8
HVAC Systems:						
mech. vent	none	none	none	none	none	none
cooling type	central	central	central	central	central	central
cooling SEER	9.25	9.25	9.5	13	13	13
heating type	Heat Pump	Heat Pump	Electric Strip	Heat Pump	Heat Pump	Heat Pump
HSPF	5.95	5.95	COP = 1	7.7	7.7	7.7
thermostat schedule	FI existing proto	FI existing proto	FI existing proto	FL new proto	FL new proto	FL new proto
set points (°F)	68/78.5	68/78.5	68/78.5	68/78.5	68/78.5	68/78.5
air distribution system	forced air	forced air	forced air	forced air	forced air	forced air
duct insulation	4.2	4.2	4.2	8	8	8
duct location	Attic	Attic	Attic	Attic	Attic	Attic
AHU location	Garage	Garage	Garage	Garage	Garage	Garage

Building type: Climate:	Existing Jacksonville	Existing Tampa	Existing Miami	New Jacksonville	New Tampa	New Miami
duct leakage (Qn out)	0.1	0.1	0.1	0.1	0.1	0.1
return leak fraction	0.6	0.6	0.6	0.6	0.6	0.6
hot water (size and fuel type)	40 gal electric	40 gal electric	40 gal electric	50 gal electric	50 gal electric	50 gal electric
EF	0.86	0.86	0.86	0.9	0.9	0.9
Appliances:						
% fluorescent	10%	10%	10%	10%	10%	10%
eStar refrigerator	no	no	no	no	no	no
eStar dishwasher	no	no	no	no	no	no
eStar ceiling fans	no	no	no	no	no	no
eStar washer	no	no	no	no	no	no
dryer	electric	electric	electric	electric	electric	electric
range	electric	electric	electric	electric	electric	electric

Commercial Buildings

A total of 8 commercial building types were simulated and analyzed by this study. These prototypes have been developed by LBNL (Huang and Franconi 1999) based on the Commercial Buildings Energy Consumption Survey (EIA 1995). These prototypes represent building types, which cover 85% of the commercial building stock surveyed by CBECS. The building types are:

- Large office ($\geq 25,000$ ft²)
- Small office ($< 25,000$ ft²)
- Large retail store ($\geq 25,000$ ft²)
- Small retail store ($< 25,000$ ft²)
- School
- Hospital
- Large hotel
- Restaurant

A brief description of the building construction of each building prototype used in the analysis is given below.

Large office

Floor area: 90,000 ft²

Number of floors: 6

Floor types: First floor, interior floor and top floor

Zones: Each floor has 4 perimeter zones and one core zone

Small office

Floor area: 6,600 ft²

Number of floors: 1

Zone: Each floor has 2 zones

Large retail store

Floor area: 79,000 ft²

Number of floors: 2

Floor types: First floor, and top floor
Zones: Each floor has a single zone

Small retail store

Floor area: 6,400 ft²
Number of floors: 1
Zone: A single zone

School

Floor area: 16,000 ft²
Number of floors: 2 for classrooms
Floor type: First floor, and top floor
Zones: Each floor has a multiplier for class room. Each class room has a floor area of 1,800 ft². In addition, the school has a library, gymnasium, auditorium, kitchen, and dining area. The percentages of each zone compared to the total floor area are listed below:

Library	13%
Gymnasium	13%
Auditorium	8%
Kitchen	2%
Dinning	4%
Classroom	60%

Hospital

Floor area: 155,800 ft²
Number of floors: 12
Floor type: First floor, interior floors and top floor
Zones: Each floor has patient rooms, core & public area, kitchen, hallway, and clinic. The percentages of each zone compared to the total floor area are listed below:

Patient room	15%
Core & public	35%
Kitchen	5%
Hallway	20%
Clinic	25%

Large hotel

Floor area: 250,000 ft²
Number of floors: 10
Floor types: First floor, interior floor and top floor
Zones: Each floor has hotel rooms. Kitchen & laundry, and lobby & conference rooms are located in the first floor. The percentages of each zone compared to the total floor area are as listed below:

Hotel room	70%
Lobby/Conf	25%
Kitchen/Laun	5%

Sit-down restaurant

Floor area: 5,250 ft²

Number of floors: 1

Zones: Consists of dining area and kitchen. The percentages of each zone compared to the total floor area are listed below:

Dining	80%
Kitchen	20%

The primary thermal envelope and HVAC characteristics for each of these prototypes are available from the Florida Solar Energy Center. Table A-10a below provides a detailed list of the features of the baseline commercial buildings used for the simulation and analyses reported here.

Table A-10a. Detailed Characteristics of Baseline Commercial Buildings

Small Office							
Building Code	Existing			New			
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami	
ExtWallRValue	5.600	5.600	5.600	2.000	2.000	2.000	
ExtRoofRValue	12.600	12.600	12.600	19.000	19.000	19.000	
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700	
WndUValue	1.500	1.580	1.580	1.220	1.220	1.220	
WndSC	0.750	0.750	0.750	0.287	0.287	0.287	
WWR	0.150	0.150	0.150	0.150	0.150	0.150	
LgtWPerSF	1.700	1.700	1.700	1.000	1.000	1.000	
ClgSysEff	9.220	9.220	9.220	10.100	10.100	10.100	
HeatSysEff	0.780	0.780	0.780	0.800	0.800	0.800	
FanWPerCfm	0.800	0.800	0.800	0.800	0.800	0.800	
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800	
Large Office							
Building Code	Existing			New			
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami	
ExtWallRValue	6.000	6.000	6.000	2.000	2.000	2.000	
ExtRoofRValue	12.600	12.600	12.600	19.000	19.000	19.000	
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700	
WndUValue	1.670	1.670	1.670	1.220	1.220	1.220	
WndSC	0.710	0.710	0.710	0.287	0.287	0.287	
WWR	0.500	0.500	0.500	0.150	0.150	0.150	
LgtWPerSF	1.300	1.300	1.300	1.000	1.000	1.000	
FanWPerCfm	0.800	0.800	0.800	1.250	1.250	1.250	
ClgSysCop	3.800	3.800	3.800	5.000	5.000	5.000	
HeatEff	0.800	0.800	0.800	0.800	0.800	0.800	
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800	
Large Hotel							
Building Code	Existing			New			
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami	
ExtWallRValue	6.200	6.200	6.200	2.000	2.000	2.000	
ExtRoofRValue	14.000	14.000	14.000	19.000	19.000	19.000	

Potential for EE/RE to Meet Florida's Growing Energy Demands, ACEEE

Small Office						
Building Code	Existing			New		
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700
WndUValue	1.670	1.670	1.670	1.220	1.220	1.220
WndSC	0.740	0.740	0.740	0.287	0.287	0.287
WWR	0.350	0.350	0.350	0.150	0.150	0.150
LgtWPerSF	1.500	1.500	1.500	1.000	1.000	1.000
FanWPerCfm	0.800	0.800	0.800	1.250	1.250	1.250
ClgSysCop	3.800	3.800	3.800	5.000	5.000	5.000
HeatSysEff	0.800	0.800	0.800	0.800	0.800	0.800
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800
Small Retail						
Building Code	Existing			New		
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
ExtWallRValue	4.400	4.400	4.400	2.000	2.000	2.000
ExtRoofRValue	12.200	12.200	12.200	19.000	19.000	19.000
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700
WndUValue	1.300	1.300	1.300	1.220	1.220	1.220
WndSC	0.830	0.830	0.830	0.287	0.287	0.287
WWR	0.150	0.150	0.150	0.150	0.150	0.150
LgtWPerSF	1.800	1.800	1.800	1.500	1.500	1.500
ClgSysEff	9.220	9.220	9.220	10.100	10.100	10.100
HeatSysEff	0.780	0.780	0.780	0.800	0.800	0.800
FanWPerCfm	0.800	0.800	0.800	0.800	0.800	0.800
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800
Large Retail						
Building Code	Existing			New		
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
ExtWallRValue	4.800	4.800	4.800	2.000	2.000	2.000
ExtRoofRValue	12.000	12.000	12.000	19.000	19.000	19.000
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700
WndUValue	1.500	1.500	1.500	1.220	1.220	1.220
WndSC	0.760	0.760	0.760	0.287	0.287	0.287
WWR	0.150	0.150	0.150	0.150	0.150	0.150
LgtWPerSF	1.600	1.600	1.600	1.500	1.500	1.500
FanWPerCfm	0.800	0.800	0.800	1.250	1.250	1.250
ClgSysCop	3.800	3.800	3.800	5.000	5.000	5.000
HeatSysEff	0.800	0.800	0.800	0.800	0.800	0.800
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800
Restaurant						
Building Code	Existing			New		
Climate	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
ExtWallRValue	4.900	4.900	4.900	2.000	2.000	2.000
ExtRoofRValue	13.200	13.200	13.200	19.000	19.000	19.000
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700
WndUValue	1.530	1.530	1.530	1.220	1.220	1.220
WndSC	0.800	0.800	0.800	0.287	0.287	0.287
WWR	0.150	0.150	0.150	0.150	0.150	0.150
LgtWPerSF	2.000	2.000	2.000	1.600	1.600	1.600

Potential for EE/RE to Meet Florida's Growing Energy Demands, ACEEE

Small Office Building Code Climate	Existing			New		
	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
ClgSysEff	9.220	9.220	9.220	10.100	10.100	10.100
HeatSysEff	0.780	0.780	0.780	0.800	0.800	0.800
FanWPerCfm	0.800	0.800	0.800	0.800	0.800	0.800
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800
School						
Building Code Climate	Existing			New		
	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
ExtWallRValue	5.700	5.700	5.700	2.000	2.000	2.000
ExtRoofRValue	13.300	13.300	13.300	19.000	19.000	19.000
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700
WndUValue	1.700	1.700	1.700	1.220	1.220	1.220
WndSC	0.730	0.730	0.730	0.287	0.287	0.287
WWR	0.180	0.180	0.180	0.150	0.150	0.150
LgtWPerSF	2.200	2.200	2.200	1.200	1.200	1.200
FanWPerCfm	0.800	0.800	0.800	1.250	1.250	1.250
ClgSysCop	3.800	3.800	3.800	5.000	5.000	5.000
HeatSysEff	0.800	0.800	0.800	0.800	0.800	0.800
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800
Hospital						
Building Code Climate	Existing			New		
	Jacksonville	Orlando	Miami	Jacksonville	Orlando	Miami
ExtWallRValue	6.900	6.900	6.900	2.000	2.000	2.000
ExtRoofRValue	11.500	11.500	11.500	19.000	19.000	19.000
RoofAbs	0.700	0.700	0.700	0.700	0.700	0.700
WndUValue	1.960	1.960	1.960	1.220	1.220	1.220
WndSC	0.660	0.660	0.660	0.287	0.287	0.287
WWR	0.250	0.250	0.250	0.150	0.150	0.150
LgtWPerSF	1.150	1.150	1.150	1.200	1.200	1.200
FanWPerCfm	0.800	0.800	0.800	1.250	1.250	1.250
ClgSysCop	3.800	3.800	3.800	5.000	5.000	5.000
HeatSysEff	0.800	0.800	0.800	0.800	0.800	0.800
DHWEff	0.610	0.610	0.610	0.800	0.800	0.800

Table A-10b provides a list of the energy efficiency measures that were applied to the baseline commercial buildings for the analysis reported here.

Table A-10b. List of Measures Applied to Commercial Buildings Analysis

New Buildings	Sm. Office	Sm. Retail	Restaurant	Lg. Office	Lg. Hotel	Lg. Retail	School	Hospital
R Value of External Walls	13	13	13	13	13	13	13	13
R-Value of Roof	30	30	30	30	30	30	30	30
Roof Absorptivity	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Lighting Watts per SF	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Cooling System EER	12.5	12.5	12.5	---	---	---	---	---
Cooling Plant COP	---	---	---	6	6	6	6	6
Fan Watts per CFM	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Existing Buildings								
Roof Absorptivity	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Window Shading Coefficient	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lighting Watts per SF	1.22	1.296	1.44	0.936	1.08	1.152	1.584	0.828
Cooling System EER	12.5	12.5	12.5	---	---	---	---	---
Cooling Plant COP	---	---	---	4.7	4.7	4.7	4.7	4.7
Fan Watts per CFM	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6

According to our analysis, the economic efficiency potential for the commercial sector is roughly 30%, or 39,495 GWh, by 2023. The majority of the savings come from energy efficiency improvements in existing buildings (20,765 GWh), while significant additional savings can be achieved through advanced new buildings (18,730 GWh). The breakdown of savings by building type and region are shown in Tables A-11a and A-11b.

Table A-11a. Economic Potential for Energy Efficiency in Existing Commercial Buildings by Building Type and Region

Existing Buildings		Sm. Office	Lg. Office	Lg. Hotel	Sm. Retail	Lg. Retail	Restaurant	School	Hospital	
		kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	
Baseline Energy Use:	North	82,811	1,497,711	4,478,266	107,942	1,495,335	261,416	169,701	8,875,472	
	Central	84,222	1,513,719	4,535,697	110,203	1,522,257	266,651	169,829	8,875,203	
	South	92,969	1,598,047	4,958,332	123,123	1,640,157	291,759	186,381	9,167,816	
Measure Savings:	Roof Absorptivity	North	1,913	5,791	5,172	1,841	14,269	3,148	2,257	7,944
		Central	1,762	5,987	4,940	1,769	14,269	2,896	2,198	7,948
		South	1,961	7,075	5,794	1,887	15,702	3,154	2,533	7,736
	Window Shading Coefficient (Film)	North	3,006	103,849	220,394	5,777	26,774	3,904	5,706	88,683
		Central	3,242	103,483	223,549	6,132	29,286	4,195	6,455	89,400
		South	3,646	115,221	252,162	7,307	35,855	4,733	8,528	94,501
	Lighting Watts per SF (T-8 + Occ. Sen.)	North	13,813	127,166	549,128	17,774	260,129	30,635	24,029	925,865
		Central	14,054	181,969	565,877	17,882	267,623	31,563	24,683	932,139
		South	14,354	189,755	586,669	18,459	279,977	32,955	25,884	942,102
Cooling System (EER=12.6)	North	8,814	n/a	n/a	12,605	n/a	18,725	n/a	n/a	
	Central	9,202	n/a	n/a	13,207	n/a	20,322	n/a	n/a	
	South	11,504	n/a	n/a	16,592	n/a	26,958	n/a	n/a	
Cooling Plant (COP=4.8)	North	n/a	72,999	248,905	n/a	58,836	n/a	9,505	439,281	
	Central	n/a	77,031	261,048	n/a	63,164	n/a	9,870	441,932	
	South	n/a	90,408	323,361	n/a	77,796	n/a	12,507	483,713	
Fan Watts per CFM	North	n/a	40,559	105,772	n/a	31,268	n/a	3,651	201,215	

Potential for EE/RE to Meet Florida's Growing Energy Demands, ACEEE

Existing Buildings		Sm. Office kWh/yr	Lg. Office kWh/yr	Lg. Hotel kWh/yr	Sm. Retail kWh/yr	Lg. Retail kWh/yr	Restaurant kWh/yr	School kWh/yr	Hospital kWh/yr
(VSD fans)	Central	n/a	40,119	107,549	n/a	32,426	n/a	3,538	202,007
	South	n/a	42,214	116,536	n/a	37,083	n/a	3,880	209,932
Existing Buildings Package	North	25,593	371,164	883,894	35,097	368,925	53,330	42,821	1,589,518
	Central	26,263	376,277	911,798	35,975	382,384	55,627	43,970	1,599,326
	South	29,340	409,181	1,001,513	40,694	418,319	63,937	50,127	1,661,679
Package savings (%)	North	30.9%	24.8%	19.7%	32.5%	24.7%	20.4%	25.2%	17.9%
	Central	31.2%	24.9%	20.1%	32.6%	25.1%	20.9%	25.9%	18.0%
	South	31.6%	25.6%	20.2%	33.1%	25.5%	21.9%	26.9%	18.1%
Statewide 2023 Savings (GWh)	North	637	511	471	448	340	369	221	213
	Central	1,822	1,452	1,360	1,274	981	1,068	643	607
	South	1,639	1,330	1,214	1,147	885	997	593	543
Total Statewide Savings (GWh)		4,098	3,293	3,045	2,869	2,205	2,434	1,457	1,362

Notes: Our analysis estimates savings in the 15-year time period, 2008–2023. Regions and building types are weighted according to the 1993 Synergic Research Corporation Survey of Commercial Building End-Uses (Rose et al. 1993). Regions are weighted by commercial electricity sales: 45% in Orlando, 16% in Jacksonville, and 40% in Miami.

Table A-11b. Economic Potential for Energy Efficiency in New Commercial Buildings by Building Type and Region

New Buildings		Sm. Office kWh/yr	Lg. Office kWh/yr	Lg. Hotel kWh/yr	Sm. Retail kWh/yr	Lg. Retail kWh/yr	Restaurant kWh/yr	School kWh/yr	Hospital kWh/yr
Baseline Energy Use:	North	57,329	1,099,182	3,335,772	85,277	1,381,073	229,088	120,214	8,680,740
	Central	57,638	1,102,800	3,364,974	86,849	1,397,787	232,903	118,316	8,682,232
	South	64,520	1,150,160	3,677,604	95,797	1,490,302	255,129	121,702	8,967,943
Measure Savings:									
R-Value of External Walls	North	3,984	39,117	68,782	1,558	12,055	4,736	2,009	17,461
	Central	3,715	35,620	67,219	1,391	9,836	4,544	1,700	19,644
	South	4,674	37,012	89,376	1,876	14,100	6,299	1,367	56,568
R-Value of Roof	North	798	1,841	3,655	639	5,727	1,634	1,147	1,610
	Central	668	1,704	3,079	544	5,017	1,432	982	1,613
	South	839	2,214	3,337	647	5,084	1,664	1,010	2,565
Roof Absorptivity	North	1,362	3,332	3,696	1,180	10,362	2,324	1,359	5,218
	Central	1,187	3,195	4,004	1,098	9,934	2,174	1,214	5,269
	South	1,339	3,599	4,913	1,052	11,293	2,269	1,610	5,215
Lighting Watts per SF (Daylighting)	North	11,224	191,399	535,096	31,125	515,179	53,786	21,681	1,701,701
	Central	11,394	195,230	546,031	31,782	527,153	55,329	22,639	1,718,188
	South	11,765	203,257	567,066	32,227	555,731	58,647	24,259	1,748,307
Cooling System EER	North	5,224	n/a	n/a	7,232	n/a	10,887	n/a	n/a
	Central	5,261	n/a	n/a	7,525	n/a	11,771	n/a	n/a
	South	6611	n/a	n/a	9255	n/a	16070	n/a	n/a
Cooling Plant COP	North	n/a	98,708	351,663	n/a	120,606	n/a	14,941	890,159
	Central	n/a	99,854	362,573	n/a	125,596	n/a	14,292	896,659
	South	n/a	111502	428358	n/a	147452	n/a	14528	961437
Fan Watts per CFM (VSD)	North	n/a	70,484	225,742	n/a	86,566	n/a	10,114	614,521
	Central	n/a	70,279	231,287	n/a	89,204	n/a	9,277	619,243
	South	n/a	76,334	262,348	n/a	102,399	n/a	8,563	654,459

New Buildings		Sm. Office	Lg. Office	Lg. Hotel	Sm. Retail	Lg. Retail	Restaurant	School	Hospital
		kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr	kWh/yr
New Package Savings	North	20,706	310,516	903,523	39,754	615,604	70,134	43,470	2,469,063
	Central	20,490	311,889	922,420	40,307	627,716	71,753	42,457	2,485,340
	South	23,280	330,598	1,018,394	43,170	672,024	80,702	43,013	2,595,584
Package Savings (%)	North	36.1%	28.2%	27.1%	46.6%	44.6%	30.6%	36.2%	28.4%
	Central	35.5%	28.3%	27.4%	46.4%	44.9%	30.8%	35.9%	28.6%
	South	36.1%	28.7%	27.7%	45.1%	45.1%	31.6%	35.3%	28.9%
Statewide 2023 Savings (GWh)	North	472	370	428	409	391	354	217	206
	Central	1,318	1,048	1,227	1,154	1,117	1,009	611	589
	South	1,189	947	1,102	996	996	921	535	529
Total Statewide Savings	(GWh)	2,979	2,365	2,758	2,559	2,504	2,284	1,362	1,324

Notes: Our analysis estimates savings in the 15-year time period, 2008–2023. Regions and building types are weighted according to the 1993 Synergic Research Corporation Survey of Commercial Building End-Uses (Rose et al. 1993). Regions are weighted by commercial electricity sales: 45% in Orlando, 16% in Jacksonville, and 40% in Miami.

Combined Heat and Power Systems

Technical Potential for CHP

This section provides an estimate of the technical market potential for combined heat and power (CHP) in the industrial, commercial/institutional, and multi-family residential market sectors. The estimation of technical market potential consists of the following elements:

- Identification of applications where CHP provides a reasonable fit to the electric and thermal needs of the user. Target applications were identified based on reviewing the electric and thermal energy consumption data for various building types and industrial facilities.
- Quantification of the number and size distribution of target applications. Several data sources were used to identify the number of applications by sector that meets the thermal and electric load requirements for CHP.
- Estimation of CHP potential in terms of megawatt (MW) capacity. Total CHP potential is then derived for each target application based on the number of target facilities in each size category and sizing criteria appropriate for each sector.
- Subtraction of existing CHP from the identified sites to determine the remaining technical market potential.

The technical market potential does not consider screening for economic rate of return, or other factors such as ability to retrofit, owner interest in applying CHP, capital availability, natural gas availability, and variation of energy consumption within customer application/size class. The technical potential as outlined is useful in understanding the potential size and size distribution of the target CHP markets in the state. Identifying technical market potential is a preliminary step in the assessment of market penetration.

The basic approach to developing the technical potential is described below:

- *Identify applications where CHP provides a reasonable fit to the electric and thermal needs of the user.* Target applications were identified based on reviewing the electric and thermal energy (heating and cooling) consumption data for various building types and industrial facilities. Data sources include the DOE EIA *Commercial Buildings Energy Consumption Survey (CBECS)*, the DOE *Manufacturing Energy Consumption Survey (MECS)* and various market summaries developed by DOE, Gas Technology Institute (GRI), and the American Gas Association. Existing CHP installations in the commercial/institutional and industrial sectors were also reviewed to understand the required profile for CHP applications and to identify target applications.
- *Quantify the number and size distribution of target applications.* Once applications that could technically support CHP were identified, the iMarket, Inc. *MarketPlace Database* and the *Major Industrial Plant Database (MIPD)* from IHI were utilized to identify potential CHP sites by SIC code or application, and location (county). The *MarketPlace Database* is based on the Dun and Bradstreet financial listings and includes information on economic activity (8 digit SIC), location (metropolitan area, county, electric utility service area, state) and size (employees) for commercial, institutional and industrial facilities. In addition, for select SICs limited energy consumption information (electric and gas consumption, electric and gas expenditures) is provided based on data from Wharton Econometric Forecasting (WEFA). MIPD has detailed energy and process data for 16,000 of the largest energy consuming industrial plants in the United States. The *MarketPlace Database* and MIPD were used to identify the number of facilities in target CHP applications and to group them into size categories based on average electric demand in kilowatt-hours.
- *Estimate CHP potential in terms of MW capacity.* Total CHP potential was then derived for each target application based on the number of target facilities in each size category. It was assumed that the CHP system would be sized to meet the average site electric demand for the target applications unless thermal loads (heating and cooling) limited electric capacity. **Tables A-1-1 and A-1-2** present the specific target market sectors, the number of potential sites and the potential MW contribution from CHP.
- *Estimate the growth of new facilities in the target market sectors.* The technical potential included economic projections for growth through 2020 by target market sectors in Florida. The growth factors used in the analysis for growth between the present and 2020 by individual sectors are shown in **Table A-1-3**. Unless otherwise indicated, the growth rates represent the annualized 5-year (2000-2004) trend in GDP quantity growth indices by industry as reported by the Bureau of Economic Analysis. The BEA reports industries by NAICS which was mapped to the older SIC basis used by the market databases described above. Sectors that have been growing annually at greater than 5% per year are capped at 5% per year for the long-term growth estimate. Sectors that are declining are assumed to have zero growth during the forecast period. ACEEE provided growth rates for selected industries in the manufacturing sector; these growth rates were used as provided.

Two different types of CHP markets were included in the evaluation of technical potential. Both of these markets were evaluated for high and low load factor applications resulting in four distinct market segments that are analyzed. The markets, summarized in **Table A-1-4**, are described below:

- **Traditional CHP**—electric output is produced to meet all or a portion of the base load for a facility and the thermal energy is used to provide steam or hot water. Depending on the type of facility, the appropriate sizing could be either electric or thermal limited. Industrial facilities often have “excess” thermal load compared to their on-site electric load. Commercial facilities almost always have excess electric load compared to their thermal load. Two sub-categories were considered:
- **High load factor applications**—This market provides for continuous or nearly continuous operation. It includes all industrial applications and round-the-clock commercial/institutional operations such as colleges, hospitals, hotels, and prisons.
- **Low load factor applications**—Some commercial and institutional markets provide an opportunity for coincident electric/thermal loads for a period of 3,500 to 5,000 hours per year. This sector includes applications such as office buildings, schools, and laundries.
- **Combined Cooling Heating and Power (CCHP)** —All or a portion of the thermal output of a CHP system can be converted to air conditioning or refrigeration with the addition of a thermally activated cooling system. This type of system can potentially open up the benefits of CHP to facilities that do not have the year-round thermal load to support a traditional CHP system. A typical system would provide the annual hot water load, a portion of the space heating load in the winter months and a portion of the cooling load in during the summer months. Two sub-categories were considered:
- **Low load factor applications**—These represent markets that otherwise could not support CHP due to a lack of thermal load.

Table A-12. Florida Technical Market Potential for CHP in Existing Facilities—Industrial Sector

SIC	Description	50-500 kW		500-1000 kW		1-5 MW		5-20 MW		> 20 MW		Total	
		Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW
20	Food	279	42	73	55	33	83	4	42			389	221
22	Textiles	73	8	12	7	2	4					87	19
24	Lumber and Wood	263	8	32	5	3	2					298	14
25	Furniture	17	1									17	1
26	Paper	98	15	44	33	23	58	1	18	1	30	167	153
27	Printing/Publishing	123	18	12	9	1	3					136	30
28	Chemicals	242	36	70	53	57	143			2	48	371	279
29	Petroleum Refining	43	6	4	3	1	3					48	12
30	Rubber/Misc Plastics	212	10	116	26	34	26					362	61
32	Stone/Clay/Glass	8	1									8	1
33	Primary Metals	32	1	7	1	1	1					40	3
34	Fabricated Metals	119	5	13	3	5	4	1	18			138	30
35	Machinery/Computer Equip	46	2	5	1							51	3
36	Electrical and electronic equipment							1	5			1	5
37	Transportation Equip.	100	8	44	17	27	34			1	27	172	85
38	Instruments	28	2	8	3			1	7			37	12
39	Misc Manufacturing	38	1	4	1							42	2
	Total Industrial	1,721	165	444	215	187	356	8	91	4	106	2,364	933

Table A-13. Florida Technical Market Potential for CHP in Existing Facilities—Commercial and Institutional Sectors

SIC	Description	50-500 kW		500-1000 kW		1-5 MW		5-20 MW		> 20 MW		Total	
		Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW	Sites	MW
4222, 5142	Warehouses	55	8									55	8
43	Post Offices	58	9	1	1							59	9
4581	Airports	3,309	248	1,323	496	330	413	25	156			4,987	1,313
4941, 4952	Water Treatment/Sanitary	1,065	80	386	145	60	75					1,511	300
52,53,56,57	Big Box Retail	141	21	1	1							142	22
5411, 5421, 5451, 5461, 5499	Food Sales	118	18									118	18
5812, 00, 01, 03, 05, 07, 08	Restaurants	94	14	3	2	1	3					98	19
6512	Office Buildings - Cooling	52	8	28	21	1	3					81	31
6513	Apartments	106	16	48	36	33	83					187	134
7011, 7041	Hotels	1,661	249	437	328	106	265					2,204	842
7211, 7213, 7218	Laundries	2,257	169	412	155	13	16					2,682	340
7542	Carwashes	3,054	229	23	9							3,077	238
7832	Movie Theaters	2,159	324	477	358	164	410	7	88			2,807	1,179
7991, 00, 01	Health Clubs	73	11	3	2							76	13
7992, 7997-9904, 7997-9906	Golf/Country Clubs	320	48	17	13	1	3					338	63
8051, 8052, 8059	Nursing Homes	677	102	50	38	1	3					728	142
8062, 8063, 8069	Hospitals	533	96	286	257	18	54					837	407
8211, 8243, 8249, 8299	Schools	122	22	90	81	165	495					377	598
8221, 8222	Colleges/Universities	1,107	42	183	34	20	13			1	25	1,311	113
8412	Museums	146	22	95	71	52	130	16	200			309	423
9223, 9211 (Courts), 9224 (firehouses)	Prisons	50	8	135	101	61	153	18	225			264	486
	Commercial, Institutional Totals	17,157	1,742	3,998	2,148	1,026	2,115	66	669	1	25	22,248	6,699

- Incremental high load factor applications**—These markets represent round-the-clock commercial/institutional facilities that could support traditional CHP, but with cooling, incremental capacity could be added while maintaining a high level of utilization of the thermal energy from the CHP system. All of the market segments in this category are also included in the high load factor traditional market segment, so only the incremental capacity for these markets is added to the overall totals.

Table A-14. Target Market Sectors for CHP and Florida Sector Growth Projections Through 2020

SIC	Industry Description	Florida		
		Florida	Annual Growth Rate	Growth 2007-2020
20	Food	0.99	-1.00%	0%
22	Textiles	0.98	-2.00%	0%
24	Lumber and Wood	1.05	4.70%	99%
25	Furniture	1.02	2.36%	42%
26	Paper	0.99	-1.00%	0%
27	Printing/Publishing	1.01	0.55%	9%
28	Chemicals	1.00	0.27%	4%
29	Petroleum Refining	1.01	1.17%	19%
30	Rubber/Misc Plastics	1.01	1.08%	17%
32	Stone/Clay/Glass	1.02	2.05%	36%
33	Primary Metals	1.01	0.75%	12%
34	Fabricated Metals	0.98	-1.51%	0%
35	Machinery/Computer Equip	1.08	8.00%	110%
37	Transportation Equip.	0.99	-1.00%	0%
38	Instruments	0.99	-0.52%	0%
39	Misc Manufacturing	1.09	9.27%	110%
4222, 5142	Warehouses	1.01	1.29%	21%
4941, 4952	Water Treatment/Sanitary	1.02	2.31%	41%
5411, 5421, 5451, 5461, 5499	Food Sales	1.06	5.90%	110%
5812, 00, 01, 03, 05, 07, 08	Restaurants	1.04	4.41%	91%
7011, 7041	Hotels	1.01	1.04%	17%
7211, 7213, 7218	Laundries	1.06	5.90%	110%
7542	Carwashes	1.06	5.90%	110%
7991, 00, 01	Health Clubs	1.03	2.62%	47%
7992, 7997-9904, 7997-9906	Golf/Country Clubs	1.03	2.62%	47%
8051, 8052, 8059	Nursing Homes	1.02	1.59%	27%
8062, 8063, 8069	Hospitals	1.02	1.59%	27%
8211, 8243, 8249, 8299	Schools	1.03	2.55%	46%
8221, 8222	Colleges/Universities	1.03	2.55%	46%
8412	Museums	1.00	-0.44%	0%
9223, 9211 (Courts), 9224 (firehouses)	Prisons	1.01	1.21%	20%
6513	Apartments	1.06	5.88%	110%
43	Post Offices	1.01	1.43%	24%
4581	Airports	1.05	4.82%	103%
52,53,56,57	Big Box Retail	1.06	5.90%	110%
7832	Movie Theaters	1.02	1.66%	28%
7011, 7041	Hotels- Cooling	1.01	1.04%	17%
8051, 8052, 8059	Nursing Homes- Cooling	1.02	1.59%	27%
8062, 8063, 8069	Hospitals- Cooling	1.02	1.59%	27%
6512	Office Buildings - Cooling	1.06	5.88%	110%
Color Code				
Long term growth capped at 5% per year				
Declining Industry -- no growth				
Growth specified by ACEEE				

Table A-15. CHP Market Segments, Florida Existing Facilities and Expected Growth 2007-2020

Market	50-500 kW MW	500-1 MW (MW)	1-5 MW (MW)	5-20 MW (MW)	>20 MW (MW)	Total MW
Traditional High Load Factor Market						
Existing Facilities	639	1,140	1,564	582	131	4,055
New Facilities	145	275	295	116	2	833
Total	783	1,415	1,859	698	133	4,888
Traditional Low Load Factor Market						
Existing Facilities	237	90	20	0	0	347
New Facilities	94	32	4	0	0	130
Total	331	122	24	0	0	477
Cooling CHP High Load Factor Market (partially additive)						
Existing Facilities	442	696	959	88	0	2,184
New Facilities	64	113	163	9	0	349
Total	506	809	1,122	97	0	2,534
Cooling CHP Low Load Factor Market						
Existing Facilities	930	988	694	156	0	2,768
New Facilities	718	814	573	131	0	2,236
Total	1,649	1,801	1,267	288	0	5,004
Total Market including Incremental Cooling Load						
Existing Facilities	1,939	2,426	2,565	765	131	7,825
New Facilities	976	1,155	921	250	2	3,304
Total	2,915	3,581	3,486	1,015	133	11,130

Note: High load factor cooling market is comprised of a portion of the traditional high load factor market that has both heating and cooling loads. The total high load factor cooling market is shown, but only 30% of it is incremental to the portion already counted in the traditional high load factor market.

Energy Price Projections

The expected future relationship between purchased natural gas and electricity prices, called the *spark spread* in this context, is one major determinant of the ability of a facility with electric and thermal energy requirements to cost-effectively utilize CHP. For this screening analysis, a fairly simple methodology was used:

Electric Price Estimation

- Existing gas and electric price levels for the industrial market were taken from the EIA 2005 state average price of 7.14 cents/kWh.
- The future electric prices are based on the rate of change in the EIA early release *Annual Energy Outlook 2007* (2006d estimate of average electric prices multiplied by the EIA 2005 Florida actual price. This price track is shown in **Table A-2-1**.
- Based on the average industrial price above, price differentials were estimated for the 5 CHP market size bins covered by the analysis. These price differentials are based on prior detailed utility rate analysis undertaken for a number of utilities in California and New York. The factors applied to the EIA average industrial price are as follows:

- 50-500 kW—116%
 - 500-1000 kW—105%
 - 1-5 MW—100%
 - 5-20 MW—91%
 - >20 MW—91%
- Price adjustments for customer load factor were defined as follows:
 - High load factor—100% of the estimated value
 - Low load factor—120% of the estimated value
 - Peak cooling load—179% of the estimated value
 - For a customer generating a portion of his own power with CHP, standby charges are estimated at 15% of the defined average electric rate. Therefore, when considering CHP, only 85% of a customer's rate can be avoided.

Natural Gas Price Estimation

- Current industrial natural gas price is defined from the EIA 2005 actual of \$7.64/MMBtu.
- Wellhead gas real prices over the forecast period are based on the *Annual Energy Outlook 2007* as shown in **Table A-2-1**. This EIA forecast is very close to the price assumptions used by the Regional Greenhouse Gas Initiative.
- The wellhead gas prices were “marked up” to retail prices using first a city-gate adder of \$0.20/MMBtu and then retail adders were included as follows:
 - 50-500 kW—\$1.00/MMBtu for boiler fuel, \$0.25/MMBtu for CHP fuel
 - 500-1000 kW—\$0.40/MMBtu for boiler fuel, \$0.25/MMBtu for CHP fuel
 - 1-5 MW—\$0.40/MMBtu for boiler fuel, \$0.25/MMBtu for CHP fuel
 - 5-20 MW—\$0.25/MMBtu for both boiler fuel and CHP fuel
 - >20 MW—\$0.25/MMBtu for both boiler fuel and CHP fuel.

Table A-16. Input Price Forecast and Florida Industrial Electric Price Estimation

Year	Wellhead Natural Gas	Average Retail Electricity		Florida Industrial Electricity
	\$/MMBtu	\$/MMBtu	\$/kWh	\$/kWh
2005	\$7.29	\$23.70	\$0.0809	\$0.0646
2006	\$6.47	\$24.38	\$0.0832	\$0.0665
2007	\$6.45	\$24.32	\$0.0830	\$0.0663
2008	\$6.40	\$24.30	\$0.0829	\$0.0662
2009	\$5.88	\$24.02	\$0.0820	\$0.0655
2010	\$5.59	\$23.66	\$0.0808	\$0.0645
2011	\$5.17	\$23.09	\$0.0788	\$0.0629
2012	\$5.02	\$22.80	\$0.0778	\$0.0622
2013	\$4.87	\$22.66	\$0.0774	\$0.0618
2014	\$4.90	\$22.55	\$0.0769	\$0.0615
2015	\$4.84	\$22.55	\$0.0769	\$0.0615
2016	\$4.94	\$22.69	\$0.0774	\$0.0618
2017	\$5.13	\$22.95	\$0.0783	\$0.0625
2018	\$5.05	\$23.14	\$0.0790	\$0.0631
2019	\$4.99	\$23.09	\$0.0788	\$0.0629
2020	\$5.07	\$23.15	\$0.0790	\$0.0631

Source: EIA 2006d

CHP Technology Cost and Performance

The CHP system itself is the engine that drives the economic savings. The cost and performance characteristics of CHP systems determine the economics of meeting the site's electric and thermal loads. A representative sample of commercially and emerging CHP systems was selected to profile performance and cost characteristics in combined heat and power (CHP) applications. The selected systems range in capacity from approximately 100–20,000 kW. The technologies include gas-fired reciprocating engines, gas turbines, microturbines and fuel cells. The appropriate technologies were allowed to compete for market share in the penetration model. In the smaller market sizes, reciprocating engines competed with microturbines and fuel cells. In intermediate sizes (1 to 20 MW), reciprocating engines competed with gas turbines.

Cost and performance estimates for the CHP systems were based on work previously conducted for NYSERDA (Energy Nexus Group¹⁵ 2002) on peer-reviewed technology characterizations that the Energy and Environmental Analysis (EEA) developed for the National Renewable Energy Laboratory (NREL 2003), and on follow-on work conducted by DE Solutions for Oak Ridge National Laboratory (DE Solutions 2004). Additional emissions characteristics and cost and performance estimates for emissions control technologies were based on ongoing work EEA is conducting for EPRI (2005). Data is presented for a range of sizes that include basic electrical performance characteristics, CHP performance

¹⁵ Energy Nexus Group later became part of Energy and Environmental Analysis, Inc.

characteristics (power to heat ratio), equipment cost estimates, maintenance cost estimates, emission profiles with and without after-treatment control, and emissions control cost estimates. The technology characteristics are presented for three years: 2005, 2010, 2020. The 2005 estimates are based on current commercially available and emerging technologies. The cost and performance estimates for 2010 and 2020 reflect current technology development paths and currently planned government and industry funding. These projections were based on estimates included in the three references mentioned above. NO_x, CO and VOC emissions estimates in lb/MWh are presented for each technology both with and without aftertreatment control (AT). NO_x emissions are presented with and without a CHP thermal credit (using a displaced emissions approach and displaced boiler emissions of 0.2 lb/MMBtu for all technologies). Which system is applicable in any size category (e.g., with aftertreatment or without) is a function of the specific emissions requirements assumptions for each scenario. The installed costs in the following technology performance summary tables are based on typical national averages.

Table A-17. Reciprocating Engines

Size and Type	Characterization	2005	2012	2020	
100 kW Rich Burn w/three way catalyst	Capacity, kW	100	100	100	
	Installed Costs, \$/kW	1,550	1,350	1,100	
	Heat Rate, Btu/kWh	11,500	10,830	10,500	
	Electric Efficiency, %	29.7%	31.5%	32.5%	
	Power to Heat Ratio	0.61	0.67	0.7	
	Thermal Output, Btu/kWh	5593	5093	4874	
	O&M Costs, \$/kW	0.018	0.013	0.012	
	NOx Emissions, lbs/MWh (no AT)	40	40	40	
	NOx Emissions, lbs/MWh (w/ AT)	0.5	0.25	0.2	
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A	
	CO Emissions, gm/bhp-hr	13.00	10.00	10.00	
	CO Emissions w/AT, lb/MWh	1.87	0.60	0.30	
	VOC Emissions w/AT, lb/MWh	0.47	0.09	0.05	
	PMT 10 Emissions, lb/MWh	0.11	0.11	0.11	
	SO2 Emissions, lb/MWh	0.0068	0.0064	0.0062	
AT Cost, \$/kW	N/A	N/A	N/A		
300 kW Rich Burn w/three way catalyst	Capacity, kW	300	300	300	
	Installed Costs, \$/kW	1,250	1,150	1,050	
	Heat Rate, Btu/kWh	11,500	10,830	10,500	
	Electric Efficiency, %	29.7%	31.5%	32.5%	
	Power to Heat Ratio	0.61	0.67	0.7	
	Thermal Output, Btu/kWh	5593	5093	4874	
	O&M Costs, \$/kW	0.013	0.012	0.01	
	NOx Emissions, lbs/MWh (no AT)	40	40	40	
	NOx Emissions, lbs/MWh (w/ AT)	0.5	0.25	0.2	
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A	
	CO Emissions, gm/bhp-hr	13.00	10.00	10.00	
	CO Emissions, gm/bhp-hr	13	10	10	
	CO Emissions w/AT, lb/MWh	1.87	0.60	0.30	
	VOC Emissions w/AT, lb/MWh	0.47	0.09	0.05	
	PMT 10 Emissions, lb/MWh	0.10	0.10	0.10	
SO2 Emissions, lb/MWh	0.0068	0.0064	0.0062		
AT Cost, \$/kW	50	50	45		
800 kW Lean Burn AT is SCR	Capacity, kW	800	800	800	
	Installed Costs, \$/kW	1,200	1,100	950	
	Heat Rate, Btu/kWh	10,650	9,750	9,225	
	Electric Efficiency, %	32.0%	35.0%	37.0%	
	Power to Heat Ratio	0.8	0.9	1.05	
	Thermal Output, Btu/kWh	4265	3791	3250	
	O&M Costs, \$/kW	0.012	0.01	0.009	
	NOx Emissions, gm/bhp-hr	0.8	0.4	0.3	
	NOx Emissions, lbs/MWh (no AT)	2.48	1.24	0.93	
	NOx Emissions, lbs/MWh (no AT; w/CHP)	1.41	0.29	0.12	
	NOx Emissions, lbs/MWh (w/ AT)	1.49	0.87	0.56	
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A	
	CO Emissions, gm/bhp-hr	3	2.5	2	
	CO Emissions w/AT, lb/MWh	0.87	0.45	0.31	
	VOC Emissions w/AT, lb/MWh	0.38	0.05	0.05	
PMT 10 Emissions, lb/MWh	0.01	0.01	0.01		
SO2 Emissions, lb/MWh	0.0063	0.0057	0.0054		
AT Cost, \$/kW	300	190	140		
3,000 kW Lean Burn AT is SCR	Capacity, kW	3000	3000	3000	
	Installed Costs, \$/kW	950	925	875	
	Heat Rate, Btu/kWh	9,700	8,750	8,325	
	Electric Efficiency, %	35.2%	39.0%	41.0%	
	Power to Heat Ratio	1.04	1.07	1.18	
	Thermal Output, Btu/kWh	3261	3189	2892	
	O&M Costs, \$/kW	0.0085	0.0083	0.008	
	NOx Emissions, gm/bhp-hr	0.7	0.4	0.25	
	NOx Emissions, lbs/MWh (no AT)	2.17	1.24	0.775	
	NOx Emissions, lbs/MWh (no AT; w/CHP)	1.35	0.44	0.05	
	NOx Emissions, lbs/MWh (w/ AT)	1.52	0.87	0.53	
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A	
	CO Emissions, gm/bhp-hr	2.5	2	2	
	CO Emissions w/AT, lb/MWh	0.78	0.31	0.31	
	VOC Emissions w/AT, lb/MWh	0.34	0.10	0.10	
PMT 10 Emissions, lb/MWh	0.01	0.01	0.01		
SO2 Emissions, lb/MWh	0.0057	0.0051	0.0049		
AT Cost, \$/kW	200	130	100		
5,000 kW Lean Burn AT is SCR	Capacity, kW	5000	5000	5000	
	Installed Costs, \$/kW	925	900	850	
	Heat Rate, Btu/kWh	9,213	8,325	7,935	
	Electric Efficiency, %	37.0%	41.0%	43.0%	
	Power to Heat Ratio	1.02	1.22	1.31	
	Thermal Output, Btu/kWh	3345	2797	2605	
	O&M Costs, \$/kW	0.008	0.008	0.008	
	NOx Emissions, gm/bhp-hr	0.5	0.4	0.25	
	NOx Emissions, lbs/MWh (no AT)	1.55	1.24	0.775	
	NOx Emissions, lbs/MWh (no AT; w/CHP)	0.71	0.54	0.12	
	NOx Emissions, lbs/MWh (w/ AT)	1.24	0.87	0.54	
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A	
	CO Emissions, gm/bhp-hr	2.5	2	2	
	CO Emissions w/AT, lb/MWh	0.75	0.31	0.31	
	VOC Emissions w/AT, lb/MWh	0.22	0.1	0.1	
PMT 10 Emissions, lb/MWh	0.01	0.01	0.01		
SO2 Emissions, lb/MWh	0.0054	0.0049	0.0047		
AT Cost, \$/kW	150	115	80		

Additional O&M Costs for SCR			
	2005	2012	2020
0.005 SCR Adder, \$/kW			
0.017 New total O&M w/SCR, \$/kW			
0.003 SCR Adder, \$/kW			
0.011 New total O&M w/SCR, \$/kW			
0.002 SCR Adder, \$/kW			
0.010 New total O&M w/SCR, \$/kW			
0.002 SCR Adder, \$/kW			
0.009 New total O&M w/SCR, \$/kW			

CHP thermal credit based on Displaced Boiler Emissions = 0.2 lbs/MMBtu
AT = Aftreatment

Table A-18. Gas Turbines

Size and Type	Characterization	2005	2012	2020
1 MW Gas Turbine AT is SCR	Capacity, MW	1	1	1
	Installed Costs, \$/kW	1,900	1,500	1,300
	Heat Rate, Btu/kWh	15,580	14,500	13,500
	Electric Efficiency, %	21.9%	23.5%	25.3%
	Power to Heat Ratio	0.51	0.61	0.7
	Thermal Output, Btu/kWh	6690	5593	4874
	O&M Costs, \$/kWh	0.01	0.013	0.012
	NOx Emissions, ppm	42.0	15.0	9.0
	NOx Emissions, lbs/MWh (no AT)	2.2	0.7	0.4
	NOx Emissions, lbs/MWh (no AT, w/CHP)	0.53	-0.70	-0.82
	NOx Emissions, lbs/MWh (w/ AT)	0.22	0.07	0.04
	CO Emissions, ppm	6	20	20
	CO Emissions, lb/MWh	0.027	0.6	0.56
	VOC Emissions, lb/MWh	0.027	0.025	0.023
PMT 10 Emissions, lb/MWh	0.32	0.30	0.28	
SO2 Emissions, lb/MWh	0.0092	0.0085	0.0079	
AT Cost, \$/kW	300	250	150	
3 MW Gas Turbine AT is SCR	Capacity, MW	3	3	3
	Installed Costs, \$/kW	1,300	1,200	1,000
	Heat Rate, Btu/kWh	13,100	12,650	11,200
	Electric Efficiency, %	26.0%	27.0%	30.5%
	Power to Heat Ratio	0.68	0.76	0.84
	Thermal Output, Btu/kWh	5018	4489	4062
	O&M Costs, \$/kWh	0.006	0.005	0.005
	NOx Emissions, ppm	15.0	9.0	5.0
	NOx Emissions, lbs/MWh (no AT)	0.68	0.38	0.2
	NOx Emissions, lbs/MWh (no AT, w/CHP)	-0.57	-0.74	-0.82
	NOx Emissions, lbs/MWh (w/ AT)	0.068	0.038	0.02
	CO Emissions, ppm	20	20	20
	CO Emissions, lb/MWh	0.55	0.53	0.47
	VOC Emissions, lb/MWh	0.027	0.025	0.023
PMT 10 Emissions, lb/MWh	0.21	0.20	0.18	
SO2 Emissions, lb/MWh	0.007	0.0069	0.0069	
AT Cost, \$/kW	210	175	150	
5 MW Gas Turbine AT is SCR	Capacity, MW	5	5	5
	Installed Costs, \$/kW	1,100	1,000	950
	Heat Rate, Btu/kWh	12,590	11,375	10,500
	Electric Efficiency, %	27.1%	30.0%	32.5%
	Power to Heat Ratio	0.68	0.76	0.84
	Thermal Output, Btu/kWh	5018	4489	4062
	O&M Costs, \$/kWh	0.006	0.005	0.005
	NOx Emissions, ppm	15.0	9.0	5.0
	NOx Emissions, lbs/MWh (no AT)	0.68	0.38	0.2
	NOx Emissions, lbs/MWh (no AT, w/CHP)	-0.57	-0.74	-0.82
	NOx Emissions, lbs/MWh (w/ AT)	0.068	0.038	0.02
	CO Emissions, ppm	20	20	20
	CO Emissions, lb/MWh	0.5	0.46	0.42
	VOC Emissions, lb/MWh	0.022	0.021	0.02
PMT 10 Emissions, lb/MWh	0.2	0.18	0.17	
SO2 Emissions, lb/MWh	0.0069	0.0064	0.0059	
AT Cost, \$/kW	140	125	100	
10 MW Gas Turbine AT is SCR	Capacity, MW	10	10	10
	Installed Costs, \$/kW	965	950	850
	Heat Rate, Btu/kWh	11,765	10,800	9,950
	Electric Efficiency, %	29.0%	31.6%	34.3%
	Power to Heat Ratio	0.73	0.84	0.94
	Thermal Output, Btu/kWh	4674	4062	3630
	O&M Costs, \$/kWh	0.006	0.005	0.005
	NOx Emissions, ppm	15.0	9.0	5.0
	NOx Emissions, lbs/MWh (no AT)	0.67	0.37	0.2
	NOx Emissions, lbs/MWh (no AT, w/CHP)	-0.50	-0.65	-0.71
	NOx Emissions, lbs/MWh (w/ AT)	0.067	0.037	0.02
	CO Emissions, ppm	20	20	20
	CO Emissions, lb/MWh	0.5	0.46	0.42
	VOC Emissions, lb/MWh	0.022	0.021	0.02
PMT 10 Emissions, lb/MWh	0.2	0.18	0.17	
SO2 Emissions, lb/MWh	0.0069	0.0064	0.0059	
AT Cost, \$/kW	140	125	100	
25 MW Gas Turbine AT is SCR	Capacity, MW	25	25	25
	Installed Costs, \$/kW	800	755	725
	Heat Rate, Btu/kWh	9,945	9,225	8,865
	Electric Efficiency, %	34.3%	37.0%	38.5%
	Power to Heat Ratio	0.95	1.04	1.1
	Thermal Output, Btu/kWh	3592	3281	3102
	O&M Costs, \$/kWh	0.005	0.005	0.004
	NOx Emissions, ppm	15.0	5.0	3.0
	NOx Emissions, lbs/MWh (no AT)	0.6	0.2	0.1
	NOx Emissions, lbs/MWh (no AT, w/CHP)	-0.30	-0.62	-0.68
	NOx Emissions, lbs/MWh (w/ AT)	0.06	0.02	0.01
	CO Emissions, ppm	20	20	20
	CO Emissions w/AT, lb/MWh	0.05	0.05	0.04
	VOC Emissions w/AT, lb/MWh	0.01	0.01	0.01
PMT 10 Emissions, lb/MWh	0.17	0.16	0.15	
SO2 Emissions, lb/MWh	0.0058	0.0054	0.0052	
AT Cost, \$/kW	100	80	50	
40 MW Gas Turbine AT is SCR	Capacity, MW	40	40	40
	Installed Costs, \$/kW	700	680	660
	Heat Rate, Btu/kWh	9,220	8,865	8,595
	Electric Efficiency, %	37.0%	38.5%	39.7%
	Power to Heat Ratio	1.07	1.13	1.18
	Thermal Output, Btu/kWh	3189	3019	2892
	O&M Costs, \$/kWh	0.004	0.004	0.004
	NOx Emissions, ppm	15.0	5.0	3.0
	NOx Emissions, lbs/MWh (no AT)	0.55	0.2	0.1
	NOx Emissions, lbs/MWh (no AT, w/CHP)	-0.25	-0.55	-0.62
	NOx Emissions, lbs/MWh (w/ AT)	0.055	0.02	0.01
	CO Emissions, ppm	20	20	20
	CO Emissions w/AT, lb/MWh	0.04	0.04	0.04
	VOC Emissions w/AT, lb/MWh	0.01	0.01	0.01
PMT 10 Emissions, lb/MWh	0.157	0.15	0.15	
SO2 Emissions, lb/MWh	0.0054	0.0052	0.0051	
AT Cost, \$/kW	90	75	40	

CHP Thermal credit based on Displaced Boiler Emissions =
AT = Aftertreatment

0.2 lbs/MMBtu

Table A-19. Microturbines

Size and Type	Characterization	2005	2012	2020
70-100 kW	Capacity, kW	70	70	70
	Installed Costs, \$/kW	2,200	1,800	1,400
	Heat Rate, Btu/kWh	13,500	12,500	11,375
	Electric Efficiency, %	25.3%	27.3%	30.0%
	Power to Heat Ratio	0.7	0.9	1.1
	Thermal Output, Btu/kWh	4874	3791	3102
	O&M Costs, \$/kWh	0.017	0.016	0.012
	NOx Emissions, ppm	3.0	3.0	3.0
	NOx Emissions, lbs/MWh (no AT)	0.15	0.14	0.13
	NOx Emissions, lbs/MWh (no AT; w/CHP)	-1.07	-0.81	-0.65
	NOx Emissions, lbs/MWh (w/ AT)	N/A	N/A	N/A
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A
	CO Emissions, ppm	8	8	8
	CO Emissions, lb/MWh	0.24	0.22	0.20
	VOC Emissions, lb/MWh	0.027	0.025	0.023
	PMT 10 Emissions, lb/MWh	0.22	0.20	0.19
	SO2 Emissions, lb/MWh	0.0079	0.0074	0.0067
AT Cost, \$/kW	N/A	N/A	N/A	
250 kW	Capacity, kW	250	250	250
	Installed Costs, \$/kW	2,000	1,600	1,200
	Heat Rate, Btu/kWh	11,850	11,750	10,825
	Electric Efficiency, %	28.8%	29.0%	31.5%
	Power to Heat Ratio	0.94	1	1.3
	Thermal Output, Btu/kWh	3630	3412	2625
	O&M Costs, \$/kWh	0.016	0.015	0.012
	NOx Emissions, ppm	9.0	5.0	3.0
	NOx Emissions, lbs/MWh (no AT)	0.43	0.24	0.13
	NOx Emissions, lbs/MWh (no AT; w/CHP)	-0.48	-0.62	-0.53
	NOx Emissions, lbs/MWh (w/ AT)	N/A	N/A	N/A
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	N/A	N/A	N/A
	CO Emissions, ppm	9	9	9
	CO Emissions, lb/MWh	0.26	0.26	0.24
	VOC Emissions, lb/MWh	0.027	0.025	0.023
	PMT 10 Emissions, lb/MWh	0.18	0.18	0.16
	SO2 Emissions, lb/MWh	0.0070	0.0069	0.0064
AT Cost, \$/kW	500	200	90	
500 kW	Capacity, kW	-	500	500
	Installed Costs, \$/kW	-	1,150	900
	Heat Rate, Btu/kWh	-	10,350	9,750
	Electric Efficiency, %	-	33.0%	35.0%
	Power to Heat Ratio	-	1.3	1.38
	Thermal Output, Btu/kWh	-	2625	2472
	O&M Costs, \$/kWh	-	0.015	0.012
	NOx Emissions, ppm	-	5.0	3.0
	NOx Emissions, lbs/MWh (no AT)	-	0.2	0.11
	NOx Emissions, lbs/MWh (no AT; w/CHP)	-	-0.46	-0.51
	NOx Emissions, lbs/MWh (w/ AT)	-	N/A	N/A
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	-	N/A	N/A
	CO Emissions, ppm	-	9	9
	CO Emissions, lb/MWh	-	0.24	0.23
	VOC Emissions, lb/MWh	-	0.025	0.023
	PMT 10 Emissions, lb/MWh	-	0.0061	0.0057
	SO2 Emissions, lb/MWh	-	0.0056	0.0053
AT Cost, \$/kW	-	200	90	

CHP thermal credit based on Displaced Boiler Emissions =
AT = Aftertreatment

0.2 lbs/MMBtu

Table A-20. Fuel Cells

Size and Type	Characterization	2005	2012	2020
150 kW PEMFC	Capacity, kW	150	150	150
	Installed Costs, \$/kW	3,800	3,600	2,700
	Heat Rate, Btu/kWh	9,750	9,480	8,980
	Electric Efficiency, %	35.0%	36.0%	38.0%
	Power to Heat Ratio	0.95	0.98	1.04
	Thermal Output, Btu/kWh	3592	3482	3281
	O&M Costs, \$/kWh	0.023	0.017	0.015
	NOx Emissions, ppm	-	-	-
	NOx Emissions, lbs/MWh (no AT)	0.10	0.07	0.05
	NOx Emissions, lbs/MWh (no AT; w/CHP)	-0.80	-0.80	-0.77
	CO Emissions, ppm	-	-	-
	CO Emissions, lb/MWh	0.07	0.07	0.07
	VOC Emissions, lb/MWh	0.01	0.01	0.01
	PMT 10 Emissions, lb/MWh	0.001	0.001	0.001
	SO2 Emissions, lb/MWh	0.0057	0.0056	0.0053
250 kW MCFC/SOFC	Capacity, kW	250	250	250
	Installed Costs, \$/kW	5,000	3,200	2,500
	Heat Rate, Btu/kWh	7,930	7,125	6,920
	Electric Efficiency, %	43.0%	47.9%	49.3%
	Power to Heat Ratio	1.95	1.98	2.13
	Thermal Output, Btu/kWh	1750	1723	1602
	O&M Costs, \$/kWh	0.032	0.02	0.015
	NOx Emissions, ppm	-	-	-
	NOx Emissions, lbs/MWh (no AT)	0.06	0.05	0.04
	NOx Emissions, lbs/MWh (no AT; w/CHP)	-0.38	-0.38	-0.36
	NOx Emissions, lbs/MWh (w/ AT)	-	-	-
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	-	-	-
	CO Emissions, ppm	-	-	-
	CO Emissions, lb/MWh	0.06	0.05	0.04
	VOC Emissions, lb/MWh	0.01	0.01	0.01
PMT 10 Emissions, lb/MWh	0.001	0.001	0.001	
SO2 Emissions, lb/MWh	0.0047	0.0042	0.0041	
2 MW MCFC	Capacity, kW	2,000	2,000	2,000
	Installed Costs, \$/kW	3,250	2,800	2,200
	Heat Rate, Btu/kWh	7,420	7,110	6,820
	Electric Efficiency, %	46.0%	48.0%	50.0%
	Power to Heat Ratio	1.92	2	2.27
	Thermal Output, Btu/kWh	1777	1706	1503
	O&M Costs, \$/kWh	0.033	0.019	0.015
	NOx Emissions, ppm	-	-	-
	NOx Emissions, lbs/MWh (no AT)	0.05	0.05	0.04
	NOx Emissions, lbs/MWh (no AT; w/CHP)	-0.39	-0.38	-0.34
	NOx Emissions, lbs/MWh (w/ AT)	-	-	-
	NOx Emissions, lbs/MWh (W/ AT; w/CHP)	-	-	-
	CO Emissions, ppm	-	-	-
	CO Emissions, lb/MWh	0.04	0.04	0.03
	VOC Emissions, lb/MWh	0.01	0.01	0.01
PMT 10 Emissions, lb/MWh	0.001	0.001	0.001	
SO2 Emissions, lb/MWh	0.0044	0.0042	0.0040	

CHP thermal credit based on Displaced Boiler Emissions = 0.2 lbs/MMBtu
 AT = Aftertreatment

Market Penetration Analysis

EEA has developed a CHP market penetration model that estimates cumulative CHP market penetration in 5-year increments. For this analysis, the forecast periods are 2010, 2015, and 2020. The target market is comprised of the facilities that make up the technical market potential as defined in this Appendix. The economic competition module in the market penetration model compares CHP technologies (Appendix C) to purchased fuel and power (Appendix B) in 5 different sizes and 4 different CHP application types. The calculated payback determines the potential pool of customers that would consider accepting the CHP investment as economic. Additional, non economic screening factors are applied that limit the pool of customers that can accept CHP in any given market/size. Based on this calculated economic potential, a market diffusion model is used to determine the cumulative market penetration for each 5-year time period. The basic outputs of the model are shown in Table A-21 as follows:

- *Technical potential* represents the total capacity potential from existing and new facilities that are likely to have the appropriate physical electric and thermal load characteristics that would support a CHP system with high levels of thermal utilization during business operating hours.
- *Economic potential*, as shown in the table, reflects the share of the technical potential capacity (and associated number of customers) that would consider the CHP investment economically acceptable according to a procedure that is described in more detail below.
- *Cumulative market penetration* represents an estimate of CHP capacity that will actually enter the market between 2006 and 2020. This value discounts the economic potential to reflect non-economic screening factors and the rate that CHP is likely to actually enter the market.

Table A-21. Summary CHP Market Values for Florida: Technical Potential, Economic Potential, Cumulative 2006-2020 Market Penetration

Region	50-500 kW	500-1,000 kW	1-5 MW	5-20 MW	>20 MW	Total MW
Technical Potential	2,915	3,581	3,486	1,015	133	11,130
Economic Potential	75	0	198	59	25	357
Cumulative 2006-2020 Market Penetration	8	0	49	21	10	88

In addition to segmenting the market by size, as shown in the table, the analysis is conducted in four separate CHP market applications (high load and low load factor traditional CHP and high and low load factor CHP with cooling.) These markets are considered individually because both the annual load factor and the installation and operation of thermally activated cooling has an impact on the system economics.

Economic potential is determined by an evaluation of the competitiveness of CHP versus purchased fuel and electricity. The projected future fuel and electricity prices and the cost and performance of CHP technologies determine the economic competitiveness of CHP in each market. CHP technology and performance assumptions appropriate to each size category and region were selected to represent the competition in that size range (**Table A-4-2**). Additional assumptions were made for the competitive analysis. Technologies below 1 MW in electrical capacity are assumed to have an economic life of 10 years. Larger systems are assumed to have an economic life of 15 years. Capital related amortization costs were based on a 10% discount rate. Based on their operating characteristics (each category and each size bin within the category have specific assumptions about the annual hours of CHP operation (80-90% for the high load factor cases with appropriate adjustments for low load factor facilities), the share of recoverable thermal energy that gets utilized (80%-90%), and the share of useful thermal energy that is used for cooling compared to traditional heating. The economic figure-of-merit chosen to reflect this competition in the market penetration

model is simple payback.¹⁶ While not the most sophisticated measure of a project's performance, it is nevertheless widely understood by all classes of customers.

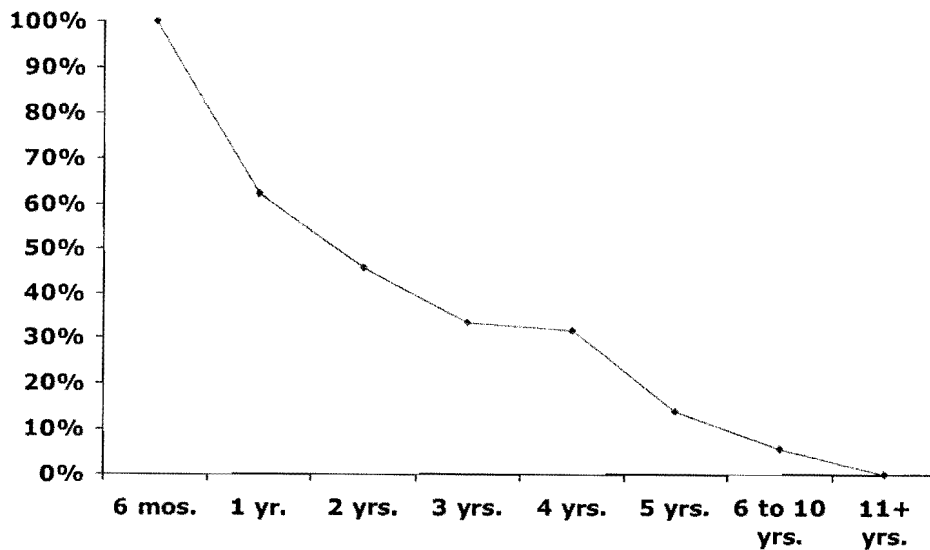
Table A-22. Technology Competition Assumed within Each Size Category

Market Size Bins	Competing Technologies
50–500 kW	100 kW Recip. Engine
	70 kW Microturbine
	150 kW PEM Fuel Cell
500–1,000 kW	300 kW Recip Engine (multiple units)
	70 kW Microturbine (multiple units)
	250 kW MC/SO Fuel Cell (multiple units)
1–5 MW	3 MW Recip Engine
	3 MW Gas Turbine
	2 MW MC Fuel Cell
5–20 MW	5 MW Recip Engine
	5 MW Gas Turbine
20–100 MW	40 MW Gas Turbine

Rather than use a single payback value, such as 3-years or 5-years as the determinant of economic potential, we have based the market acceptance rate on a survey of commercial and industrial facility operators concerning the payback required for them to consider installing CHP. Figure A-3 shows the percentage of survey respondents that would accept CHP investments at different payback levels (CEC 2005). As can be seen from the figure, more than 30% of customers would reject a project that promised to return their initial investment in just one year. A little more than half would reject a project with a payback of 2 years. This type of payback translates into a project with an ROI of between 49-100%. Potential explanations for rejecting a project with such high returns is that the average customer does not believe that the results are real and is protecting himself from this perceived risk by requiring very high projected returns before a project would be accepted, or that the facility is very capital limited and is rationing its capital raising capability for higher priority projects (market expansion, product improvement, etc.).

¹⁶ Simple payback is the number of years that it takes for the annual operating savings to repay the initial capital investment.

Figure A-3. Customer Payback Acceptance Curve



Source: Primen 2003

For each market segment, the economic potential represents the technical potential multiplied by the share of customers that would accept the payback calculated in the economic competition module.

The estimation of market penetration includes both a non-economic screening factor and a factor that estimates the rate of market penetration (diffusion.) The non-economic screening factor was applied to reflect the share of each market size category (i.e., applications of 50 to 500 kW, applications of 500 to 1,000 kW, etc) within the economic potential that would be willing and able to consider CHP at all. These factors range from 32% in the smallest size bin (50-500 kW) to 64% in the largest size bin (more than 20 MW.) These factors are intended to take the place of a much more detailed screening that would eliminate customers that do not actually have appropriate electric and thermal loads in spite of being within the target markets, do not use gas or have access to gas, do not have the space to install a system, do not have the capital or credit worthiness to consider investment, or are otherwise unaware, indifferent, or hostile to the idea of adding CHP. The specific value for each size bin was established based on an evaluation of EIA facility survey data and gas use statistics from the iMarket database.

The rate of market penetration is based on a *Bass diffusion curve* with allowance for growth in the maximum market. This function determines cumulative market penetration for each 5-year period. Smaller size systems are assumed to take a longer time to reach maximum market penetration than larger systems. Cumulative market penetration using a Bass diffusion curve takes a typical S-shaped curve. In the generalized form used in this analysis, growth in the number of ultimate adopters is allowed. The curves shape is determined by an initial market penetration estimate, growth rate of the technical market potential, and two factors described as *internal market influence* and *external market influence*.

The cumulative market penetration factors reflect the economic potential multiplied by the non-economic screening factor (maximum market potential) and by the Bass model market cumulative market penetration estimate.

Once the market penetration is determined, the competing technology shares within a size/utility bin are based on a *logit function* calculated on the comparison of the system paybacks. The greatest market share goes to the lowest cost technology, but more expensive technologies receive some market share depending on how close they are to the technology with the lowest payback. (This technology allocation feature is part of the EEA CHP model that is not specifically used for this analysis.)

APPENDIX B: POLICY CASE ASSESSMENT

Table B-1. Annual Electricity Savings from Policy Recommendations and Cost Assumptions

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Electricity Savings from Recommended Policies																
Million kWh Saved (GWh)																
1 Utility savings target																
Savings from current year programs	0	465	960	1,478	2,021	2,590	2,656	2,722	2,789	2,868	2,950	3,034	3,120	3,209	3,300	3,394
Savings from current & prior years	0	465	1,409	2,838	4,759	7,183	9,587	11,973	14,343	16,709	19,073	21,439	23,809	26,184	28,568	30,962
2 Appliance & equipment standards																
EPAct 2005	383	766	1,149	1,453	1,757	2,061	2,365	2,669	2,973	3,277	3,581	3,885	4,189	4,244	4,299	4,354
New standards	0	0	157	313	470	776	1,082	1,388	1,694	2,000	2,305	2,611	2,917	3,223	3,529	3,680
3 More stringent building codes																
Savings from current yr construction	0	0	0	0	879	897	907	912	1,099	1,131	1,165	1,200	1,236	1,273	1,311	1,351
Savings from current & prior years	0	0	0	0	879	1,760	2,638	3,505	4,544	5,598	6,668	7,755	8,860	9,982	11,124	12,286
4 Advanced building program																
Savings from current yr construction	0	26	45	85	132	179	227	274	384	453	524	600	1,236	1,273	1,255	1,255
Savings from current & prior years	0	26	71	154	284	458	677	939	1,308	1,738	2,233	2,795	3,984	5,189	6,356	7,503
5 Public buildings program	0	307	614	922	1,229	1,536	1,843	2,150	2,457	2,765	3,072	3,379	3,686	3,993	4,300	4,608
6 Short-term public ed and rate incentives	0	0	7,391	5,838	5,024	4,582	4,326	4,163	4,047	3,956	3,878	3,801	3,736	3,673	3,610	3,549
7 Expanded RD&D efforts	0	0	0	0	0	23	43	67	100	167	267	427	684	1,094	1,750	2,800
8 Improved CHP policies	0	219	439	658	878	1,097	1,316	1,536	1,755	1,974	2,194	2,413	2,633	2,852	3,071	3,291
9 Industrial competitiveness initiative																
Savings from current yr construction	37	38	38	39	40	40	41	42	43	43	44	45	46	46	47	48
Savings from current & prior years	37	75	113	152	191	232	273	315	357	400	445	490	535	581	628	676
10 Renewable portfolio standard																
Savings from current year (total)	0	796	1,571	2,406	3,248	4,090	4,938	5,790	6,671	7,564	8,468	9,381	10,279	11,179	12,079	12,976
11 On-site renewables policy package																
Current year residential SHW	35	70	140	211	281	351	421	492	562	632	702	772	843	913	983	1,053
Current year commercial SHW	2	4	9	13	18	23	29	34	40	47	54	61	69	76	84	91
Current year residential PV	18	36	72	108	144	180	216	252	288	324	360	396	432	468	504	540
Current year commercial PV	26	53	109	169	233	298	366	437	512	594	683	777	874	970	1,066	1,163
Total savings from current year	81	163	330	501	676	852	1,032	1,215	1,402	1,597	1,799	2,007	2,217	2,427	2,636	2,848
Total savings from current & prior years	81	243	569	1,061	1,718	2,542	3,530	4,685	6,007	7,501	9,173	11,024	13,053	15,258	17,635	20,183
Total (GWh)	119	2,131	12,333	14,342	18,679	24,278	30,252	36,510	43,284	50,373	57,776	65,515	74,175	83,209	92,651	102,513
Total from Efficiency	37	873	9,755	10,216	12,836	16,550	20,468	24,500	28,850	33,333	37,941	42,697	48,210	53,920	59,866	66,064
Total from Renewables	81	1,039	2,140	3,467	4,966	6,631	8,468	10,474	12,678	15,066	17,641	20,405	23,332	26,437	29,713	33,159

Notes:

- Establish mandatory electricity savings targets of 1% of prior year sales effective 2013. Ramp in over prior 4 years (0.2%, 0.4%, 0.6% and 0.8% in 2009, 2010, 2011 and 2012 respectively). For gas, ultimate target is 0.5% of sales and it ramps in over five years. Assumes savings degrade at 3.5%/year (14 year average measure life, half get replaced without intervention). Costs based on a 3 cents/kWh levelized cost, 4.5% real discount rate, and utility paying 1/3 of total costs.
- From ACEEE 2006 analysis of savings from standards by state. The first line includes standards contained in the federal EPAct 2005. The second line includes additional products featured in ACEEE's 2006 "Leading the Way" report, plus new DOE standards on dishwashers, refrigerators, small commercial AC, PTACs, and vending machines. For Florida state standards, delayed effective date to 2010.
- Based on 10% savings in residential sector and 20% in commercial sector, effective 2012, as discussed in text. Savings degrade at 1.7%/year (30 year average measure life, half replaced without intervention). Assumes an investment cost of \$0.16/kWh for commercial buildings per ACEEE estimate based on discussions with building experts and \$0.75/kWh for residential buildings per the economic potential analysis for residential buildings.
- Based on 30% savings minus savings already counted in the row above per FSEC and federal tax incentive goals. Assume participation of 2.5% in 2009, 5% in 2010, increasing 5% per year until 2020 when new code at this level takes effect. Savings degrade at 1.7%/year per policy above. Costs for residential buildings based on economic potential analysis and for commercial buildings based on personal communication with buildings experts.
- The Texas Loan STAR program is saving an average of about 15% with an average simple payback of 8-10 years (Haberl et al. 2002, Verdict personal communication). CBECS 1995 finds state and local buildings account for 17.6% of total commercial floor area. We estimate 50% of buildings can be served over a 15-year period based on discussions with TAMU/LoanSTAR experts.
- California achieved 6.7% energy savings and 11% demand savings in 2001 at a total cost of \$893 million (GEP 2003), with savings in 2002 about 1/2 -2/3 of the 2001 figure (Lutzenhiser et al. 2004, Dahlberg 2002). To be conservative, we assume a Florida program will save 3% of energy and 5% of peak in its first full year and degrade by 50% per year. We estimate costs for a FL program at half those of the CA program, based on the fact that our savings estimates are less than half those that CA achieved.
- Based on NYS program that saved \$150 million in tenth year with annual expenditures of \$17 million/year. Assume 2/3's of savings are electricity and 1/3 gas, converted to kWh and cf of gas using typical NYS rates in past decade. Assume FL program 75% the size, based on relative energy use.
- Assumes that an incentive equivalent to \$600/kW installed in offered which doubles the economic potential and 2/3 of the economic potential is realized. Peak 95% of installed capacity. Incremental Natural Gas is required to generate the output so value is negative.
- Based on results from U.S.DOE's Industrial Assessment Center and Save Energy Now programs. Assumes average of 7% identified savings per site, 50% implementation rate, with surveys at 5% of industrial site in the state per year. Assume cost of saved energy is 0.027/kWh and \$2.50/MMBtu.
- Based on weighted averages, RPS costs are assumed be \$0.157/kWh in 2008 and decline steadily to \$0.116/kWh by 2023 as a result of greater technology advances and experience in the production of these systems.
- Assumes 0.9% of the state's electricity need comes from onsite small-scale solar hot water systems (10% penetration for residential and 3% for commercial over 15 years) and photovoltaic (PV) systems (3% penetration for residential and 0.75% penetration over 15 years)

APPENDIX C: RENEWABLE PORTFOLIO STANDARDS

Current renewable resources in Florida that don't rely on waste products are largely solar, hydroelectric and biomass, as the wind resources on land is insufficient except perhaps in the Keys and Cape Canaveral area. Electric generation from wastes from landfill methane and from burning trash are growing resources, however classifying them as renewable may be a matter of political debate.

An estimate of current renewable energy capacity derived from a 2006 Florida Public Service Commission utility questionnaire, including generation from waste products, is shown in Table C-1.

Table C-1. Current Florida Renewable Energy Capacity

Resource	Capacity (kW)
Waste-to-energy	386,600
Biomass	493,600
Landfill gas	56,470
Hydroelectric	245,200
Solar thermal	139
Photovoltaics	769
Other (waste wood, heat recovery, hydrogen and wastewater)	61,017
Total	1,243,795

Source: FPSC 2006d

Future renewable generation resources include additional capacity from the technologies currently employed, plus possible offshore wind and ocean current technologies. The 2006 FPSC questionnaire noted above requested identification of renewable generation planned for in-service dates within the next five years and also capacity of currently negotiated renewable generator purchased power agreements (no in-service window given). Table C-2 provides a summary of both these planned and currently negotiated purchased generation capacities by technology.

Table C-2. Planned / Currently Negotiated Florida Renewable Energy Capacity

Resource	Capacity (kW)
Waste-to-energy	53,500
Biomass	130,000
Landfill gas	53,000
Hydroelectric	0
Solar thermal	2,000
Photovoltaics	267
Other (waste wood, heat recovery, hydrogen and wastewater)	20,205
Total	258,972

Questionnaire respondents also noted a number of additional potential projects and in two cases confidential purchase negotiations without providing capacity estimates for them, which may explain why the total planned / currently negotiated total renewable capacity of

around 259 MW is significantly lower than the 651 MW near term potential capacity reported to the FPSC (FPSC 2003)

According to the 2006 Florida Public Service Commission 10-year site plan reviews, the current renewable capacity represents 2.2% of present statewide capacity (56,914 MW). Adding the expected future renewable capacity will result in a drop in renewable energy production to 2.05% over 10 years as total capacity requirements are projected to increase to 73,318 MW by 2015.

Current hydroelectric generation capacity in Florida identified in the FPSC questionnaire is approximately 245 MW, of which approximately 200 MW is purchased power. Hydroelectric power generated in Florida is currently provided by two power plants, the Jim Woodruff Lock and Dam on the Apalachicola River and the C.H. Corn Hydroelectric Plant on Lake Talquin. The FPSC (2003) reports an analysis that concludes that an additional 43 MW of potentially undeveloped hydroelectric power is available for Florida.

Future offshore wind and ocean current technologies were not reported by any of the questionnaire respondents. Ocean current energy potential identified in a May 2006 white paper from the U.S. Department of the Interior Minerals Management Service notes that capturing just 1/1000th of the available Gulf Stream energy would supply 35% of Florida's electrical needs. While the potential for this technology is large, the technology is as yet unproven so is not considered as part of the resource potential as discussed in the main body of the report.

Costs of renewable resources will of course be a determining factor in how quickly these technologies are incorporated into Florida's generation capacity. Renewable generation costs were estimated in FPSC (2003) renewable electric generating technologies publication noted above and are provided here in Table C-3.

Table C-3. FPSC Estimated Electric Generation Technology Cost Comparison

Plant Type	Levelized Costs (cents/kWh)
Municipal Solid Waste	3.5–15.3
Biomass (direct combustion)	6.3–11.0
Landfill gas	2.4–6.3
Hydroelectric	No data
Solar Photoelectric	19.4–47
Waste heat facilities using exothermic process	Zero fuel cost
Natural gas combined cycle	3.9–4.4
500 megawatt pulverized coal	5.2–5.5

Source: FPSC 2003

This appendix also includes a detailed analysis of the potential for distributed solar photovoltaic power production and solar thermal power displacement.

A report to the FPSC (REPP 2002) concludes that a cost comparison between photovoltaics and electric service costs per kilowatt-hour will be pivotal to how attractive consumers will

see photovoltaics as an option. An analysis performed for this study indicates that with the current \$2,000 federal tax credit and \$4/peak watt Florida rebate, the levelized cost for a 2kW residential photovoltaic array is \$0.1367/kWh while Florida's typical residential retail rate is currently \$0.12/kWh, a difference of \$0.0167/kWh. Assuming that a combination of future incentives and/or price reductions will keep the photovoltaic cost at the same level, a relatively small increase in electric rates would erase the cost difference. While the cost of PV has increased in the past few years due to strong global demand, this cost is anticipated to resume its decline as additional manufacturing capacity comes online and the price of polysilicon falls as new dedicated solar capacity comes online. Even at the current prices, a number of consumers may still conclude that photovoltaics is attractive enough to have a system installed.

Fred Beck, Research Manager of the Renewable Energy Policy Project proposed a Residential Photovoltaic (PV) Development program for Florida [testimony to the FPSC, July 2, 2002]. The program would employ modest capital buydowns to allow PV to provide competitively priced electricity to consumers. Buydown funds were suggested to be generated through system benefit charges under a public benefit fund policy.

An FSEC analysis from 2004 that compares estimated output of photovoltaic systems in locations across the country shows that the daily output of a 2kW array ranges from 7.2kWh to 7.5kWh in Florida, compared with the highest outputs of around 8.1kWh to 8.7kWh in the desert southwest.

In 2006, Florida passed legislation to encourage Florida solar installations. Floridians can receive a rebate of up to \$500 after purchase and installation of the solar water heating system on a residence (\$100 for pool heating system). Rebates on water heating systems on commercial properties will be calculated at \$15 per 1000 Btu per day with a maximum \$5000 rebate. Also available are rebates for purchase and installation of photovoltaic systems for solar-generated electricity (calculated at \$4.00 per rated Watt). Rebates will be allowed at a maximum of \$20,000 for residential installations, while systems on commercial property may qualify for up to \$100,000 rebate.

Twenty other states and the District of Columbia have mandated utilities meet goals for renewables as shown in Table C-4. These renewable goals are referred to as renewable portfolio standards (RPS). States define renewables differently, administer programs differently and offer various incentives. Most of the states passed legislations with Republican governors. Colorado's RPS was passed by a state petition by the voters; overcoming considerable, well-funded utility opposition.

Table C-4. Renewable Portfolio Standards by State

State	Amount	Year	Organization Administering RPS
Arizona	15%	2025	<u>Arizona Corporation Commission</u>
California	20%	2017	<u>California Energy Commission</u>
Colorado	10%	2015	<u>Colorado Public Utilities Commission</u>
Connecticut	10%	2010	<u>Department of Public Utility Control</u>
District of Columbia	11%	2022	<u>DC Public Service Commission</u>
Delaware	10%	2019	<u>Delaware Energy Office</u>
Hawaii	20%	2020	<u>Hawaii Strategic Industries Division</u>
Iowa	105 MW		<u>Iowa Utilities Board</u>
Illinois*	25%	2017	<u>Illinois Department of Commerce</u>
Massachusetts	4%	2009	<u>Massachusetts Division of Energy Resources</u>
Maryland	7.5%	2019	<u>Maryland Public Service Commission</u>
Maine	10%	2017	<u>Maine Public Utilities Commission</u>
Minnesota	1,125 MW	2010	<u>Minnesota Department of Commerce</u>
Montana	15%	2015	<u>Montana Public Service Commission</u>
New Jersey	6.5%	2008	<u>New Jersey Board of Public Utilities</u>
New Mexico	10%	2011	<u>New Mexico Public Regulation Commission</u>
Nevada	20%	2015	<u>Public Utilities Commission of Nevada</u>
New York	24%	2013	<u>New York Public Service Commission</u>
Pennsylvania	18%	2020	<u>Pennsylvania Public Utility Commission</u>
Rhode Island	15%	2020	<u>Rhode Island Public Utilities Commission</u>
Texas	5,880 MW	2015	<u>Public Utility Commission of Texas</u>
Vermont*	10%	2013	<u>Vermont Department of Public Service</u>
Washington	15%	2020	<u>Washington Secretary of State</u>
Wisconsin	2.2%	2011	<u>Public Service Commission of Wisconsin</u>

Source: DOE (2007c)

*Two states, Illinois and Vermont, have set voluntary goals for adopting renewable energy instead of portfolio standards with binding targets.

Table C-5. Qualifying Renewable Electricity Sources

State	Wind	Photo-voltaics	Solar Thermal	Biomass	Geo-Thermal	Small Hydro-electric	Fuel Cells	Land Fill Gas	Tidal/Ocean	Wave/Thermal	Energy Efficiency
Arizona	✓	✓	✓	✓					✓		
California	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Colorado	✓	✓		✓	✓	✓		✓	✓	✓	
Connecticut	✓	✓	✓	✓			✓	✓	✓	✓	
Delaware	✓	✓	✓	✓	✓		✓	✓	✓	✓	
D C	✓	✓	✓	✓	✓		✓		✓	✓	
Hawaii	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Illinois	✓	✓	✓	✓			✓		✓		
Iowa	✓	✓		✓			✓				
Maine	✓	✓	✓	✓			✓	✓	✓	✓	
Maryland	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Massachusetts	✓	✓	✓	✓				✓	✓	✓	
Minnesota	✓			✓							
Montana	✓	✓	✓	✓	✓		✓	✓	✓		
Nevada	✓	✓	✓	✓	✓		✓		✓		✓
New Jersey	✓	✓		✓	✓		✓	✓	✓	✓	
New Mexico	✓	✓	✓	✓	✓		✓	✓	✓		
New York	✓	✓		✓			✓	✓	✓		
Pennsylvania	✓	✓	✓	✓	✓		✓	✓	✓		✓
Rhode Island	✓	✓		✓	✓	✓		✓	✓	✓	
Texas	✓	✓	✓	✓	✓		✓		✓	✓	
Vermont	✓	✓	✓	✓			✓	✓	✓		
Wisconsin	✓	✓	✓	✓	✓		✓	✓	✓	✓	

Source: Rabe 2006

In 2001, the state of Arizona sought the modest goal of 1.1% of electricity from renewables by 2007 with at least 60% from solar. After three years their commission determined that the cost benefit ratio had not improved sufficiently and they reduced the 2007 requirement.

Massachusetts is one of fifteen states that has enacted a PBF to help support their RPS. In 2005 this \$0.0005 per kilowatt hour charge was generating about \$40 million per year for renewable and energy efficiency projects.

Hawaii, Nevada and Pennsylvania have included energy efficiency in their RPSs. This is a smart decision to apply efficiency first and then seek the power sources. However, such a move increases the verification efforts of the program.

Hawaii defines renewable energy as electrical energy savings brought about by the use of solar and heat pump water heating, seawater air conditioning, district cooling systems, solar air conditioning and ice storage, quantifiable energy conservation measures, use of rejected heat from small-scale cogeneration, and customer-sited combined heat and power systems. The legislated statute requires the PUC to contract with the University of Hawaii's Hawaii Natural Energy Institute to conduct a peer-reviewed study every five years and to recommend whether to revise the RPS. On the same day the RPS bill was signed, Hawaii Governor Lingle also signed measures to raise the net metering limit for renewable energy systems from 10 kilowatts (kW) to 50 kW and extend the limit on performance contracting from 15 years to 20 years.¹⁷

¹⁷ See: http://www.eere.energy.gov/state_energy_program/project_brief_detail.cfm/pb_id=740.

Pennsylvania’s RPS has been controversial due to allowing some coal resources in the mix. However, they have established some other key features such as providing different energy credits by tiers as shown in Table C-6, they include energy efficiency/demand side management, and specify geographic region for renewable generation:

Energy derived only from alternative energy sources inside the geographical boundaries of this Commonwealth or within the service territory of any regional transmission organization that manages the transmission system in any part of this Commonwealth shall be eligible to meet the compliance requirements,

Table C-6. Pennsylvania Tiered Program

Tier I	Tier 2
Solar Photovoltaic Solar Thermal Wind Power Low-Impact Hydropower (incremental development only) Geothermal Energy Biomass Energy Biologically Derived Methane Gas Fuel Cells Coal Mine Methane	Large-Scale Hydropower Waste Coal Demand-Side Management/Energy Efficiency Distributed Generation Systems Municipal Solid Waste (existing facilities only) Byproducts of Pulping and Wood Manufacturing Integrated Combined Coal Gasification Technology
May 31, 2021 Minimum Tier 1: 8.0%, at least 0.50 % from Solar PV	May 31, 2021 Minimum of 10.0%

Pennsylvania instituted a net metering law that covers each billing cycle at the full cost of electricity for any tier one or two energy source and at wholesale energy prices for energy generated in excess of the amount used during the billing cycle. Interconnection laws were also written for small-scale producers.

California set one the highest targets of meeting 20% of their electricity with eligible sources by 2017. An energy action plan has set the goal of accelerating this to 2010. California has developed the process for verifying targets are met—something the legislature was silent about. This process includes important steps for any successful renewable program:

- Establishing each utility’s initial baseline
- Establishing an annual procurement target
- Approving or rejecting contracts executed to procure RPS-eligible electricity
- Determine if the utility is in compliance with the commission’s rules
- Impose penalties for non-compliance [CEC_300-2006-002-CMF, Feb. 2006]

The California Solar Initiative, as part of California’s Million Solar Roofs Program, has a goal of creating 3,000 megawatts of new solar-produced generation capacity by 2017, with an overall goal of helping to build a self-sustaining solar market. To achieve these goals, the

California Public Utilities Commission (CPUC), the program's administrator, is providing over \$2 billion in incentives over the next 10 years for existing residential and existing and new commercial, industrial and agricultural properties. The California Energy Commission (CEC) has a separate 10-year, \$350 million program designed to encourage solar in new residential construction.

The Initiative has initially included photovoltaic incentives starting at \$2.50 per watt for systems sized up to one megawatt, and funds for both new and existing low-income and affordable housing installations. In an August 2006 decision that will take effect in 2007, the CPUC shifted the program incentives from being volume-based to performance-based. To ensure wise energy resource use, the Initiative will be coordinated with the state's existing energy efficiency, "smart" metering and building standards programs (Go Solar California 2007).

A recent study by the PEW Charitable Trust indicated "important trends have emerged in RPS development. These include increasingly ambitious levels of renewable energy mandated over future periods, such as 25 percent of New York electricity by 2013 and 20 percent of Nevada electricity by 2015. In turn, many states have begun to differentiate between various sources of renewable electricity, providing special provisions to support certain forms of renewables that have lagged behind others due to high costs, and some are beginning to incorporate energy efficiency as a way to meet RPS goals. In a number of instances, RPSs have clearly played a central role in fostering rapid and significant expansion of the amount of renewable energy provided in a state." (Rabe 2006).

APPENDIX D: MACROECONOMIC IMPACTS ASSESSMENT

The Economic Model

The economic assessment model used in this exercise is a quasi-dynamic, input-output analytical tool we call DEEPER—or the Dynamic Energy Efficiency Policy Evaluation Routine. Although recently given a new name, the model's origins can be traced back to modeling assessments that ACEEE and others first completed in the early 1990s.

The model is “quasi-dynamic” in that it adjusts energy costs based on the level of energy quantities produced in a given year, and it adjusts labor impacts given the anticipated productivity gains within the key sectors of the Florida economy. So, for example, if efficiency measures or alternative generation technologies reduce the amount of natural gas otherwise consumed in Florida, one might naturally expect natural gas prices to be affected. Or if the construction and manufacturing sectors increase their output as a result of the alternative policy scenario, the employment benefits are likely to be affected based on expected labor productivity gains within each of those sectors. DEEPER includes these changes as they might impact the annual costs and benefits of the policy scenario.

Input-output models initially were developed to trace supply linkages in the economy. For example, an input-output accounting framework can show how purchases of lighting technologies or industrial equipment benefit not only the lighting and other equipment manufacturers in a state, but it can also reveal the multiplicative impacts that such purchases are likely to have on other industries and businesses that might supply the necessary goods and services to those manufacturers.

The DEEPER Model is a 15-sector economic impact model of the U.S. economy. Although an updated model with a new name, the model has a 15-year history of development and use for state energy policy assessments. See, for example, Laitner, Bernow, and DeCicco (1998) and Laitner (2007b) for a review of past modeling efforts. The model is generally used to evaluate the macroeconomic impacts of a variety of energy efficiency and renewable energy technologies at both the state and national level. The model now evaluates policies for the period 2008 through 2030. DEEPER is an Excel-based analytical tool that consists generally of six key modules or worksheets. These modules include:

Global data: The information in this module consists of the critical time series data and key model coefficients and parameters necessary to generate the final model results. The time series data includes the projected reference case energy quantities such as trillion Btus and kilowatt-hours, as well as the key energy prices associated with their use. It also includes the projected gross state product, wages, and salary earnings, as well as information on key technology assumptions. The source of data includes both the Energy Information Administration and Economy.com. One of the more critical assumptions in this study is that alternative patterns of consumption will defer conventional power plants that, on average, will cost \$1800 per kilowatt of installed capacity. This module also contains annual coefficients to estimate the impact a given scenario or policy will have on air emissions.

Macroeconomic model: This module contains the “production recipe” for the region’s economy for a given “base year”—in this case, 2004, which is the latest year for which a complete set of economic accounts are available for the regional economy. The I-O data, currently purchased from the Minnesota IMPLAN Group, is essentially a set of input-output accounts that specify how different sectors of the economy buy (purchase inputs) from and sell (deliver outputs) to each other. In this case, the model is now designed to evaluate impacts for 15 different sectors, including: Agriculture, Oil and Gas Extraction, Coal Mining, Other Mining, Electric Utilities, Natural Gas Distribution, Construction, Manufacturing, Wholesale Trade, Transportation and Other Public Utilities (including water and sewage), Retail Trade, Services, Finance, Government, and Households.

Investment and savings: Based on the scenarios mapped into the model, this worksheet translates the energy policies into physical energy impacts, investment flows, and energy expenditures over the desired period of analysis.

Price dynamics: With the estimated demand for energy consumption established, this module evaluates the impact of those new quantities on wholesale energy prices. Such prices include the minemouth cost of coal, the world oil price, and the wellhead price of natural gas, based on the following economic relationship:

$$\text{Price}_j = \text{EnergyIndex}_j^{\text{Elasticity}_j}$$

In other words, the price of energy for j is a function of a new Energy Index (e.g., 0.9 of the reference case) to some elasticity j . The assumed elasticities are 0.5, 0.2, and 0.7 for coal, oil, and natural gas, respectively. Given this relationship, for example, a 10% reduction in consumption—or an Energy Index of 0.9—implies a 5%, 2%, and 7% decline in the national wholesale energy price for coal, oil, and natural gas prices, respectively. These values are based on a review of various historical relationships and other modeling assessments found in the literature. Although Florida is a large state, if it is the only state to pursue the kinds of policies envisioned in this report, the impact on national wholesale energy prices will be very small.

Final demand: Once the changes in spending and investments have been established and adjusted within the previous modules of the DEEPER model, the net spending changes in each year of the model are converted into sector-specific changes in final demand, which drives the input-output model according to the following predictive model:

$$X = (I-A)^{-1} * Y$$

where:

X = total industry output by sector

I = an identity matrix consisting of a series of 0's and 1's in a row and column format for each sector (with the 1's organized along the diagonal of the matrix)

A = the production or accounting matrix also consisting of a set of production coefficients for each row and column within the matrix

Y = final demand, which is a column of net changes in final demand by sector

This set of relationships can also be interpreted as

$$\Delta X = (I-A)^{-1} * \Delta Y$$

which reads, a change in total sector output equals $(I-A)^{-1}$ times a change in final demand for each sector. Table 2 in the main report provides an illustration of the general approach used in this kind of model.

Results: For each year of the analytical time horizon, the model copies each set of results in this module in a way that can also be exported to the report. These different reports are summarized in Tables 3 through 7 of the main report.

There are other support spreadsheets as well as visual basic programming that supports the automated generation of model results and reporting. For more detail on the model assumptions and economic relationships, please refer to the forthcoming model documentation (Laitner 2007a). For a review of how an I-O framework might be integrated into other kinds of modeling activities, see Hanson and Laitner (2007).

Katie Ely

080413

From: Terri Rementeria [msrementeria@yahoo.com]
Sent: Sunday, October 25, 2009 7:09 PM
To: Records Clerk
Subject: Docket's#080407,080408,080409,080410,080411,080412,080413...

To Whom it May Concern...

Why don't the utility companies work for the true betterment and protection of our earth! Instead of the greed based behavior that guides their decisions! Our money is used for their benefit not the consumer or protection of our environment! You are nothing more than the Cancer of our earth ,cashing in for the money! You have no shame or conscious.

A true concerned American who cares about our earth !

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 09092.09		
DISTRIBUTION: _____		

Ann Cole

080413

From: Ann Cole
Sent: Monday, October 19, 2009 2:40 PM
To: Cristina Slaton
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: FW: Docket Correspondence

Attachments: Please reconsider your FEECA recommendation and support local jobs and a clean, more resilient future.; reconsider FEECA recommendation; RE: Please reconsider your FEECA recommendation and support local jobs and a clean, more resilient future.; Public Comment on Energy Efficiency ; Please reconsider your FEECA recommendation and support local jobs, and a clean and more resilient future.; Efficiency

Thanks, Cristina. The six attachments have been printed and will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos.: 080407-EG - 080413-EG.

From: Cristina Slaton
Sent: Monday, October 19, 2009 1:37 PM
To: Ann Cole
Cc: Bill McNulty
Subject: Docket Correspondence

Ann,

Please place the attached e-mails in the docket correspondence folders for 080407-080413.

Thanks,
Cristina

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO 09892.09		
DISTRIBUTION:		

Ann Cole

From: Michael Welber [michael.welber@gmail.com]
Sent: Friday, October 16, 2009 11:02 AM
To: Office of Commissioner Skop
Subject: Efficiency

According to a statewide environmental group the Florida Public Service Commission staff has just issued their recommendation for the next decade of energy efficiency programs in Florida. Or should we say inefficiency.

Their recommendation is to stick with the status quo, thereby burdening Florida with billions of dollars in unnecessary energy costs and the construction of unnecessary power plants costing tens of billions of dollars.

The staff recommendation, which is laughable, is to help reduce energy use in Florida by 1.2 percent over 10 years. At least 25 states have recently adopted much more aggressive goals: five, ten, and even twenty times more aggressive than the staff of the Florida Public Service Commission feel are in, well, Florida's interests.

As the current Health and Human Services secretary Kathleen Sebelius said when she was governor of Kansas, "The cheapest and cleanest form of energy is energy we don't use in the first place." Right. It costs far less to reduce energy consumption than to build new power plants. Clearly the PSC is in the pocket of the energy companies who only make money when they sell kilowatts.

The PSC staff proved that in their statement saying, "...the Commission's staff has advised that only energy efficiency programs that lower rates are acceptable..." Get it?

And finally to further prove that the state actually wants people to waste energy and pay more to the utilities, the staff decided to adopt a minimal spending goal for utilities to encourage customers to install renewable energy on-site. Spending to promote solar hot water or solar photovoltaic (PV) panels will amount to 5 percent of that allocated to energy efficiency.

This is pathetic and inexcusable.

Michael Welber
(305) 923-1190
Marathon, FL
michael.welber@gmail.com
www.thecrabbyhermit.blogspot.com

Ann Cole

From: Jane Gilbert [janegilbert@bellsouth.net]
Sent: Friday, October 16, 2009 11:41 AM
To: Office of Commissioner Skop
Subject: Please reconsider your FEECA recommendation and support local jobs, and a clean and more resilient future.

Dear Commissioner Skop,

Please consider the importance of energy efficiency and renewable energy in supporting local jobs, reducing our dependence on fossil fuels and nuclear power, and mitigating the impacts of climate change. This decision will keep Florida behind the times in the global move towards a clean and efficient energy economy. PSC's FEECA recommendations to be much more aggressive and include the Total Resource Cost test as an important measure.

Thank you,

Jane Gilbert
High Impact, Integrated Solutions
305-778-2999
janegilbert@bellsouth.net
<http://www.linkedin.com/in/janegilbert1>



Ann Cole

From: Jesse Glickstein [jesseg@fusenow.org]
Sent: Monday, October 19, 2009 7:07 AM
To: Office of Commissioner Skop; Office Of Commissioner Edgar; Office of the Chairman; Office of Commissioner Argenziano
Subject: Public Comment on Energy Efficiency
Importance: High

Dear PSC Commissioners:

I am extremely concerned about your recent recommendations regarding utilities and potential incentives for saving energy and reducing electrical consumption. I am ashamed to live in a state that is setting such low energy-efficiency goals, while at the same time attempting to build new power plants that are very expensive (and often times trying to charge customers in advance for the cost, ex: Levy County).

I urge you all to reconsider your recent decision and to please set meaningful goals for energy efficiency standards in Florida.

Sincerely:

Jesse Glickstein
701 SW 27th ave
Miami, Fl 33135

Ann Cole

From: Mario Yanez [mario.yanez@att.net]
Sent: Monday, October 19, 2009 5:44 AM
To: Office of the Chairman; Office of Commissioner Argenziano; Office of Commissioner Skop; Office Of Commissioner Edgar
Subject: RE: Please reconsider your FEECA recommendation and support local jobs and a clean, more resilient future.

Dear Commissioners,

Please consider the importance of energy efficiency and renewable energy in supporting local jobs, reducing our dependence on fossil fuels and nuclear power, and mitigating the impacts of climate change. Your current decision will keep Florida behind the times in the global move towards a clean and efficient energy economy. PSC's FEECA recommendations need to be much more aggressive and include the Total Resource Cost test as an important measure.

Mario Yanez

Miami-Dade County Resident

Ann Cole

From: Philip Stoddard [philip_stoddard@me.com]
Sent: Saturday, October 17, 2009 9:27 PM
To: Office of Commissioner Skop
Subject: reconsider FEECA recommendation

Dear Commissioner Skop:

In reviewing your FEECA recommendation, please consider the importance of renewable energy in supporting local jobs, reducing our dependence on fossil fuels and nuclear power, and mitigating the impacts of climate change. Rooftop solar makes lots of jobs and has no environmental risks or risk of nuclear accidents.

sincerley

Philip Stoddard
6820 SW 64 CT
South Miami FL 33143-3209
305-663-7357

10/19/2009

Ann Cole

From: Alan Farago [afarago@bellsouth.net]
Sent: Saturday, October 17, 2009 9:27 AM
To: Office of Commissioner Skop
Subject: Please reconsider your FEECA recommendation and support local jobs and a clean, more resilient future.

Dear Commissioner Skop,

Please reconsider the weak recommendations of staff for energy efficiency and renewable energy and require a much stronger alternative. The recommended standards are pitifully low in comparison to other leading states and badly undercut the need to create new, local jobs, reduce our dependence on fossil fuels and nuclear power, and mitigate the impacts of climate change.

Your current decision will keep Florida behind the times. The PSC's FEECA recommendations need to be much more aggressive and include the Total Resource Cost test as an important measure.

You have a chance to get this right. History will judge you harshly otherwise. Please read what the future holds, from "New Scientist Magazine". Is this the road you want to be remembered for? Please be bold.

Alan Farago
Coral Gables, FL

<http://www.newscientist.com/article/mg20427281300-posthuman-earth-how-the-planet-will-recover-from-us.html?full=true&print=true>

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Post-human Earth: How the planet will recover from us

30 September 2009 by Bob Holmes
Magazine issue 2728. Subscribe and get 4 free issues.
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Editorial: *Earth will be OK, but for us it's not so good*

WHEN Nobel prize-winning atmospheric chemist Paul Crutzen coined the word Anthropocene around 10 years ago, he gave birth to a powerful idea: that human activity is now affecting the Earth so profoundly that we are entering a new geological epoch.

The Anthropocene has yet to be accepted as a geological time period, but if it is, it may turn out to be the shortest - and the last. It is not hard to imagine the epoch ending just a few hundred years after it started, in an orgy of global warming and overconsumption.

Let's suppose that happens. Humanity's ever-expanding footprint on the natural world leads, in two or three hundred years, to ecological collapse and a mass extinction. Without fossil fuels to support agriculture, humanity would be in trouble. "A lot of things have to die, and a lot of those things are going to be people," says Tony Barnosky, a palaeontologist at the University of California, Berkeley. In this most pessimistic of scenarios, society would collapse, leaving just a few hundred thousand eking out a meagre existence in a new Stone Age.



Could a post-human Earth resemble the barren mud pools of Iceland perhaps? (Image: Andy Taylor Smith/Corbis)

Whether our species would survive is hard to predict, but what of the fate of the Earth itself? It is often said that when we talk about "saving the planet" we are really talking about saving ourselves: the planet will be just fine without us. But would it? Or would an end-Anthropocene cataclysm damage it so badly that it becomes a sterile wasteland?

The only way to know is to look back into our planet's past. Neither abrupt global warming nor mass extinction are unique to the present day. The Earth has been here before. So what can we expect this time?

Take greenhouse warming. Climatologists' biggest worry is the possibility that global warming could push the Earth past two tipping points that would make things dramatically worse. The first would be the thawing of carbon-rich peat locked in permafrost. As the Arctic warms, the peat could decompose and release trillions of tonnes of carbon into the atmosphere - perhaps exceeding the 3 trillion tonnes that humans could conceivably emit from fossil fuels. The second is the release of methane stored as hydrate in cold, deep ocean sediments. As the oceans warm and the methane - itself a potent greenhouse gas - enters the atmosphere, it contributes to still more warming and thus accelerates the breakdown of hydrates in a vicious circle.

"If we were to blow all the fossil fuels into the atmosphere, temperatures would go up to the point where both of these reservoirs of carbon would be released," says oceanographer David Archer of the University of Chicago. No one knows how catastrophic the resulting warming might be.

That's why climatologists are looking with increasing interest at a time 55 million years ago called the Palaeocene-Eocene thermal maximum, when temperatures rose by up to 9 °C in a few thousand years - roughly equivalent to the direst forecasts for present-day warming. "It's the most recent time when there was a really rapid warming," says Peter Wilf, a palaeobotanist at Pennsylvania State University in University Park. "And because it was fairly recent, there are a lot of rocks still around that record the event."

By measuring ocean sediments deposited during the thermal maximum, geochemist James Zachos of the University of California, Santa Cruz, has found that the warming coincided with a huge spike in atmospheric CO₂. Between 5 and 9 trillion tonnes of carbon entered the atmosphere in no more than 20,000 years (*Nature*, vol 432, p 495). Where could such a huge amount have come from?

Volcanic activity cannot account for the carbon spike, Zachos says. Instead, he blames peat decomposition, which would have happened not from melting permafrost - it was too warm for permafrost - but through climatic drying. The fossil record of plants from this time testifies to just such a drying episode.

Carbon spike

If Zachos and colleagues are right, then 55 million years ago Earth passed through a carbon crisis very much like the one feared today: a sudden spike in CO₂, followed by a runaway release of yet more greenhouse gases. What happened next may give us a glimpse of what to expect if our current crisis hits full force.

Geochemists have long known that when a pulse of CO₂ enters the air, much of it quickly dissolves in the upper layer of the ocean before gradually dispersing through deeper waters. Within a few centuries, an equilibrium is reached, with about 85 per cent of the CO₂ dissolved in the oceans and 15 per cent in the atmosphere. This CO₂ persists for tens or hundreds of thousands of years - what Archer believes will be the "long tail" of the Anthropocene. Until recently, though, climate modellers were a bit fuzzy on what this tail would look like.

"Until we had some case studies from the past, there was always some degree of uncertainty in the models," says Zachos. His studies are beginning to clear up these doubts. Carbonate rocks laid down on the sea floor during the carbon spike, for example, reveal that the oceans quickly became very acidic (*Science*, vol 308, p 1611). But this extreme acidification lasted just 10,000 or 20,000 years, barely a blink of an eye by geological standards, after which the oceans returned to near-normal conditions for the next 150,000 years. Even the stores of peat and methane hydrates must have regenerated within 2 million years, Zachos says, because at that time the planet underwent another, smaller carbon crisis, which must also have involved peat or methane hydrates. That suggests that the long tail of the Anthropocene is unlikely to last longer than 2 million years - still not long at all by geological standards.

However, today's carbon spike differs from that of the late Palaeocene in one important way: our planet is much cooler than it was back then, so warming is likely to have a more profound effect. During the late Palaeocene, the world was warm and largely ice-free. Now we have bright, shiny ice caps which reflect sunlight back into space. These will melt, giving way to dark, energy-absorbing rock and soil. And with all that meltwater, sea levels will rise and permafrost will thaw more rapidly, boosting warming still further.

This extra nudge could conceivably tip the Earth out of its present cycle of glacials and interglacials and return it to an older, warmer state. "The Earth was ice-free for many millions of years. The current ice ages started only about 35 million years ago,

so we might kick ourselves out of that," says Pieter Tans, an atmospheric scientist at the US National Oceanic and Atmospheric Administration in Boulder, Colorado. Even so, the newly ice-free world would merely be reverting to a familiar state. On this reading of the evidence, even the most drastic climate catastrophe would have little chance of pushing the Earth's physical systems into uncharted territory.

Not so, says James Hansen, director of NASA's Goddard Institute for Space Studies. He argues that past episodes are a poor guide to what will happen in the future, for the simple reason that the sun is brighter now than it was then. Add that to the mix and the release of methane hydrates could lead to catastrophic, unstoppable global warming - a so-called "Venus syndrome" (PDF) that causes the oceans to boil away and dooms the Earth to the fate of its broiling neighbour.

So much for the Earth itself - what of life? If Hansen is right, Earth is heading for sterility. But if the lesser scenario plays out instead, it's a very different story.

Conservation biologists say we may already be in the midst of an extinction event that could potentially turn into one of the greatest mass extinctions ever - one that would alter the trajectory of evolution.

Oddly enough, the climatic turmoil of the thermal maximum led to very little loss of biodiversity. "Nobody has ever picked the Palaeocene-Eocene boundary as a major extinction interval. It's not even in the second tier," says Scott Wing, a palaeobotanist at the Smithsonian Institution in Washington DC. Instead, the fossil record shows that species simply migrated, following their preferred climate across the globe.

Today, of course, that is often not possible because roads, cities and fields have fragmented so many natural habitats. Polar and alpine species may find their habitat vanishes entirely, and this is not to mention all the other ways people imperil species.

"We're a perfect storm as far as biodiversity is concerned," says David Jablonski, a palaeontologist at the University of Chicago. "We're not just overhunting and overfishing. We're not just changing the chemistry of the atmosphere and acidifying the oceans. We're not just taking the large-bodied animals. We're doing all this stuff simultaneously." Even so, Jablonski thinks humans are unlikely to be capable of causing an extinction comparable to the one at the end of the Permian, 251 million years ago, when an estimated 96 per cent of all marine species and 70 per cent of terrestrial ones bit the dust.

Whether the Anthropocene mass extinction eventually ranks with the Permian or with lesser ones, it would still reshuffle the evolutionary deck. Once again, the past gives us some idea of what we could expect.

The fossil record tells us that every mass extinction plays out differently, because each has its own unique causes. However, there is one common factor: the species at greatest risk are those with the narrowest geographic ranges. Jablonski's studies of fossil marine snails show that species with planktonic larvae - which disperse widely - fare better than species with a more restricted distribution (*Science*, vol 279, p 1327).

Cockroach world

Add to that massive habitat disturbances, says Jablonski, and a picture emerges of life after the Anthropocene extinction. Small body sizes, fast reproductive rates and an ability to exploit disturbed habitats will all prove advantageous. "It's a rats, weeds and cockroaches kind of world," says Jablonski.

The wave of extinctions is likely to sweep through species in a fairly predictable way. "First we would probably lose the species that are already endangered, then it would work its way down," says Barnosky. "Eventually it would hit some of the species that we don't consider at risk today - for example, many of the African herbivores that today seem to have healthy populations."

However, predictions about the fate of any particular species are almost impossible, as luck will also play a role. The survivors will probably be a more-or-less random selection of weedy plants and opportunistic animals, notes Doug Erwin, a palaeobiologist at the Smithsonian Institution.

If the Anthropocene does end with a mass extinction, the fossil record tells us a lot about what the recovery might look like. Whether the news is good or bad depends on your perspective. "Recoveries from mass extinctions are geologically rapid, but from a human point of view grindingly long. We're talking millions of years," says Jablonski.

Recoveries from mass extinctions are geologically rapid, but from a human point of view grindingly long.

We're talking about millions of years

immediately after a mass extinction, the fossil evidence suggests that ecosystems go into a state of shock for several million years. For many millions of years after the Permian extinction, for example, marine environments the world over were dominated by the same 25 or 30 species. "It's pretty boring," says Erwin.

Something similar happened on land after the Cretaceous extinction. Pre-extinction plant fossils from western North America testify to flourishing ecosystems, with a variety of insects feeding on a wide assortment of plants. After the extinction, though, both plant and insect diversity drops dramatically, with some insect feeding methods vanishing almost completely.

After that, confusion reigns for 10 million years. There are fossil assemblages with only a few insects and plants, ones with many insects but few plants, others with many plants but few insects - just about everything except what ecologists would call "normal" (*Science*, vol 313, p 1112). "At no time did we have what I would call a healthy ecosystem, with diverse insects feeding on diverse plants," says Wilf. All the while biodiversity remains low, with few new species evolving. "You're just trying to hang on," says Erwin.

A study of marine fossil diversity bears this out. Nearly a decade ago, James Kirchner of the University of California, Berkeley, and Anne Weil of Duke University in Durham, North Carolina, took a database of all known marine fossils and used it to work out how closely peaks of speciation follow peaks of extinction (*Nature*, vol 404, p 177). "We went into this thinking, like everybody else, that when you have an extinction, you begin repopulating almost immediately," says Kirchner, now at the Swiss Federal Institute for Forest, Snow and Landscape Research in Birmensdorf. Instead, they found that speciation peaks lagged about 10 million years behind extinction peaks. "We pretty much fell out of our chairs," he says.

In fact, for the first few million years after an extinction the speciation rate actually falls. "That suggests to us a sort of wounded biosphere. Extinction events don't just remove organisms from an ecosystem, leaving lots of opportunity for new species to diversify. Instead, what we think happens is that the niches themselves collapse, so you won't have new organisms emerging to occupy them. The niches themselves don't exist any more," says Kirchner.

Eventually, though, evolution wins the day, and after a few tens of millions of years biodiversity rebounds. Sometimes, as after the Ordovician mass extinction 440 million years ago, the new regime looks a lot like the old one. But more often a new world emerges. "You're not re-establishing the old chessboard, you're designing a whole new game," says Erwin.

In the Permian, the oceans were dominated by filter-feeding animals such as brachiopods and sea lilies, which lived their whole lives attached to the bottom. Predators were rare. All that changed after the extinction, leaving a more dynamic and richer ecosystem. "From my point of view, the end-Permian mass extinction was the best thing that ever happened to life," says Erwin.

In a perverse way, then, the bottom line is an encouraging one. Even if we manage to overpopulate and overconsume ourselves back to the Stone Age, the Earth will probably survive. Life will go on. By the time the long tail of the Anthropocene is over, what little was left of humanity will probably be gone. A new geological age will dawn. Shame there won't be anybody around to give it a name.

Editorial: *Earth will be OK, but for us it's not so good*

Bob Holmes is a consultant for New Scientist based in Edmonton, Canada

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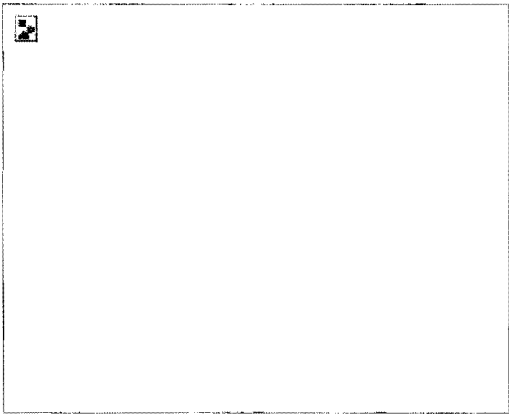
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Ann Cole

080413

From: Ann Cole
Sent: Monday, October 19, 2009 10:41 AM
To: Office of Commissioner Skop
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: RE: Do your Job

Thank you. This e-mail, which includes information regarding the voicemail, will be placed in the *Docket Correspondence - Consumers and their Representatives*, in Docket Nos.: 080407-EG - 080413-EG.

From: Office of Commissioner Skop
Sent: Monday, October 19, 2009 10:23 AM
To: Ann Cole
Cc: Bill McNulty
Subject: FW: Do your Job

FPSC, CLK - CORRESPONDENCE		
<input type="checkbox"/> Administrative	<input type="checkbox"/> Parties	<input checked="" type="checkbox"/> Consumer
DOCUMENT NO. 09892-09		
DISTRIBUTION:		

Ann,

Please add the e-mail below to the correspondence folders for docket numbers 080407-080413. In addition to the e-mail below, the same individual left a voicemail on the main line for the Office of Commissioner Skop at 10:23 AM on Sunday, October 18th.

Thanks,
Cristina

Casey Eckels
 500 NE 5th Ave.
 Pompano Beach, FL 33060
 (954) 946-6133

She is deeply ashamed to be a resident of a state with a Commission that refuses to get on board with aggressive energy reduction programs and building sustainability into our community. She has three grandchildren under 10 years old. Your decisions are condemning her grandchildren to live in a very difficult land and making it probably impossible to live in Florida, and contributing to the demise of the entire planet. She is so tired of corporate control of the well-being of the people of this state and your people are the ones who are letting it happen. Please consider changing your standards to allow us to achieve energy efficiency to allow us to build sustainable communities and quit beholding to the corporate interest. They do not have vision for this planet. They only have vision for their own pocketbooks and apparently that's what you have vision for too. But you must change your mind. You will be held accountable.

From: Casey Eckels [mailto:ceckels@bellsouth.net]
Sent: Sunday, October 18, 2009 10:55 AM
To: Office Of Commissioner Edgar; Office of Commissioner Skop; Office of the Chairman; Office of Commissioner Argenziano
Subject: Do your Job

10/19/2009

Commissioners;

I have followed with disgust and disbelief your irresponsible decisions and your refusal to show leadership regarding energy efficiency and proactive energy saving incentive programs for citizens in this state.

That you are recommending **business as usual**, at a time when science is showing us what that policy has done to our planet, and our ability to survive here, when technology and public willingness exist like never before to implement aggressive and visionary programs for the future, only leaves me with the sad conclusion that you are willing to put corporate desires first, at the expense of the public well-being and the future of life on this planet.

It is too late for pilot programs, and people are ready to act. By ignoring the science, the experts, the public willingness, the Legislature, and the Governor you exhibit either arrogance or ignorance, or a combination of both.

Your actions will not only cost consumers more money in the short run and leave Florida, SUNSHINE STATE, left drowning, it also condemns people I love to suffering. Without aggressive leadership and commitment to sustainable energy programs and CARBON REDUCTION NOW, you encourage the continued environmental degradation of the planet and condemn those who have no voice to suffer for your decisions.

Any children under 12 will start to see the severe results of our neglect in their lifetimes. That includes my grandchildren, and maybe yours also, or maybe your own children. Your voice and the voice of people like me is here to protect them.

I hope that you love them enough to want to save them.

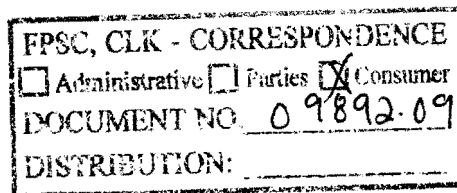
Ann Cole

080413

From: Ann Cole
Sent: Tuesday, October 13, 2009 11:05 AM
To: Office of Commissioner Skop
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: RE: Set high efficiency standards for Florida

Thank you for this information, which will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos. 080407 through 080413-EG.

From: Office of Commissioner Skop
Sent: Tuesday, October 13, 2009 10:10 AM
To: Ann Cole
Cc: Bill McNulty
Subject: FW: Set high efficiency standards for Florida



Hello Ann,

Please place the attached e-mails in the docket correspondence folders for 080407 through 080413-EG.

From: Jody Smith Williams [mailto:kwjody@yahoo.com]
Sent: Monday, October 12, 2009 8:30 PM
To: Office of Commissioner Argenziano; Office Of Commissioner Edgar; Office of Commissioner Skop; Office of the Chairman
Subject: Set high efficiency standards for Florida

Dear Public Service Commissioners,

I'm writing to urge you not to bow to pressure from companies that have a financial stake in raising base utility rates for the sake of their interests in selling more fossil fuel and nuclear power.

A 1% efficiency goal as recommended by staff is a huge step backward for Florida and the country, at a time when Florida should be leading the nation. Many other states have adopted energy efficiency standards far exceeding this paltry "goal." Through efficiency we can avoid the need for new expensive and dangerous nuclear reactors (the proposed expansion of Turkey Point, upwind from us in the Florida Keys, is a major cause for concern due to power lines across the Everglades and encroaching sea level rise) and put more money in the pockets of Florida's citizens. Your vote to put Florida on the path to clean energy is vital - anything less than a strong efficiency standard would be short sighted and foolish.

Thank you.

Jody Smith Williams
305-304-2064
Green Living & Energy Education (GLEE)
www.keysglee.com
Last Stand

www.last-stand.org

"The only thing worse than being blind is having sight but no vision."
~ Helen Keller

Ann Cole

080413

From: Ann Cole
Sent: Wednesday, October 07, 2009 11:51 AM
To: Cristina Slaton
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: FW: Docket Correspondence
Attachments: More energy efficiency; Energy efficiency goals

Thanks, Cristina. The two attachments have been printed and will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos. 080407-EG through 080413-EG.

From: Cristina Slaton
Sent: Wednesday, October 07, 2009 11:39 AM
To: Ann Cole
Cc: Bill McNulty
Subject: Docket Correspondence

Ann,

Please place the attached e-mails in the docket correspondence folders for 080407 through 080413-EG.

Thank you,
Cristina

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DISTRIBUTION: _____		

Ann Cole

From: June Cussen [june@pineapplepress.com]
Sent: Tuesday, October 06, 2009 4:29 PM
To: Office of Commissioner Skop
Subject: Energy efficiency goals

Dear Commissioner Skop,

I know the PSC will be considering energy efficiency goals this month. This is a very important decision that will have a long-term effect on the Florida economy and environment. Please vote to make those goals meaningful--at least 1%.

Thank you.

June Cussen
1644 Seminole Drive
Sarasota, FL 34239

Ann Cole

From: Alison Higgins [ahiggins@TNC.ORG]
Sent: Saturday, September 26, 2009 5:16 PM
To: Office of Commissioner Argenziano; Office of Commissioner McMurrian; Office of Commissioner Skop; Office of the Chairman; Office Of Commissioner Edgar
Cc: Charlie.Crist@MyFlorida.com
Subject: More energy efficiency

Hello Commissioners,

The negawatt option is the smartest path to take for our energy independence. Other states are getting 5-10 times more efficiency than our sunshine state. They are proving that its smarter for both the consumer and the supplier to not build that next plant, but rather to reduce the need for it.

Energy efficiency reduces bills - a state of inefficiency is bad for consumers.
17 states have annual energy savings goals of AT LEAST 1%.
Florida utilities are meet about 0.2% of sales from efficiency.

It's not like you are being asked to invent the wheel, the proof and methods are there.
The federal dollars are there.

Be strong on efficiency measures.

Alison Higgins

President, Green Living & Energy Education
www.KeysGLEE.com
C) 305-923-1783



please consider the environment before printing this email

Ann Cole

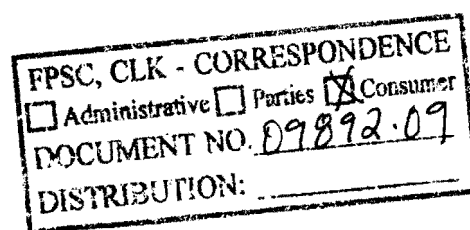
080413

From: Ann Cole
Sent: Wednesday, October 07, 2009 7:47 AM
To: Office of Commissioner McMurrrian
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: RE: comments to Public Service Commission

Thank you for this information, which will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos. 080407-EG - 080413-EG.

-----Original Message-----

From: Office of Commissioner McMurrrian
 Sent: Tuesday, October 06, 2009 4:05 PM
 To: Ann Cole
 Subject: FW: comments to Public Service Commission



Please place in the file for DNs 080407-080413. Thank you.

-----Original Message-----

From: sarah [mailto:rwerlink@mindspring.com]
 Sent: Wednesday, September 02, 2009 12:02 AM
 To: Office of Commissioner Argenziano; Office Of Commissioner Edgar; Office of the Chairman;
 Office of Commissioner McMurrrian; Office of Commissioner Skop
 Subject: comments to Public Service Commission

I am writing you this email because there seems to be a mind set on part of the Public Service Commission to disregard the people of Florida in deference to the massive plans from the utilities to push for approval of Nuclear power. Hugh rate increases to fund these plants are being asked for as you know. Your goal should be to obtain unbiased facts and make decisions which are best for the people in regards to environmental impacts, Public health and the cost of power.

Nuclear power plants are very expensive (about 9 billion actual cost per Reactor) these plants have always gone over budget,

Consider there is no private investment money for new Nuclear without Government guarantees (limited liability for accidents)

,massive tax breaks and massive rate increases from commissions like you.

Your first order of business should be increasing the efficiency of electricity use in Florida by increased efficiency standards for new and existing buildings and homes, commercial and public buildings energy use, No real effort is required from the Utilities which have only token programs. Your commission must require much more before rate increases for massive power plants are considered.

Establishing consumer rebates for Solar heating and providing rebates and requiring utilities to buy back electricy at higher rates

from electricy generated by photovoltaic panels. Do you know that the cost of these panels has dropped (30-40%) and improved

efficiency (AC/DC converters at individual panels for example) makes this a much preferred solution

10/7/2009

in Florida vs. large Power

generators such as Nuclear or Coal? I hope I don't have to make the argument again that Global warming is real and largely man made which must preclude any new coal plants. Nuclear power while contributing far less direct CO2 than Coal has its own environmental problems, the big one being no plan to handle the spent nuclear fuel with the likely long term effects being radiation leaks and cancer. Spent fuel is already piled up in water cooling pools or concrete storage on reactor sites with nowhere to go and providing a target for Terrorists. What is your plan if terrorists manage to cause a massive radiation leak in Florida? Think about the economic devastation. Is Nuclear power worth the risk? NO.

What about the fact that the sun doesn't provide a continuous power source? Modern Natural Gas Turbines should be used to supply the remaining demand, Natural Gas in an abundant domestic clean fuel -with low predicted prices. Natural Gas is the cleanest hydrocarbon energy source. As you should know, Coal is very dirty- largely contributing to the mercury levels in fresh water fish throughout Florida making the fish unsafe. Is there a cost to renewable energy and efficiency requirements? Of course, but fair comparisons including economic payback would establish Efficiency, Renewable (solar hot water / photovoltaic panels) and Gas Turbines as the proper course to generate power in Florida.

Nuclear power or coal does not make economic sense if all the costs are included -long term health and environmental effects.

The commission is required to not just listen to the vested interests of big utilities that do not profit from efficiency and renewable power- using the recent pitiful public hearings on rate increases to meet legal requirements is a whitewash. Consider the facts and serve all the people of Florida as the commission is chartered to do.

Rudy Werlink PE MS
1220 Stone Harbour
Winter Springs, Florida

Ann Cole

080413

From: Ann Cole
Sent: Friday, October 02, 2009 3:08 PM
To: Office of Commissioner McMurrian
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: RE: More energy efficiency

Tracking: Recipient **Read**
Office of Commissioner McMurrian
Commissioners Advisors
Administrative Assistants - Commission Suite
Cristina Slaton Read: 10/2/2009 3:08 PM

Thank you for this information, which will be placed in *Docket Correspondence - Consumers and their Representatives*, in Docket Nos. 080407-EG - 080413-EG.

From: Office of Commissioner McMurrian
Sent: Friday, October 02, 2009 3:04 PM
To: 'Alison Higgins'
Cc: Ann Cole
Subject: RE: More energy efficiency

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Dear Ms. Higgins,

Thank you for taking time to express your concerns about the Numeric Conservation Goals. I received your note and have placed it in the case docket files (Docket Nos. 080407-EG - 080413-EG).

I appreciate your input in this matter before the Commission.

Best regards,

Katrina

Katrina J. McMurrian
Florida Public Service Commission
2540 Shumard Oak Blvd.
Tallahassee, FL 32399-0850

*For a complete list of tips on how to conserve energy and use energy more efficiently in your home, please see: <http://www.floridapsc.com/consumers/house/FullInformation.aspx>

*Eligible low-income households in Florida can get help paying energy bills through the Low-Income Home Energy Assistance Program (LIHEAP). For more information, please see: <http://www.floridacommunitydevelopment.org/liheap/index.cfm>

*Need discounted phone service? Eligible low-income residents will receive a 50% rebate in

the telephone hook-up charge (up to \$30.00) through the Link-Up Florida program as well as a \$13.50 credit per month on local phone bills through the Lifeline Assistance program.

For more information or to apply, please see:

<http://www.floridapsc.com/utilities/telecomm/lifeline/engbrochure.aspx>

*In addition to information about the PSC's services, *Where to Find Help* offers information about various social service agencies that can assist consumers. Please

see: <http://www.floridapsc.com/publications/consumer/brochure/wheretofindhelp.pdf>

From: Alison Higgins [mailto:ahiggins@TNC.ORG]

Sent: Saturday, September 26, 2009 5:16 PM

To: Office of Commissioner Argenziano; Office of Commissioner McMurrian; Office of Commissioner Skop; Office of the Chairman; Office Of Commissioner Edgar

Cc: Charlie.Crist@MyFlorida.com

Subject: More energy efficiency

Hello Commissioners,

The negawatt option is the smartest path to take for our energy independence. Other states are getting 5-10 times more efficiency than our sunshine state. They are proving that its smarter for both the consumer and the supplier to not build that next plant, but rather to reduce the need for it.

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Florida utilities are meet about 0.2% of sales from efficiency.

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The federal dollars are there.

Be strong on efficiency measures.

Alison Higgins

President, Green Living & Energy Education

www.KeysGLEE.com

C) 305-923-1783



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CONSUMER 080413-EG

Ann Cole

From: Ann Cole
Sent: Wednesday, September 23, 2009 4:20 PM
To: Cristina Slaton
Cc: Commissioners Advisors; Administrative Assistants - Commission Suite
Subject: FW: Docket Correspondence
Attachments: Efficiency for Florida Utilities; proposed utility efficiency goals

Thank you for this information. The attachments have been printed and will be placed in *Docket Correspondence - Customers and their Representatives*, in docket nos. 080407-080413-EG.

From: Cristina Slaton
Sent: Wednesday, September 23, 2009 3:18 PM
To: Ann Cole
Cc: Bill McNulty
Subject: Docket Correspondence

Hello Ann,

Please add the attached e-mails to the docket correspondence folders for 080407-080413-EG.

Thanks,
Cristina

9/23/2009

DOCUMENT NUMBER-DATE
09892 SEP 24 8
FPSC-COMMISSION CLERK

Ann Cole

From: Vicki Eckels [veeckels@gmail.com]
Sent: Monday, September 21, 2009 5:35 PM
To: Office of the Chairman; Office of Commissioner Argenziano; Office Of Commissioner Edgar; Office of Commissioner McMurrin; Office of Commissioner Skop
Subject: proposed utility efficiency goals

All,

As a residential solar energy producer since 2008, I know what I'd like to see in the way of goals for utility efficiency.

I expect you to look at the big, long-term picture and show true leadership when you vote next month on this matter. Support the TRC test because it allows measures with high kilowatt hour reductions to pass, the type of measures that can help consumers lower their electricity bills.

Florida is the only state to rely exclusively on the RIM test, doesn't this say something as to ineffectiveness as a benefit-cost test? Florida utilities' energy efficiency performance pales in comparison to leading utilities in other states. Your vote for TRC will allow Florida to join other states that are capturing meaningful energy efficiency.

We do not need more power plants at this time. We need more distributed power; the closer the source of energy produced to its actual use, the more energy efficiency.

Do what is in the interest of the Florida consumer as well as the utilities. Do not favor one over the other lest you sentence future generations, your own among them, to a energy marketplace that damages us all. Vote for something we call all live with, the TRC test.

-- Vicki Eckels

Solar Powered Homeowner since June 2008

917 SE 14th St.

Fort Lauderdale, FL 33316

350 International Day of Climate Change on October 24, 2009; go to www.350.org

Ann Cole

From: Rob Brinkman [robbrinkman@cox.net]
Sent: Wednesday, September 23, 2009 3:07 PM
To: Office of the Chairman; Office of Commissioner Argenziano; Office Of Commissioner Edgar; Office of Commissioner McMurrin; Office of Commissioner Skop; George Cavros; George Cavros
Cc: Charlie.Crist@MyFlorida.com
Subject: Efficiency for Florida Utilities

Dear Chairman Carter and Commissioners,

Regarding the pending matter of efficiency goals for Florida Utilities. Gainesville Regional Utilities (GRU) owned by the people it serves, has a 2010 conservation goal over 1.25 % of 2010 projected sales. The most important factor in becoming a leader in conservation in Florida for GRU was direction by the Gainesville City Commission to adopt the total resource cost (TRC) test to screen conservation programs, previously the rate impact measure (RIM) test had been employed as a screening tool. I was personally present when GRU presented an offer to pay half of a proposed lighting upgrade at Alta printing systems in Gainesville and the GRU representative attributed GRU's ability to make this offer to the use of the TRC test as a conservation screening tool. Like investor owned utilities, Gainesville City Commissioners have an economic incentive to assist GRU in maximizing profits as the transfer from GRU to the general government amounts to nearly thirty percent of general fund revenues. These conservation programs along with other efforts such as the solar feed in tariff, currently paying 34 cents per kWh, have had small rate impacts.

But many have seen their bill go down as usage was reduced and these programs have enjoyed widespread public support.

I do believe and advocate for even more investment in conservation, we could do much more than we are currently. GRU and the Gainesville City Commission have proceeded cautiously with due concern about the economic impacts on consumers, after all raising municipal utility bills is even less popular than raising taxes since renters don't see their property's tax bill, but do generally pay the electric bill. One important benefit of the conservation and renewable energy efforts locally has been job and business creation. Unlike PSC Commissioners and investor owned utility executives we have annual elections for members of the Gainesville City Commission. Energy efficiency is the least cost way to reduce greenhouse gas emissions and the utility bills of participants, both of these should be of concern to you as you make your decision. Because of the many low cost, widespread efforts it also has the potential to allow the most citizens of Florida to participate, something that will be essential if we are to meet the challenges of our climate future. I urge the PSC to ask Florida utilities to make a Florida a leader in the field of conservation.

Thank you for your attention to my concerns,

Rob Brinkman, Chair
Suwannee-St. John's group of the Sierra Club Florida