

Report on the
Workshop for Research in Electricity Infrastructure Hardening

Held on Friday, June 9, 2006
Best Western Gateway Grand
Gainesville, Florida

And sponsored by
Public Utility Research Center
University of Florida

Purpose

The purpose of this workshop was to provide a forum at which utility managers and hazard research professionals could discuss means to prepare Florida's electric infrastructure to better withstand and recover from hurricanes. This workshop was the first phase of a research coordination effort launched by the electric utilities in Florida in response to the Florida Public Service Commission's (FPSC) Order No. PSC-06-00351-PAA-EI, issued April 25, 2006, directing each investor-owned electric utility to establish a plan that increases collaborative research to further the development of storm resilient electric utility infrastructure and technologies that reduce storm restoration costs and outages to customers. The Public Utility Research Center (PURC) worked with the utilities in the design of this workshop so that: (1) researchers could learn the needs and priorities of the utility industry's hardening efforts and how utilities currently prepare for and recover from hurricanes; and (2) utility managers could learn about research capabilities from a variety of independent university programs and industry groups that focus on hazard research.

This report summarizes the workshop and identifies areas of interest for future research coordination. It is organized as follows. The next section describes the workshop agenda. We then summarize the presentations by the industry and researchers. Next we summarize the synthesis and dialogue that identified possible research needs. We conclude by summarizing the research priorities that we observed during the workshop. Copies of the presentations by industry and researchers, and the researcher abstracts, are available on the PURC website www.purc.ufl.edu. This report contains the following appendices:

- Appendix A Agenda
- Appendix B List of Attendees

Workshop Agenda

The workshop began with presentations by industry infrastructure managers who described their experiences with outages, damage, and recovery during recent hurricanes. Presentations were made by:

- J. R. "Pepe" Diaz, Reliability Engineering Manager, Power Systems – Distribution, FPL
- Jason Cutliffe, Manager, Distribution Asset Performance, Progress Energy Florida
- Alan McDaniel, Project Services Manager, Gulf Power Company
- T.J. Szelistowski, Director, Transmission and Distribution Operations, TECO
- Jorge Puentes, Electric Operations Manager, Florida Public Utilities Company

The PURC [web site](#) contains copies of their presentations.

Following a Q&A, researchers from Florida and other states discussed their work and the capabilities of their universities, centers, or consulting firms. Presentations were made by

- Dr. Kurt Gurley, University of Florida
- Dr. Steinar J. Dale, Florida State University
- Dr. Alex Domijan, Jr., University of South Florida
- Calvin Stewart, Davies Consulting, Maryland
- Dr. Francis M. Lavelle, Applied Research Associates, N. Carolina
- Dr. Seth Guikema, Texas A&M; and Dr. Rachel Davidson, Cornell University

Their presentations are also available on the PURC [web site](#).

The researchers who presented were selected by an industry steering committee for the workshop. PURC and the steering committee first developed a list of individuals and organizations they believed conducted research that was relevant to the issue of storm hardening. PURC issued an invitation to each person and organization on the list, requesting that they submit abstracts of their capabilities to be considered by the steering committee. PURC received seven abstracts and all seven were invited to the workshop. The abstracts are on the PURC [web site](#).

Industry Presentations

Following are summaries of the presentations. Copies of the PowerPoint slides are on the PURC [web site](#).

J. R. "Pepe" Diaz, Reliability Engineering Manager, Power Systems – Distribution, FPL
Mr. Diaz reviewed FPL's experiences with hurricanes, the company's procedures and practices regarding strengthening their systems for hurricanes, and its initial thoughts on research needs. His points included:

- Hurricanes have been a drain on the nation's resources.
- Forensic research data collection is done during restoration by forensic teams. FPL hired KEMA to examine the data after the fact.
- Determining cost-effective solutions to system hardening includes:

- Overhead to underground conversion;
- Increased line clearing; vegetation management;
- NESC (National Electric Safety Code) extreme wind standards.
- Areas to explore include:
 - Overhead hardening materials and work methods
 - Need lighter poles that meet strength standards and are less expensive to install.
 - Effects of wind
 - Need better data at a more granular level, considering sustained versus choppy wind.
 - Need testing and simulation.
 - Storm surge
 - Materials not subject to flood damage are needed.
 - Network operations issues should be addressed; e.g., downtown network is underground at mouth of Miami River near Atlantic Ocean. Should utilities de-energize underground facilities in storm surge areas before the storm hits?

Jason Cutliffe, Manager, Distribution Asset Performance, Progress Energy Florida

Mr. Cutliffe reviewed Progress Energy's experiences with hurricanes, the company's procedures and practices regarding strengthening their systems for hurricanes, and its initial thoughts on research needs. His points included:

- The GIS system – need to populate systems.
- Vegetation management is a priority.
- Post-storm data collection is important for diagnosing what happened.
- Audits of joint-use pole attachments are important
- Construction standards should be reviewed.
- Undergrounding practices should be reviewed to determine where undergrounding makes sense.
- Information gaps:
 - Data collection and analysis – take advantage of analytical capabilities of universities; identify normal and abnormal events.
 - Need to better understand wind.
 - Need new, more sophisticated statistical methods for examining data.

Alan McDaniel, Project Services Manager, Gulf Power Company

Mr. McDaniel reviewed Gulf Power's experiences with hurricanes, the company's procedures and practices regarding strengthening their systems for hurricanes, and its initial thoughts on research needs. His points included:

- Key contributors to storm damage are:
 - Trees
 - Wind
 - Storm Surge
 - Debris
 - Debris Removal vehicles

- Problem areas:
 - Need solution to joint-use loading problems.
 - Alternatives to installation of larger, heavier poles. Need to be more cost effective and have fewer traffic disruptions.
 - Locating underground systems after a storm. Complicated by shifting sands.
 - Making system components waterproof.
 - Solution to damaged meters, which had to be replaced. Need to focus on breakaway system for meters and masts.
- Biggest needs:
 - How to keep poles standing.
 - Better ways to tie down pad/mount transformers.

T.J. Szelistowski, Director, Transmission and Distribution Operations, TECO

Mr. Szelistowski reviewed TECO's experiences with hurricanes, the company's procedures and practices regarding strengthening their systems for hurricanes, and its initial thoughts on research needs. His presentation:

- Explained restoration prioritization logic;
- Highlighted that customers want accurate information about system restoration;
- Explained that research should provide practical solutions;
- Asked whether there are opportunities to better coordinate resource sharing among utilities;
 - Investor-owned vs. municipality vs. coop?
- Described the need for a cost-efficiency study for overhead to underground conversion.

Jorge Puentes, Electric Operations Manager, Florida Public Utilities Company

Mr. Puentes reviewed FPUC's experiences with hurricanes, the company's procedures and practices regarding strengthening their systems for hurricanes, and its initial thoughts on research needs. His points included:

- FPUC is a small utility, lacking scale economies
- Needs include:
 - Better prediction tools for hurricanes
 - A narrower zone of influence
 - Economical alternatives to for construction materials
 - Unconventional approaches for vegetation management

The question and answer period raised the following points:

1. The "right tree in the right place" concept is important for vegetation management.
2. Vegetation and tree impacts are significant causes of storm damage.
3. Need to consider the degree to which utilities are coordinating with local communities and governments, building codes, and sign ordinances.
4. Mobile homes came apart in storms and came into contact with power lines.
5. Utilities use specialized forensics teams to examine damage so that repair crews can focus on recovery.

In summary, the research issues raised during the industry presentation time included:

- Overhead hardening materials and work methods
 - Need lighter poles that meet strength standards and are less expensive to install
- Effects of wind
 - Need better data at a more granular level, considering sustained versus choppy wind
 - Need testing and simulation
- Storm surge
 - Materials not subject to flood damage
 - Better recovery techniques
- Advanced analytical techniques of forensic and storm data
 - More clearly identify normal and abnormal events
- New approaches for managing joint-use loading problems
- Techniques for locating underground systems after a storm has shifted sands
- Waterproof components
- Ways to prevent meter damage, such as breakaway systems
- Ways to prevent pole and line damage, such as:
 - breakaway system for masts;
 - improved vegetation management.
- Better ways to tie down pad/mount transformers
- Opportunities to better coordinate resource sharing among utilities
- Cost-efficiency study for overhead to underground conversion
- Better prediction tools for hurricanes

Researcher Presentations

Following are summaries of the researcher presentations. Copies of their abstracts and PowerPoint slides are available on the PURC [web site](#).

Dr. Kurt Gurley, University of Florida (UF)

Dr. Gurley summarized the research, research capabilities and experiences of a team at UF and Florida International University (FIU). His key points included:

- The research uses portable wind measurement equipment to measure dynamics of wind during hurricanes.
- Putting such wind measuring equipment on utility infrastructure can provide more detailed data on how wind actually behaves. The researchers have learned that wind speed, direction, and swirling can vary considerably from wind speeds stated by weather centers.
- The team's "Wall of Wind" (WoW) – a hurricane simulation lab – has been used for analyzing how hurricane wind, hurricane-driven rain, and debris affect buildings and how buildings can be hardened. The lab can be used for utility infrastructure research. Tentative tests show that pruning trees can affect how

- trees behave in wind, such that some pruning may actually increase the probability of damage to power lines.
- The group is seeking funding to increase the size of the WoW
 - New methods have been recently created for accurately forecasting storm surge.
 - The team includes researchers who study:
 - Wind speed measurement in real-time;
 - Wind load quantification;
 - Infrastructure vulnerability quantification;
 - Vegetation management issues;
 - Hardening options (w/cost modeling);
 - Design & engineering
 - Full-scale hurricane simulation
 - Coastal surge / flood modeling:
 - Real-time during event
 - Forecasting over long term.

Dr. Steinar J. Dale, Florida State University (FSU)

Dr. Dale described the capabilities of his research center at FSU. His key points included:

- The center focuses on research and education related to application of new technologies to electric power systems.
- The center's network simulator can be used to evaluate restoration alternatives:
 - Hybrid simulation (hardware with real-time software)
 - System dynamics
 - Advanced controls and protection
- It can also assess voltage stability.
- Predetermined system islanding can also be modeled.

Dr. Alex Domijan, Jr., University of South Florida

Dr. Domijan described the capabilities of his research center and colleagues at USF. His key points included:

- The center has certificate programs for training employees.
- It conducts research on structured intelligence, integrating various factors with technical aspects. It also researches advanced network and substation design.
- He cooperates with Florida Coastal Monitoring Program at UF and Center for Advanced Power Systems at FSU.
- His group is interested in:
 - Effects of hurricane winds and storm surge;
 - Post-Storm data collection and forensic analysis;
 - Collection of detailed outage data differentiating between reliability performance of overhead and underground;
 - Increased utility coordination.
- The team has expertise in:
 - weather and reliability;
 - performance of underground vs. overhead systems;
 - computer data-base management;
 - cost/benefit analysis.

Calvin Stewart, Davies Consulting, Maryland

Mr. Stewart described the capabilities of Davies Consulting and examples of its work. His key points included:

- The firm's consulting experience includes:
 - Storm restoration best practices;
 - Reliability performance optimization;
 - Operational excellence.
- It has an extensive database of utility best practices (Storm Benchmarking).
- Its analytic methodologies include:
 - Portfolio Optimization;
 - Simulation Modeling and Analysis.
- The firm provides analysis of economic implications and risks associated with investment decisions.
- Storm benchmarking research can support hardening analysis. The firm can expand its database to include participants in the PURC research coordination effort.
- A restoration simulation strategy model is available that provides an estimated restoration time down to the circuit/resource level with utility cost implications.
- He observed from utility presentations that foreign attachments may be a primary cause of failures.
- His firm's models use data from UF wind and hurricane research.
- Possible areas of work include:
 - Identify Critical Attributes of "Value" to Utility Companies;
 - Create Multi-Attribute Utility Value Functions;
 - Assess Cost Impact of These Attributes;
 - Evaluate Risk of Courses of Action;
 - Enhance storm benchmarking database with Florida data and more sophisticated statistical techniques;
 - Improved and more economical vegetation management options;
 - Optimization of hardening options.

Dr. Francis M. Lavelle, Applied Research Associates, N. Carolina

Dr. Lavelle described the capabilities of Applied Research Associates and examples of its work. His key points included:

- The firm provides stochastic damage modeling (transmission and distribution systems; regional response and recovery efforts; balance between costs of hardening, maintenance costs, and outage impacts) to optimize hardening measures.
- The firm has wind engineering capabilities.
- The firm also provides:
 - Optimal transmission line design analysis;
 - Lifetime cost analysis;
 - Tree blow-down prediction;
 - Coastal flooding risk analysis;
 - Decision threshold analysis for failure cost sensitivity.
- The modeling research uses data from UF wind and hurricane research.

- Research recommendations included:
 - Transmission line optimization studies
 - Optimization of new construction and maintenance
 - Impacts of response and recovery costs and indirect economic losses on design and maintenance decisions
 - Distribution line optimization studies
 - Regional analysis via statistical analysis at block level
 - Analysis of above ground vs. below ground installation
 - Develop and validate models for tree damage to distribution lines
 - Coastal flooding impacts on power plants, substations, and T&D systems

Dr. Seth Guikema, Texas A&M University

Dr. Guikema described his research and consulting work. His key points included:

- His research and consulting areas include:
 - Statistical modeling of infrastructure failure risk
 - Power outages during hurricanes
 - Effects of Tree Trimming on Power Systems
 - Damage to pipe networks
 - Probabilistic modeling
 - Risk estimation with little data
 - Supporting hardening decisions (space, power, and water systems)
 - Decision support models
 - Optimizing post-earthquake power restoration
 - Hardening complex technical systems against terrorist threats
 - Transportation Asset Management
- Statistical approaches he specializes in include:
 - Poisson GLM (General Linear Model), Negative Binomial GLM, and Poisson GLMM (Generalized Linear Mixed Model);
 - Zero-inflated models;
 - Bayesian hierarchical models.
- Current and recent applications of his work take in:
 - Estimating pole damage in hurricanes without damage data (Gulf Coast);
 - Estimating damage to water systems without complete knowledge of the system (Philadelphia);
 - Optimizing power restoration process in Los Angeles after earthquakes.
- Possible research areas include:
 - Develop Bayesian outage models to better capture uncertainty;
 - Focus on damage rather than outage estimation;
 - Develop better tree trimming effectiveness models;
 - Develop a long-term hurricane risk model that accounts for possible global warming influences;
 - Tie this together in a system-wide optimization model to suggest good hardening options.

Dr. Rachel Davidson's research, Cornell University (presented by Dr. Seth Guikema, Texas A&M)

Dr. Guikema described her research and consulting work. The key points included:

- Her recent consulting work:
 - How many outages will there be and where?
 - Work for Dominion, Duke, Progress, Southern
 - Related to hurricanes and ice storms
 - When will power be restored in each area?
 - Work for Dominion, Duke, Progress, Southern, LADWP
 - Related to hurricanes, ice storms, earthquakes
 - How fast is possible? How would that be achieved?
 - Work for Los Angeles DWP
 - Related to earthquakes
 - How much does tree trimming affect outage frequency?
 - Work for Duke
 - Related to non-storm times
- Statistical approaches she specializes in include:
 - Poisson GLM;
 - Negative binomial model;
 - Poisson GLMM;
 - Spatial Poisson GLMM.
- Possible research includes:
 - Build on work related to same 4 questions as above, especially outage count and restoration;
 - Move from outage to damage estimation;
 - Merge tree and outage modeling;
 - Use discrete event simulation for storms;
 - Do long-term analysis of outages and outage durations.

Synthesis and Dialogue

For the synthesis and dialogue portion, the presenters participated in a roundtable discussion with the audience. The discussion raised the following issues:

- Wind research including modeling, testing, data collection, and relationship to damages:
 - Participants showed interest in collecting more data in general on sustained winds, wind gusts, and wind turbulence during storms to better understand the types of damage that each facet of wind causes.
 - Interest was expressed in getting better wind loading data on structures. More data on wind pattern (speed, direction, gustiness) effects on trees and poles would be important so that data currently being used can be validated and updated. More detailed modeling would also be possible.
 - Interest was expressed in getting data on damages at a much finer detail as well as tree density at a much finer level. This would aid in modeling

- potential future damage due to tree “failure” so as to know when and how trees should be trimmed.
- There were many inquiries as to when the bigger UF-FIU WoW will be operational. The larger WoW will be able to achieve winds of 140 mph when it is complete.
 - There was an interest in testing the effects of wind gusts and wind turbulence present in storms along with sheer sustained winds using the WoW.
- Cost-effectiveness of storm hardening options and impacts on customer rates:
 - In order to address this issue, better information is needed on restoration and reliability benefits.
 - Any benefits from storm hardening works from the premise of probabilistic risk reduction.
 - Benefits must be quantified to the greatest extent possible. The direct benefits of reduced outages and avoided lost revenues must be considered as well as the indirect benefits to society.
 - Building codes as a storm hardening option:
 - Building codes must be addressed along side NESC codes as debris from buildings can damage utility assets. The benefits of stricter building codes will be seen in preventing and mitigating damage and faster restoration times.
 - The contention was made about the benefits of lower building maintenance as well.
 - The contention was also made that studies have shown the benefits of stricter building codes far outweigh the costs of those codes.
 - Service restoration and equipment updating issues:
 - During storm restoration it is usually not possible to replace damaged facilities with the most up to date, storm hardened equipment as the first priority after a storm is service restoration.
 - With respect to restoration, the response may be slowed by the distance crews are from the damaged area as well as the ability to get to the damaged area due to trees and debris blocking roads. Utilities do work with governmental authorities in coordinating this effort, but sometimes utility crews must clear the roads themselves to get through to carry out service restoration.
 - The possible benefits of underground versus overhead facilities were discussed.
 - According to limited, preliminary data, it was contended that underground cables fail more quickly (i.e., have a shorter lifespan) than overhead cables, although not much. Lifespan and failure depend on the cable type.
 - Would underground systems survive submerged, such as in downtown Tampa’s if Hurricane Charley had made a direct hit there?

- There is a need to revise construction methods for underground facilities to improve survivability with a storm surge.
- Participants examined the possibility of de-energizing facilities to protect them from storm surge.
 - Does it ever make sense to de-energize the system in response to a storm and before an outage? If so, when?
 - The point was then made about the need to improve storm surge forecasts and storm track forecasts for such a decision to be made.
 - There are political issues coordinating with local authorities, and there are safety issues both before and after the storm has passed.
 - De-energizing may not be a good idea since faults cannot be pinpointed as easily and may take longer to restore because of the need to do inspections prior to re-energizing the system. Also there is a risk of de-energizing the wrong part of the system with imperfect storm track forecasting which then leads to lengthy restoration due to the need for system inspection before service restoration.
 - Keys Energy de-energized with Hurricane Wilma and had flooding.
 - One consultant's client de-energizes its system, but there were special circumstances.
 - Attempting to de-energize Amelia Island would be tough with paper mills that may take 19 hours to shut down.
- System redundancies and re-configuration to handle operational problems. FPL employs multiple feeders into key areas and constantly re-evaluating the need for feeders, switches, etc. It uses an Automated Fuse System that can open and close switches, isolate faults, and identify faults, which also aids in restoration efforts. But this type of system is not employed to the same level as seen in the transmission system.
- Questions were asked regarding the availability of adequate inventories of equipment for restoration. There were no utility complaints in this area except for an acknowledgement of longer lead times to get equipment than was previously the case.
- At the end of the discussion, the utility participants were asked what information they would like in a report on storm hardening if they could have it by the following Monday. Responses included:
 - Information and summaries on what needs exist for hardening and restoration and where they can get more R&D.
 - Alternative materials, such as a substitute for concrete in poles that would be just as good but lighter and cheaper to install.
 - Information on the pole loading under wind stress to improve the designs of poles.
 - Prioritized list of items that can be used right away with a cost/benefit justification for each item.

- Solutions to problems of poles and equipment – such as transformers in the air. Undergrounding is a Phase 2 concern.

Conclusion

The workshop provided a valuable educational opportunity for both industry and researchers, and provided an important exchange of ideas on how Florida utilities might improve their approaches to hardening their infrastructure. About 80 percent of the participants rated the topics covered, speakers, format, and facility as excellent or very good. People were particularly complimentary of the presentations by the utility companies. Topics mentioned as especially interesting in the evaluations included tree trimming, wind and the effects of wind, and wind and water data. The most common recommendation was that we have more time for Q&A and for brainstorming in the future. Detailed meeting evaluation information is available on the PURC [web site](#).

In their presentations and discussion, the utilities emphasized the need for practical research, advanced analytical techniques, and testing and data. There appeared to be interest in the following research topics.

- Wind research, such as might be provided by the WoW and wind measurement devices
 - WoW could examine how poles and other elements of the electric infrastructure are affected by various wind and rain forces. It could also examine how trees behave in wind, with a special emphasis on how trimming affects tree behavior.
 - More granular wind data obtained from mobile devices and devices attached to electric infrastructure would provide valuable data for analyzing storm impacts and predicting storm damage.
- Cost-effectiveness of possible hardening solutions is important in all areas
 - Overhead to underground conversion is one area: What is the real cost of undergrounding versus overhead? When are the optimal circumstances for undergrounding? What rate design and cost recovery techniques might be appropriate?
 - Line clearing and vegetation management strategies are other areas: What are the optimal management programs? If the optimal strategies are different from existing practices, what are appropriate transitions to new practices?
 - NESC extreme wind standards is a third area: Should the standards be changed? To what extent should Florida utilities follow these standards?
- Materials development and analysis could provide, for example, poles that are cheaper and easier to install during storm recovery efforts
 - Lighter poles would lower the cost of installation and may speed recovery
 - Underground facilities that are better able to withstand storm surge and that are less costly to repair
- Forensic analysis after a storm

- Data collection techniques could be improved for some utilities, although this step could probably be taken without additional research
- Better analytical tools may help in the study of forensic data
- Joint use loads appear to affect storm damage and recovery. Is there a need to change joint use policies?

The topics listed above are in no particular order because the workshop did not attempt to prioritize the issues of interest.

PURC looks forward to continuing to work with the electric utilities in this effort.

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July 20, 2006

Appendix A -- Workshop Agenda

Workshop for Research in Electricity Infrastructure Hardening

Friday, June 9, 2006

Best Western Gateway Grand
4200 Northwest 97th Blvd.
Gainesville, Florida 32606

Sponsored by
Public Utility Research Center
University of Florida

Purpose: The purpose of this workshop is to provide a forum in which utility managers and hazard research professionals can discuss means to prepare Florida's electric infrastructure to better withstand and recover from hurricanes. Researchers will learn the needs and priorities of the utility industry's hardening efforts, and how utilities currently prepare for and recover from hurricanes. Utility managers will learn about research capabilities from a variety of independent university programs and industry groups that focus on hazard research.

Outcomes: Ultimately, interaction between the utilities industry and hazard researchers will lead to rational and cost effective approaches to hardening the power distribution infrastructure. This workshop is intended to start the discussions that will lead to hardening solutions and a less vulnerable power infrastructure.

Participation: Because of space limitations, the workshop will be limited to 40 representatives of industry, government, and academia.

Agenda

7:30 a.m. Registration and Refreshments

8 – 8:15 a.m. Welcome – Mark Jamison, Director, PURC

- 8:15 – 10:10 a.m. Industry presentations**
- Moderator: Paul Sotkiewicz, Director of Energy Studies, PURC**
- J. R. “Pepe” Diaz, Reliability Engineering Manager, Power Systems – Distribution, FPL**
Jason Cutliffe, Manager, Distribution Asset Performance, Progress Energy Florida
Alan McDaniel, Project Services Manager, Gulf Power Company
T.J. Szelistowski, Director, Transmission and Distribution Operations, TECO
Jorge Puentes, Electric Operations Manager, Florida Public Utilities Company
- Q&A**
- 10:10 – 10:25 a.m. Refreshments Break**
- 10:25 a.m. – 12:30 p.m. Researcher presentations**
- Moderator: Kurt Gurley, Civil Engineering, University of Florida**
- Dr. Kurt Gurley, University of Florida**
Dr. Steinar J. Dale, Florida State University
Dr. Alex Domijan, Jr., University of South Florida
Calvin Stewart, Davies Consulting, Maryland
Dr. Francis M. Lavelle, Applied Research Associates, N. Carolina
Dr. Seth Guikema, Texas A&M; and Dr. Rachel Davidson, Cornell University
- Q&A**
- 12:30 – 1:45 p.m. Lunch**
- 1:45 – 3:45 p.m. Synthesis and Dialogue – Mark Jamison, Sanford Berg, Paul Sotkiewicz, Kurt Gurley**
- **Identify possible research areas and projects that could address key problem areas**
- 3:45 – 4 p.m. Closing Comments – Mark Jamison**
- 4 p.m. Adjourn**

Appendix B -- List of Attendees

Last Name	First Name	Organization	Title
Anderson	David	City of Ocala Electric	Electric Engineering Supervisor
Beaulieu	David	Gainesville Regional Utilities	Asst. General Mgr, Energy Delivery
Berg	Sanford	PURC, University of Florida	Director of Water Studies; Florida Public Utilities Professor
Bowerfind	John	City of Jacksonville Beach	
Bryant	Howard	Tampa Electric Co.	Manager, Rates
Busot	Frank	TECO Energy, Inc.	Manager, Project Management-Planning & Scheduling
Cutcliffe	Jason	Progress Energy Florida, Inc.	Manager,, Distribution Asset Performance
Dale	Steinar	Florida State University	Director, Ctr for Advanced Power Systems
Danison	Ellis	City of Vero Beach	Group Leader
Del Forn	Luis	Florida Power & Light Co.	Director, Operations Support
Diaz	Pepe	Florida Power & Light Co.	Reliability Engineering Mgr., Power Systems Distribution
Domijan	Alex	University of South Florida	Prof & Director, Power Center for Utility Explorations
Dreadin	Mark	Gulf Power Company	Sr. Technical Services Eng.
Ebong	Imeh	University of North Florida	Asst. VP, Research
Ellis	Ralph	University of Florida	Associate Prof., Civil and Coastal Engineering
Fair	L. Earl	Gainesville Regional Utilities	Planning Engineer
Finigan	Dale	Keys Energy Services	Director, Engineering & Control
Furman	Gary	Progress Energy Florida, Inc.	Manager, Line Engineering and Real Estate
Guikema	Seth	Texas A&M University	Asst. Professor, Dept. of Civil Engineering
Gurley	Kurt	University of Florida	Associate Prof., Civil and Coastal Engineering
Haines	David	City of Vero Beach	Working Foreman
Hershel	Michelle	Florida Electric Cooperatives Assoc.	Director, Regulatory Affairs
Jamison	Mark	PURC, University of Florida	Director
Kalv	Paul	Leesburg Electric	Director
Knowles	Berdell	JEA	Regulatory Specialist
Lavelle	Francis	Applied Research Associates, Inc.	Principal Engineer
Lewis	Paul	Progress Energy Florida, Inc.	Director, Florida Regulatory Affairs
Maxwell	Tracy	Gainesville Regional Utilities	Vegetation Maintenance Manager
McBride	Don	City of Winter Park	Electric Utility Director
McDaniel	Alan	Gulf Power Company	Project Services Manager
Mintz	Jerry	Gulf Power Company	Regulatory Matters Coordinator
Miranda	Manny	Florida Power & Light Co.	VP, Distribution System Performance
Mutters	Keith	Orlando Utilities Commission	Director, System Planning & Reliability Div.
Ozair	Mohammad	City of Tallahassee Electric Utility	Operations Supervisor- T&D
Puentes	Jorge	Florida Public Utilities Company	Manager, Electrical Operations
Salerno	Tony	City of Ocala Electric	Distribution Engineer III
Shaffer	Alan	Lakeland Electric	Asst. General Mgr, Delivery
Sotkiewicz	Paul	PURC, University of Florida	Director of Energy Studies
Steurer	Mischa	Florida State University	Visiting Asst. Scientist, Ctr for Advanced Power Systems

Last Name	First Name	Organization	Title
Stewart	Calvin	Davies Consulting	VP, Strategic Relations
Stiles	Billy	Tampa Electric Co.	Senior Regulatory Consultant
Stonecipher	Joe	City of Jacksonville Beach	Electric Engineer, Beaches Energy Services
Stormant	William	Gainesville Regional Utilities	Manager, Gas & Electric Measurement and Substation/Relay
Suryanarayanan	Sid	Florida State University	Asst. Scholar Scientist, Ctr for Advanced Power Systems
Swearingen	David	Florida Public Service Commission	Engineering Specialist III
Szelistowski	T.J.	TECO Energy, Inc.	Director, Transmission & Distrib. Operations
Tisdale	John	Gainesville Regional Utilities	Transmission & Distribution Manager
Trapp	Bob	Florida Public Service Commission	Asst. Director
Valdez	Bob	Florida Power & Light Co.	Sr. Regulatory Affairs Analyst
Varghese	Soman	Orlando Utilities Commission	Project Engineer