



Desoto Next Generation Solar Energy Center

Project # 90635 1148
Date 06.25.09



Sunshine State Solar Grid Initiative SUNGRIN

FSU CAPS, UCF FSEC, USF PCUE
FP&L, JEA, FMPA, GRU, OUC, Lakeland Electric
Satcon Technologies, Sunpower Corp., AMEC

Rick Meeker

Florida State University
Center for Advanced Power Systems (CAPS)
meeker@caps.fsu.edu 850.645.1711
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Timeline

- 5-year (5-phase) project proposed: 2010 – 2015
- Project start date: 4/28/2010*
- Phase 1 end date: 4/30/2011
- Percent complete: ~1%

Budget

- Project funding:
 - 5-year: \$4.83 M
 - DOE share: \$3.6 M
 - Cost share: \$1.23 M
 - Year 1: \$1.01 M
 - DOE share: \$0.6 M
 - Cost share: \$0.41 M

*12/31/09 award doc. but no funds released

Objectives

Gain significant insight into effects of high-penetration levels of solar PV systems in the power grid, through simulation-assisted research and development involving a technically varied and geographically dispersed set of real-world test cases within the Florida grid

Barriers

- Need for better understand of the solar variation in Florida
- Addressing the impacts on the distribution and transmission grid of high penetration levels of PV with high-fidelity simulation tools and approaches
- Improving availability of validated models for the stakeholder community
- Better simulation-assisted development and evaluation/de-risking of technology solutions to enable successful integration of high levels of PV
- Improve awareness and understanding within the stakeholder community and among the general public

Partners

Universities

-  FSU Center for Advanced Power Systems (CAPS) *(lead institution)*
-  University of Central Florida, Florida Solar Energy Center (FSEC)
-  University of South Florida, Power Center for Utility Explorations (PCUE)

Utility Industry

- Florida Power and Light (FP&L)
- Jacksonville Electric Authority (JEA)
- Gainesville Regional Utilities (GRU)
- Orlando Utilities Commission (OUC)
- Lakeland Electric
- Florida Municipal Power Authority (FMPA)
- Florida Reliability Coordinating Council (FRCC)

Industry Suppliers

- SunPower Corporation
- Satcon Technologies
- AMEC



Management and Team Approach

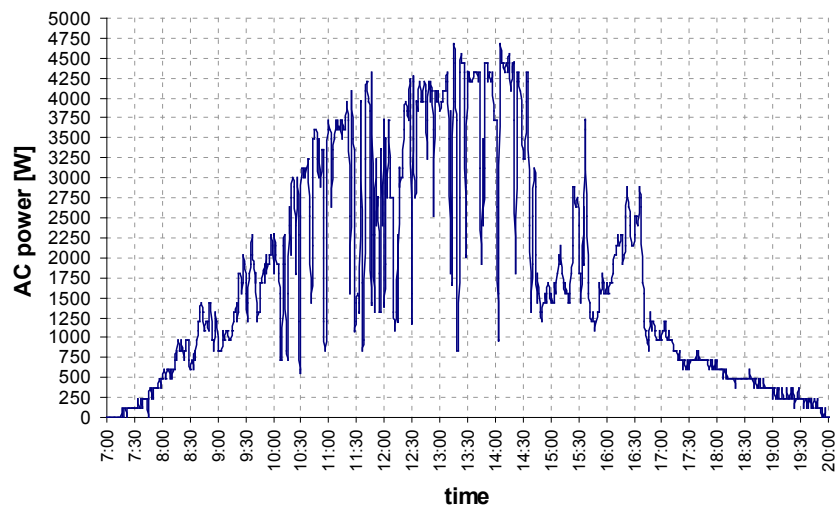
- Quarterly meetings / telecons – rotated around partner locations
- Quarterly reporting to DOE
- Project portal – sungrin.caps.fsu.edu (not yet live)
 - Extranet – public access area for information on the project
 - Intranet – access controlled for project team members
 - Project schedule information
 - Meeting agenda and notes
 - Models and selected research results
 - Solar project database
- Memoranda of understanding
- Key single points-of-contact identified for each partner
- FRCC involvement
- Utility solar project selection and prioritization process
- Form task teams as needed

Project Team

- Mike Allman, P.E., AMEC
- Randy Boswell, P.E., JEA
- Leo Casey, Ph.D., Satcon Technologies
- John Crider, GRU
- Steinar Dale, Ph.D., FIEEE, FSU CAPS
- Alex Domijan, P.E., USF PCUE
- Chris Edrington, Ph.D., P.E., FSU CAPS
- Arif Islam, USF PCUE
- Carl Lenox, Sunpower Corp.
- Hui Li, Ph.D., FSU CAPS
- Rick Meeker, P.E., FSU CAPS (PI)
- Bob Reedy, P.E., UCF FSEC
- Tom Reedy, FMPA
- Eric Senkowicz, P.E., FRCC
- Alan Shaffer, P.E., Lakeland Electric
- Mischa Steurer, Ph.D., FSU CAPS
- Jennifer Szaro, OUC
- Chris Wright, FP&L

- Challenges Addressed:
 - Variability of the solar resource, particularly in the Florida peninsula
 - Affect of variability at high PV penetration under diverse integration scenarios
 - Leveraging inverter participation in volt/VAR or frequency control
 - Modeling and simulation to support level of analysis needed (by R&D community and operations and planning)
 - Public understanding of PV integration opportunities and challenges
- Importance to the DOE Solar Program
 - Build the widespread confidence necessary in order to accelerate deployment without impacting reliability
 - Extract additional value from the resource (no longer just a low priority negative load)

CAPS PV, July 23 2009

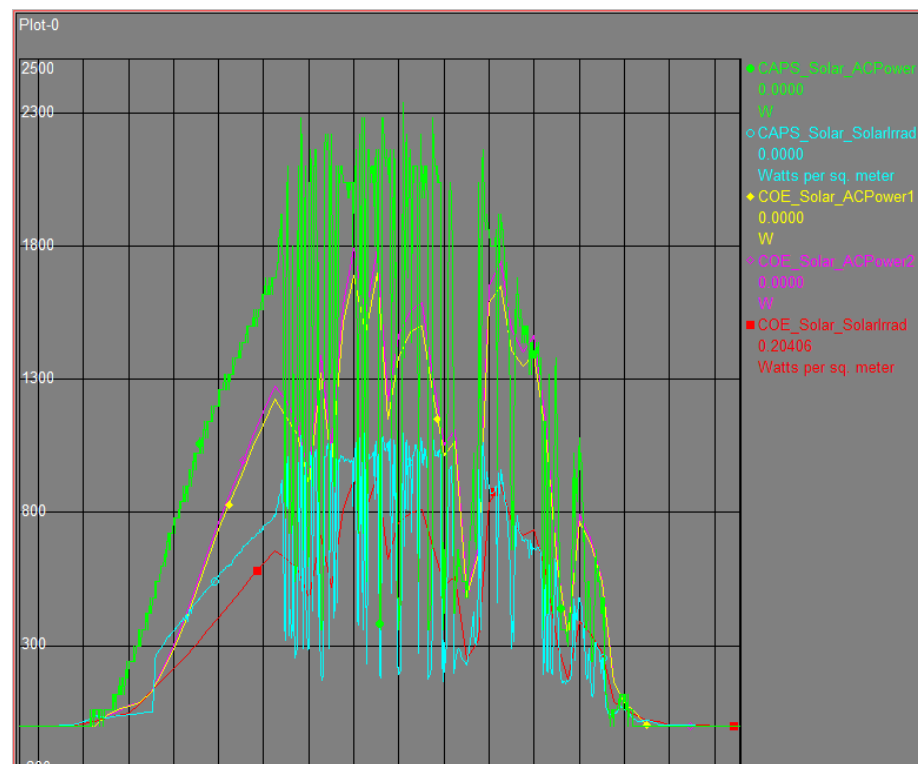


7/23/2009

NW Florida PV Variation



5/18/2010



Capacity: 5940 W
Utility Conn: City of Tall.
Arrays: Schott, SAPC -165
Inverters: SMA 2500U

- Relevance to Florida
- Broader Relevance

Florida

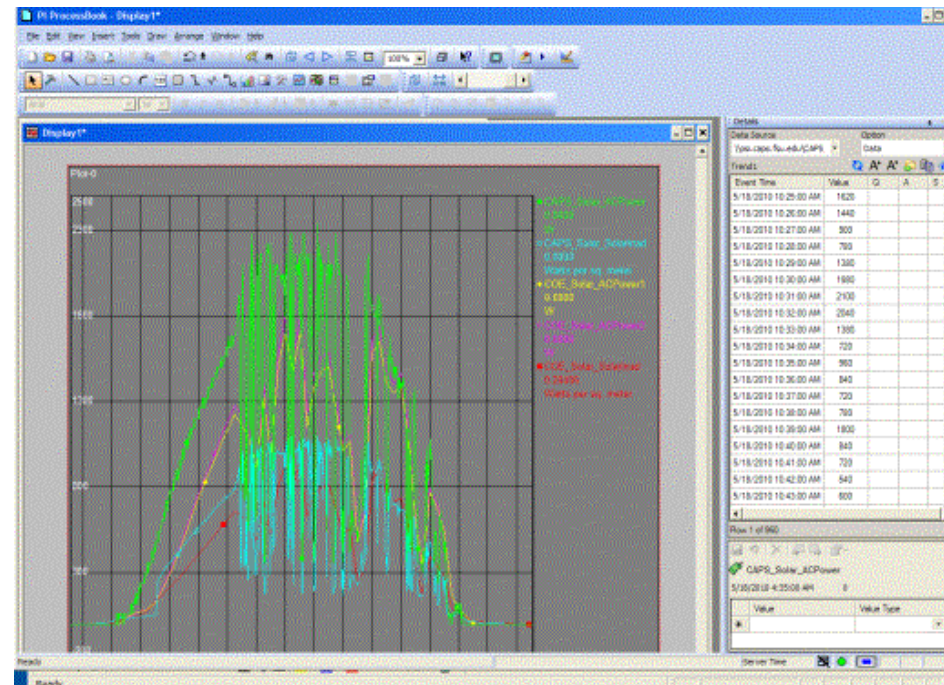
- Numerous & diverse PV projects planned or underway
- Peninsular
 - Limited interchange options
 - Vulnerability to weather and extreme events
- Large state
 - A number of large urban centers
 - 5 IOU's, 34 municipal electric utilities, 18 rural electric co-ops
- Large system
 - No. 1 in electric utility capacity and generation (59 GW winter peak cap.)
- Environment for PV Development
 - Net Metering
 - Feed-in tariffs
 - State incentives

Utility	Location or Project Name	Capacity [MW]
FPL	Desoto	25
FPL	Space Coast	10
GRU	various	8
Lakeland Electric	various	24
JEA	Brandy Branch	15
Tampa Electric	Polk County	25
OUC	various	10
FMPA	uncertain	10
FPL / Kitson	Babcock Ranch	75
		202

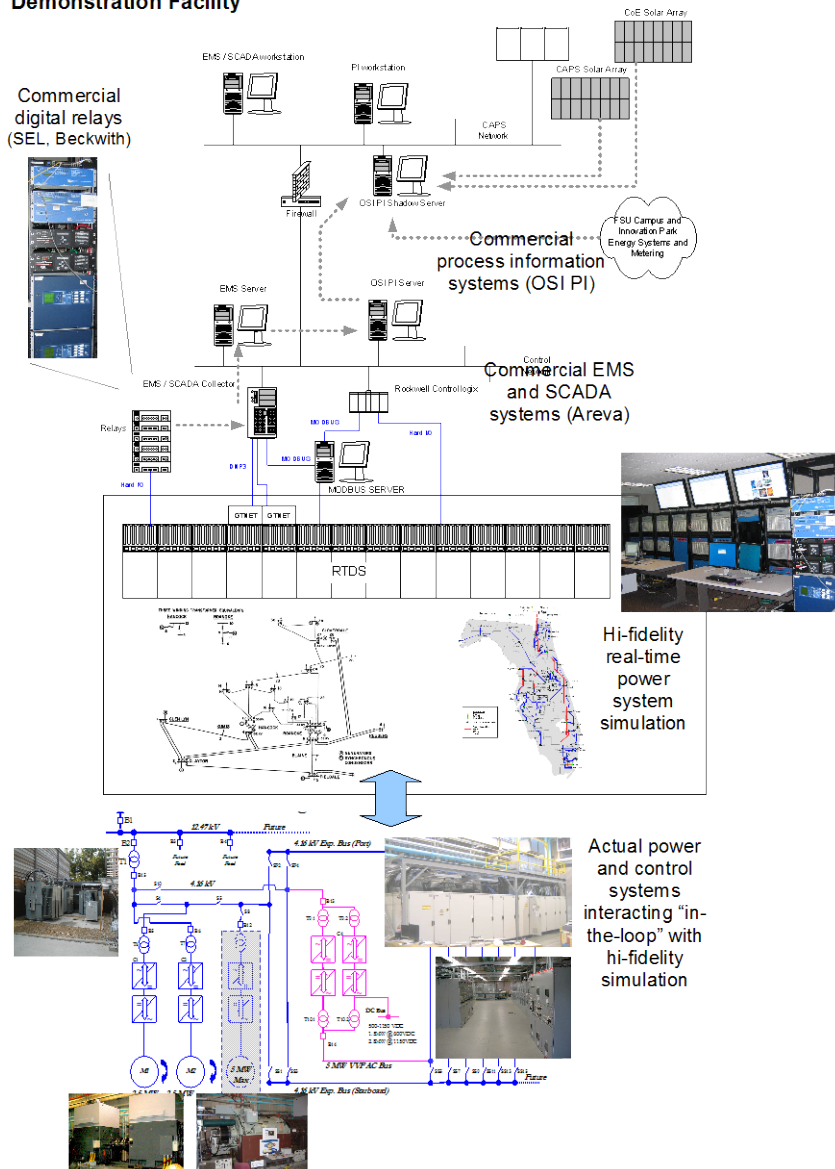
Solar PV projects announced in Florida

Solar Variation

- Leveraging OSI PI real-time database – lab capability developed with cost-share contribution from recently completed DOE-funded Electric Power Reliability Infrastructure and Security (EPIRS) project (DE-FC-26-07NT43221).
- Connect to partner and other sites across the state.
- Statistical analysis of time-series data.
- Examine, diurnal, seasonal, geographical and local variations



Power System Simulation, Control, and Information Systems Development, Test, Evaluation, and Demonstration Facility



PV Integration Analysis

- Leveraging high-fidelity simulation tools, including real-time / high performance simulation capabilities
 - Full 3-phase and transient behavior capability (EMTP)
 - Real-time Digital Simulator (RTDS)
 - Down to <math><2 \mu\text{Sec}</math> time step in real-time
 - Integrated Hardware-in-the-Loop (HIL) testbed \rightarrow 5 MW testbed + RTDS
- Also using,
 - PSS/E (existing FL grid models)
 - MATLAB / Simulink
 - Opal / RT

Developing and Vetting Solutions

- Pure simulation
- Hardware-in-the-loop (HIL) simulation
- Field pilots



Contribution to Stakeholder Community

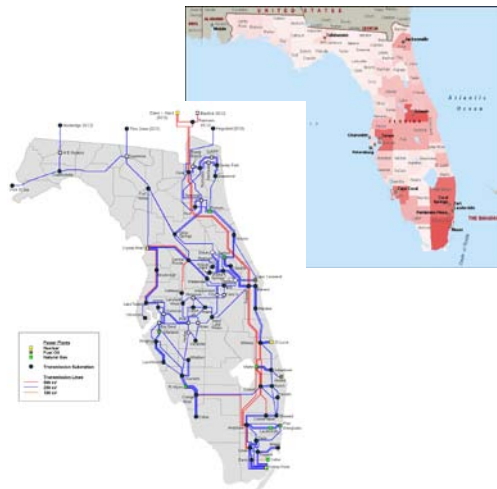
- Standards and Industry Groups
 - IEEE 1547
 - Gridwise Alliance
 - NERC
 - FMEA
- Publication
- Models
- Workshops and Conferences (SUNGRIN-hosted and by others)

Enhancing Public Awareness

- Information kiosks
- Extranet web portal

Leveraging other synergistic activities

- State of FL funded
 - Future FL Grid Studies project
 - Microgrids for DER Integration project
- DOE-funded EPIRS project
- NSF-funded FREEDM ERC



- 12 Partners (3 Universities, 6 Utilities, and 3 Supplier Companies)

- Project Partners:

Universities

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Utility Industry

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- Orlando Utilities Commission (OUC)**
- Lakeland Electric**
- Florida Municipal Power Authority (FMPA)**
- Florida Reliability Coordinating Council (FRCC)

Industry Suppliers

(technology & services)

- SunPower Corporation*
- Satcon Technologies*
- AMEC*

* Subcontract

** MOU (cost share only)

- Other potential collaborators

- Applied Research Associates (ARA), Tyndall AFB AFRL
- Naval Facilities Engineering Command (NAVFAC) Southeast

- Project under contract
- Team established
- Beginning process of establishing subcontracts
- Preliminary planning / kick-off activities in process
 - Attended and met at NREL hi-pen. PV workshop, 5/20, Denver, CO.
 - University co-PI meeting scheduled for 6/1 in Tampa, FL.
 - Kickoff meeting planning and agenda development underway; targeting week of 6/28, at FSU CAPS in Tallahassee..
- Planning and set up of intranet / extranet underway
- Publication:

Allman, M., Meeker, R., Reedy, B., Senkowicz, E., “Integrating Solar PV into the Grid”, Relay, the quarterly magazine of the Florida Municipal Electric Association (FMEA), Winter 2009..

Budget Status and Potential for Expansion

- Project funding:
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- Just started – expect some internal budget adjustments within categories (e.g equipment → personnel)
- Expansion of effort if additional funding was provided.
 - The amount of activity in Florida presents substantial additional opportunity for
 - Extensive development of well-validated models for many different scenarios and purposes
 - Contributions of modeling, simulation and analysis to aid in successful integration and testing of new concepts for a number of projects
 - Expanded field trials of solutions developed within SUNGRIN and partner utilities and suppliers of technology, or originating from other SETP projects or outside of SUNGRIN
 - More funds would be used to:
 - Expand data gathering (no. of sites) and data access functionality
 - Expand number of circuit variations for modeling, simulation and analysis.
 - Provide opportunity for additional field trials
- Industry
 - Investments in equipment / instrumentation at project sites
 - Personnel effort
 - Travel
 - Contracted services
- University
 - Faculty effort
 - Student tuition / stipend subsidies

- Project plans for the rest of FY10
 - Kickoff meeting
 - Complete subcontracts and MOU's
 - Set up and roll out project intranet / extranet
 - Set up initial data collection sites
 - Set up prioritization process and select initial utility integration projects
- Project plans for FY11
 - Set up any remaining data sites
 - Complete initial variation analysis
 - Complete 1st round of model development and analysis
 - Complete Phase 1 milestones and update Phase 2 plans
- Key milestones (Phase 1 go/no-go)
 - A list of planned solar data collection and project sites compiled with basic information about the sites.
 - At least eight (8) collection sites connected and passing data to repository at CAPS.
 - Preliminary short-term solar variation analysis completed.
 - Mathematical model for PV inverter module with energy storage implemented in RTDS
 - Models developed and validated and solar PV integration impact studied for at least one utility project site.

- Just getting started –
 - In process of organizing and mobilizing
 - Planning carefully up front to be effective given size and diversity of team
 - Kickoff meeting to occur soon.
- Highly capable and diverse team formed with substantial industry engagement
- Looking forward to making positive contribution
- Expect some initial results and contributions to SETP community by end of FY10.

Questions?