

CSU Energy Update for JISEA

Ron Sega

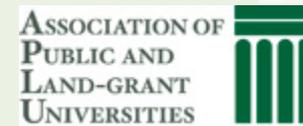
**Woodward Professor and Director
Systems Engineering
Colorado State University (CSU)**

2012 Public
and Land-Grant
University
Conference on
Energy Challenges:
The Next 50 Years



THE 2012 PUBLIC AND LAND-GRANT UNIVERSITY CONFERENCE ON ENERGY CHALLENGES: *THE NEXT 50 YEARS*

The Ohio State University
April 30-May 2, 2012



Conference Concurrent Sessions

Participants in the six energy-themed sessions identified the challenges and action plan templates based on their exchange of views and deliberations surrounding these topics and cross-cutting themes:

- Wind, solar and renewable energy
- Biomass and biofuels
- Shale energy
- Smart grid
- Transportation
- Building efficiencies



Challenges mentioned most as keys to our energy future:

- Create breakthroughs in approaches to integrating complex energy systems
- Improve the energy efficiency of buildings
- Improve battery and grid level storage of energy
- Advance development of renewable energy sources
- Develop energy-efficient biofuels without compromising food production
- Deploy cost-effective **clean coal technology**
- Make development of shale energy sources more sustainable
- Develop commercially viable **nuclear** fission and fusion
- Increase access to sufficient clean water to meet energy needs
- Implement a national energy policy

Energy Action Plan for higher education

- 10 key enablers that higher education is uniquely qualified to develop and which should be accomplished:

1. Develop Our **Workforce**
2. Increase Society's **Energy Literacy**
3. Embrace **Regional Development**
4. Bring New **Discoveries to the Market Sooner**
5. Explore **Alternatives to Fossil Fuels**
6. Develop **Cleaner Approaches to Fossil Fuel Development**
7. Discover Solutions to Fresh **Water Challenges**
8. Identify and Increase **Funding**
9. Create **Test Beds**
10. Help Inform a **National Energy Policy**

Agenda: “21st Century Energy Challenges: The Power of Extension” - *Washington, May 2014*

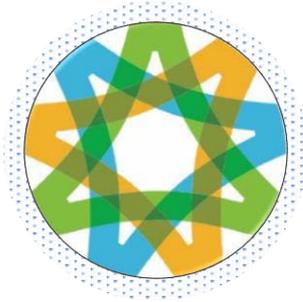
- 12:30-12:45 **Welcome** – **Ron Sega** (Colorado State University) and **Beverly Samuel** (National Program Leader, Housing and Community Living, USDA - National Institute of Food and Agriculture)
- 12:45-1:15 **Veterans Returning to Our Communities** – **Katy McBride** (Program Manager, Defense Centers for Excellence)
- 1:15 – 1:35 **USDA Office of Congressional Relations: A View from the Hill** - **Ven Neralla** (Director of Congressional Affairs, USDA-NIFA)
- 1:35-1:55 **Meeting the Nation’s Energy Challenges through Public Engagement** - **Heidi VanGenderen** (Director of Public Engagement, U.S. Dept of Energy)
- 1:55-2:05 **Break**
- 2:05-3:45 **State Extension Energy Showcase** – **Steve Bonanno** (Interim Director, West Virginia University Extension) -- Moderator: **LeAnn Oliver** (Associate Chief Information Officer, U.S. Department of Energy)
- 3:45-4:00 **Extension’s Public Engagement on Energy: Summary Remarks** - **Beverly Samuel**
- 4:00-4:30 **Capnote: 21st Century: Power of Extension – Energy** - **Dr. Sonny Ramaswamy** (Director of USDA-NIFA)

The Powerhouse Energy Campus



- A facility of the Energy Institute at CSU – Completed 2014
- 100,000 sq. ft. of project, office, and classroom space
- Facility includes Engines Lab, Electric Power Systems Lab, and Laser Sensing and Diagnostics Lab
- Fourth floor incubator, start-up, office space: Innosphere at The Powerhouse

Energy Centers and Programs



Energy Centers



ENGINES AND ENERGY CONVERSION LABORATORY



CENTER FOR THE NEW ENERGY ECONOMY



CENTER FOR ENERGY DEVELOPMENT AND HEALTH



SUSTAINABLE BIOFUELS DEVELOPMENT CENTER



CENTER FOR AGRICULTURAL ENERGY



CENTER FOR ENERGY AND BEHAVIOR



INDUSTRIAL ASSESSMENT CENTER



INSTITUTE FOR THE BUILT ENVIRONMENT



CENTER FOR ENERGY WATER SUSTAINABILITY



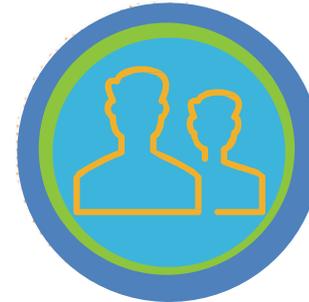
ELECTRIC POWER SYSTEMS LABORATORY



CENTER FOR LASER SENSING AND DIAGNOSTICS



CENTER FOR NEXT GENERATION PHOTOVOLTAICS



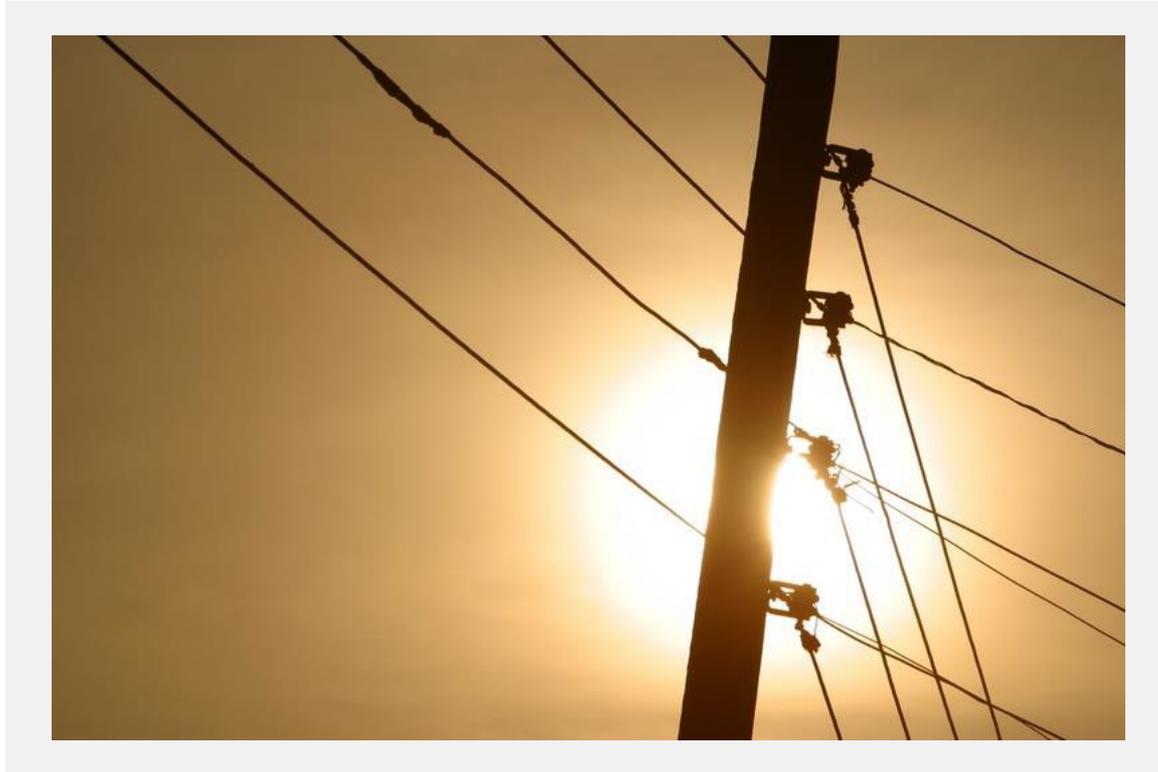
Programs

Research

Technology to Market

Education and Outreach

Strategic Partnerships



CSU Researchers
Anthony Marchese | Daniel Zimmerle

Daniel Zimmerle

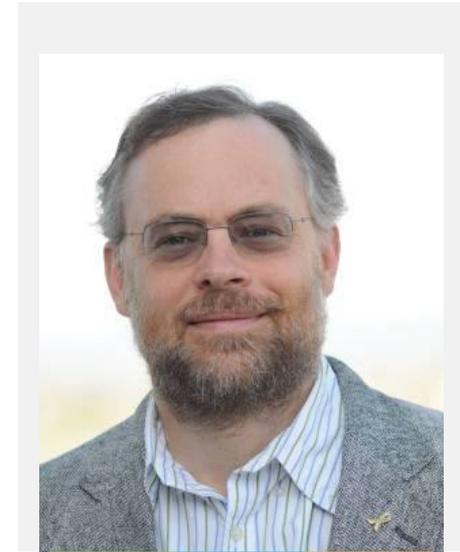
Power Systems and Devices

Daniel Zimmerle

Senior Researcher and Director of Electric Power System Laboratory

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- Multi-domain system modeling and simulation
- Microgrids and islanded power systems
- Stochastic behavior and related controls
- Program management





CSU Researchers

Thomas H. Bradley | Eugene Chen | Anthony Marchese | Daniel B. Olsen

Christie Peebles | Graham Peers | Kenneth F. Reardon

Kenneth F. Reardon

Biofuels and Bioproducts

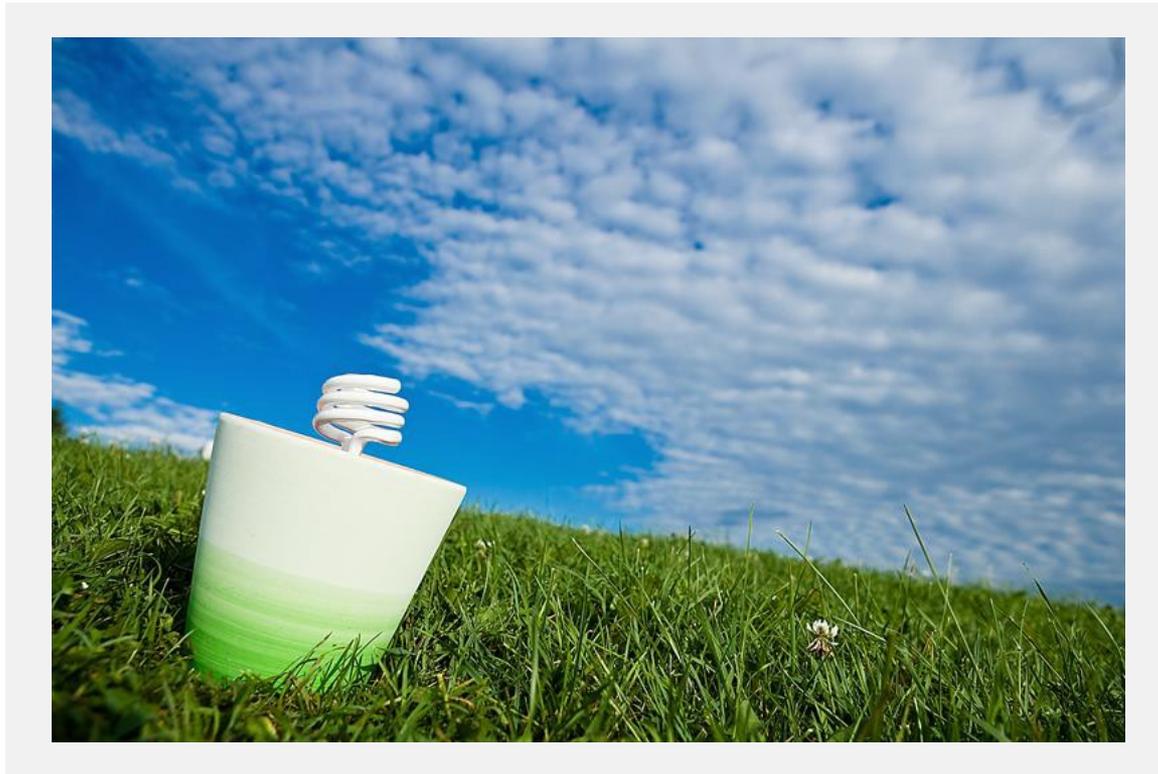
Kenneth F. Reardon

Jud and Pat Harper Professor | Chemical and Biological Engineering
Co-Director, The Energy Institute at CSU

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- Bioenergy, Biofuels, and Biorefining
- Proteomics and Systems Biology
- Metabolic Engineering and Synthetic Biology
- Biosensors
- Environmental Biotechnology
- Quantitative and Computational Toxicology





CSU Researchers

Thomas Bradley | Anthony Marchese

Thomas Bradley

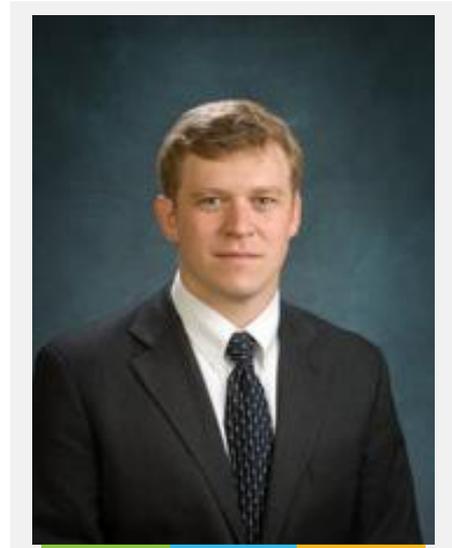
Energy and the Environment

Thomas H. Bradley, Ph.D.

Associate Professor | Mechanical Engineering

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- Energy Systems Analysis
- Transportation and Automotive Engineering
- Biofuels and Bioproducts Assessment





CSU Researchers

James R. Neilson | Amy L. Prieto

Amy L. Prieto

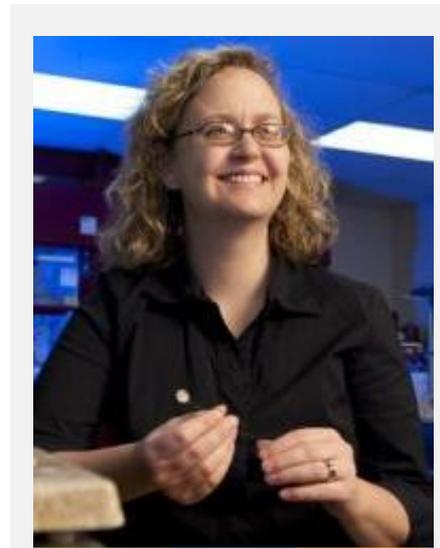
Hydrogen, Solar/PV, Energy Storage

Amy Lucía Prieto

Associate Professor, Monfort Professor | Inorganic Chemistry

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- Synthesis of new materials for energy storage and production
- Device fabrication and characterization (batteries and solar cells)
- Focus on earth abundant, environmentally benign Chemistry
- Electrochemistry





CSU Researchers

Kurt Barth and W.S. Sampath | James R. Neilson | Amy L. Prieto

Kurt Barth and W.S. Sampath

Solar/PV

Kurt Barth

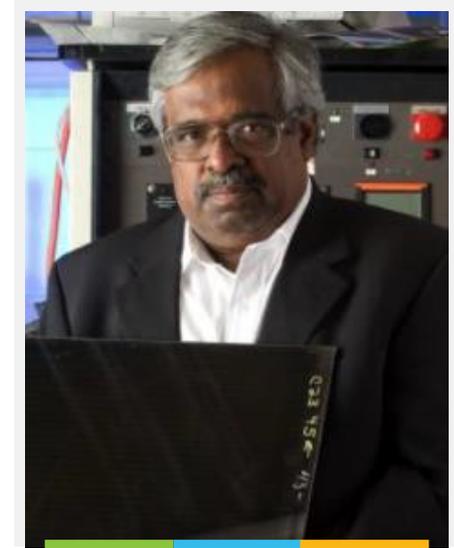
Associate Director | Next Generation PV Center

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W.S. Sampath

Professor | Mechanical Engineering

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- CdTe Solar PV
- Thin Film Photovoltaics
- Novel Materials for Electron Reflectors and Window Layers
- CFD Modeling



CSU Researchers

Thomas H. Bradley | Anthony Marchese | Daniel B. Olsen

Amy L. Prieto | Sid Suryanarayanan | Daniel Zimmerle

Sid Suryanarayanan

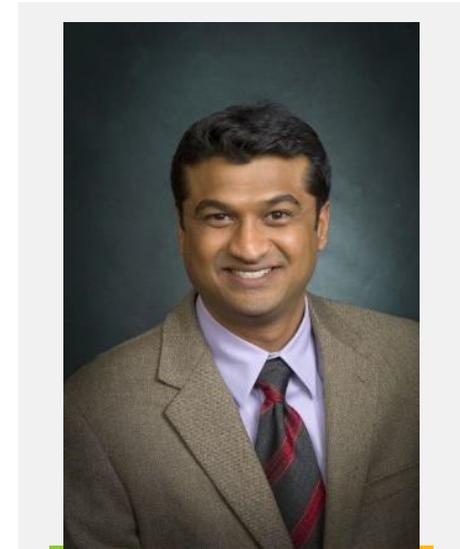
Power Systems and Devices

Sid Suryanarayanan

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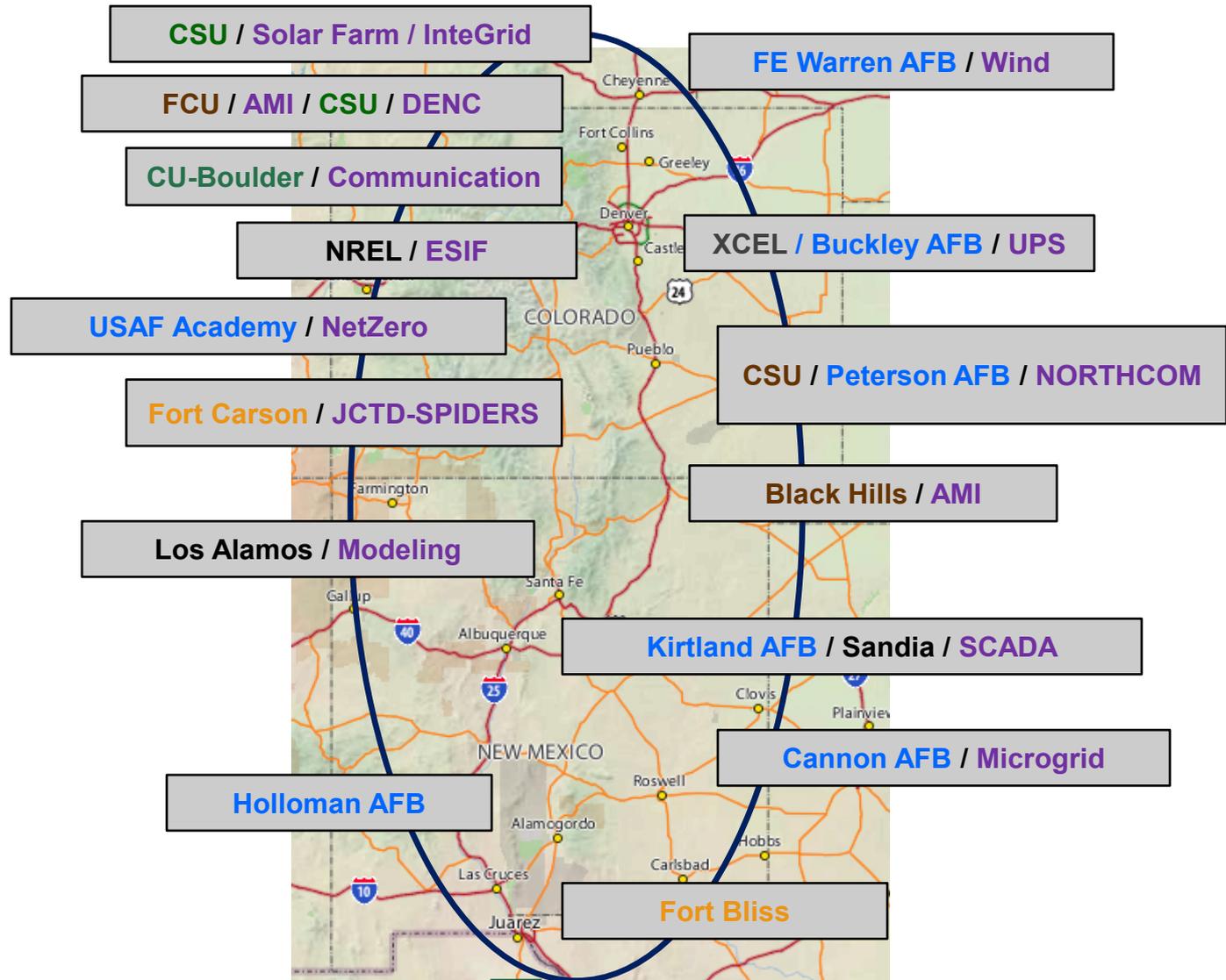
- Electric Power Systems Modeling, Design, and Analysis
- Cyber-physical Social Systems Applications
- Microgrids and Other Finite-Inertia Systems
- Applications of: Numerical Algorithms, High Performance Computing, and Visualization to Smart Grid Topics



- Trend toward Increasing **Complexity** of Systems
 - **Aerospace**, **Energy**, **Environment**, **Cyber**, Health Care, etc.
- **Needs** of Industry and Government
 - National Surveys
 - Colorado Industry and Government Surveys
- Systems Engineering **Education** at **CSU**
 - **Master of Engineering** in Systems Engineering began in the Fall 2008
 - **M.S. and Ph.D. in Systems Engineering** with an emphasize **Energy Systems** began in the Fall 2010 (Distance Delivery began in Fall 2012)
- **INCOSE** Meeting at Colorado School of Mines (May 12, 2014): *Energy-Water Nexus*

A Regional Energy System “Laboratory”

- Draft Concept with Several Activities Underway



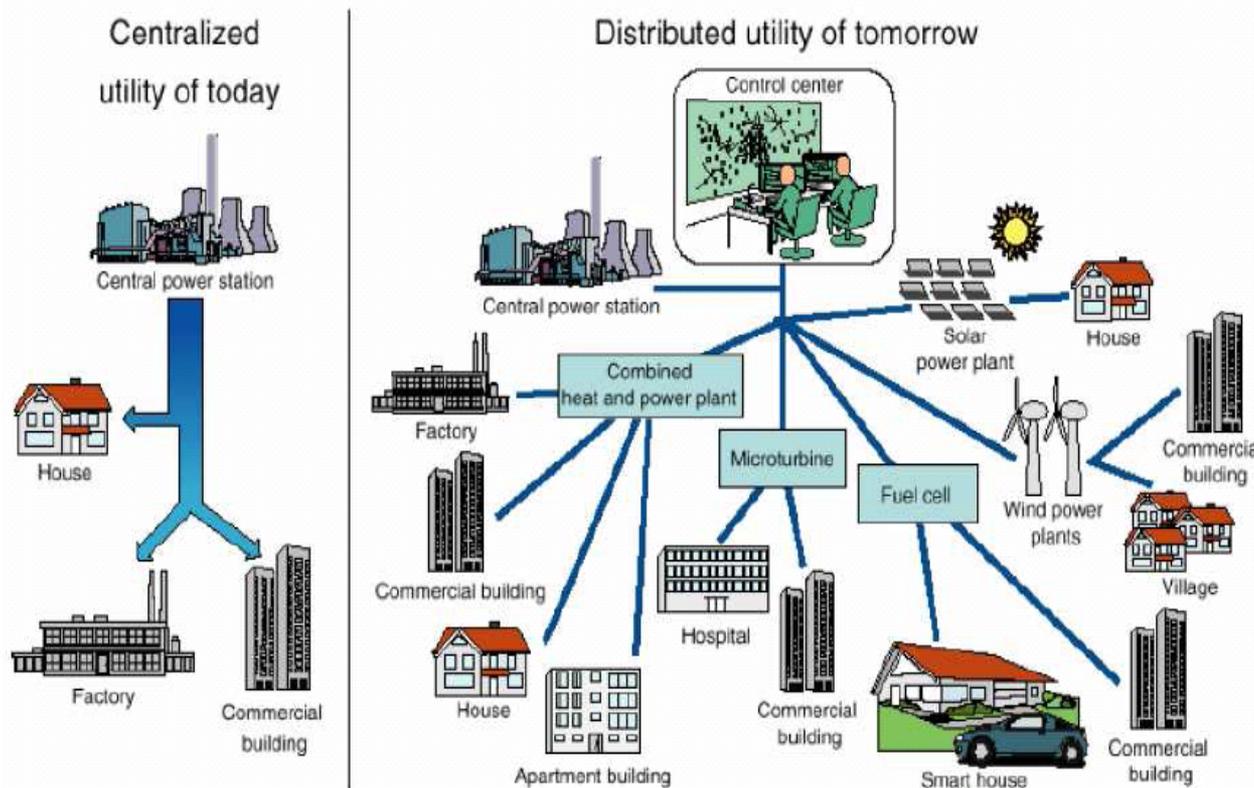
SPIDERS – Smart Power Infrastructure for Energy Reliability and Security (FY11-14)



SMART POWER INFRASTRUCTURE DEMONSTRATION FOR ENERGY RELIABILITY AND SECURITY

Systems Engineering Grid Systems

Electric Power System Transformation



System Considerations:

- Complexity
- Security
- Reliability
- Efficiency
- Design
- Management

Summary

- **CSU has a Great Deal of On-going Energy Activity**
- **Value of a Systems Approach to Energy**
 - **Efficiency**
 - **Security**
 - **Nexus with Water (and Food)**
- **Partnerships (Government, Industry, Universities) are Needed**
- **Many Opportunities and Challenges Remain**