

# Charting a Course to Energy Independence

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# Renewable Energy Microgrid Systems for Military Installation Applications

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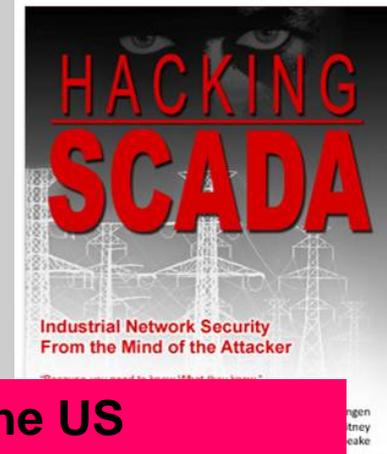
# Presentation Outline

- Introduction
- Energy Policy Guidance
- Technology Opportunities
- Renewable Energy Microgrid  
Demo – Ft. Sill
- Conclusions



# U.S. Power Systems Are Vulnerable

- Physical attacks to the grid is a long-know issue
  - Lovins' "Brittle Power" in early '80s
- CIA discloses to public they have information of cyber attacks against power system controlled from outside US.
  - Have resulted in multi-city outages
  - Extortion is a motivation
- US Power systems have been probed
- Connectivity to substations & digital hardware exist
  - NERC Survey (modems, SCADA, internet, etc...)
  - Restoration time is critical, availability is priority
- Parallels exist to EMP threat; mitigation strategies
- Short Term Outages well understood/contingency ops executed regularly for Wx, system failures



Extended Grid Outages an Unknown Experience in the US



# Recent Energy Policy Guidance

- Energy Policy Act of 2005
- Army Energy Strategy for Installations - 2005
- Executive Order 13423 - 2007
- Energy Independence & Security Act - 2007



# Technology Advances Needed to Achieve Full-Spectrum Power Delivery Architecture (Ref)

- Smart power delivery system
- Advanced distribution automation
- Fast simulation and modeling
- Integrating distributed energy resources
- Distributed storage technologies
- Power system operation and control
- Reduce vulnerability to natural disaster & attack
- Improve power quality

**Army challenge → adapt national tech advancements to blend with & scale the power vision home station-to-foxhole**



## *What is Energy Security? Utility Reliability?*

**Capacity to avoid adverse mission impact of energy disruptions caused either by natural, accidental or intentional events.**

## *What is Net Zero Energy Installations?*

**Capability to produce and export as much or more energy to the grid as imported over a 12 month cycle.**



14-MWp Solar Power Station - Nellis AFB, NV



\* 2-MWp - Fort Carson, CO



30-kWp - Fort Huachuca, AZ



Tent Shelters – Natick Soldier Center







# Military Microgrid Partners

- Engineer R&D Center – ERDC-CERL
- Sandia National Laboratories - SNL
- Assistant Chief of Staff for Installation Management - ACSIM
- Installation Management Command - IMCOM
- Fort Sill, Oklahoma
- Research & Development Engineering Command - RDECOM
- Tank Automotive R&D Engineering Center – NAC
- Communications & Electronics R&D Engineering Center - CERDEC
- Defense Logistics Agency - DLA



## *Use of Alternative Energy Technologies*

- To meet renewable energy, “Net Zero” energy, and energy security goals, DoD installations are beginning to install relatively large, on-site distributed generation technologies.
- Today, these systems are connected to the local utility grid or to the building for which they are providing emergency back-up power. ***They are not interconnected and networked as an integrated system, to serve multiple loads or perform multiple functions.***
- New networking and control approaches are needed to maximize the use of these distributed renewable energy technologies, which improve environmental sustainability, power supply reliability, and energy security at military installations.



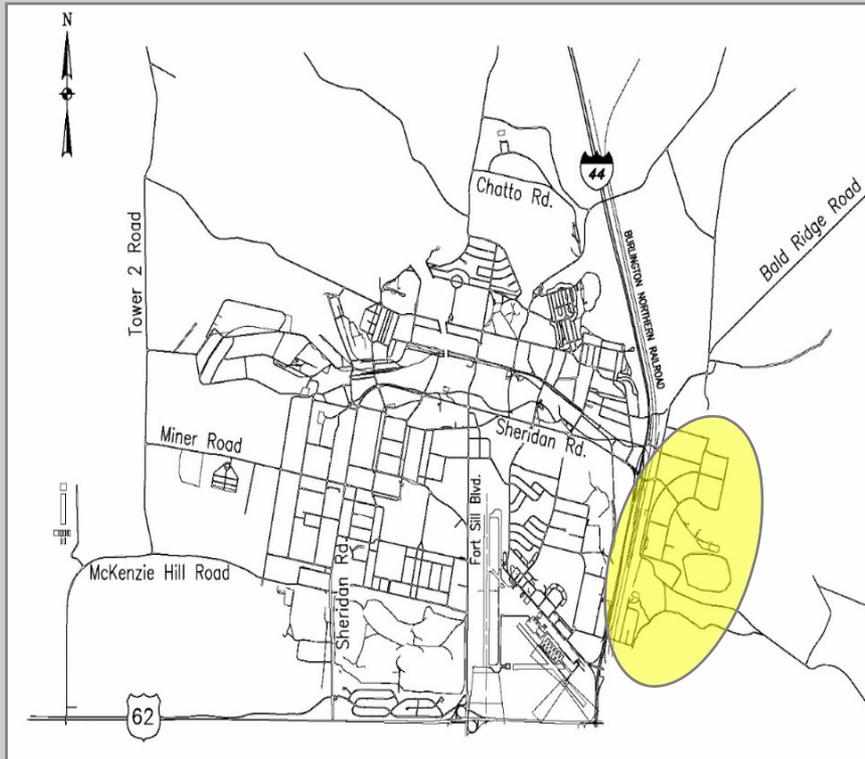
## *The Fort Sill Microgrid Demonstration*

- Demonstrate a field-scale, renewables-focused, “intelligent” microgrid at Fort Sill, Oklahoma
  - ☐ Conducted at a campus of buildings that are part of the Field Artillery Training Center
- Validate the system’s ability to:
  - ☐ Network renewable and advanced distributed generation sources
  - ☐ Quantify carbon footprint reduction
  - ☐ Serve critical mission power requirements in a sustainable, reliable, and secure manner



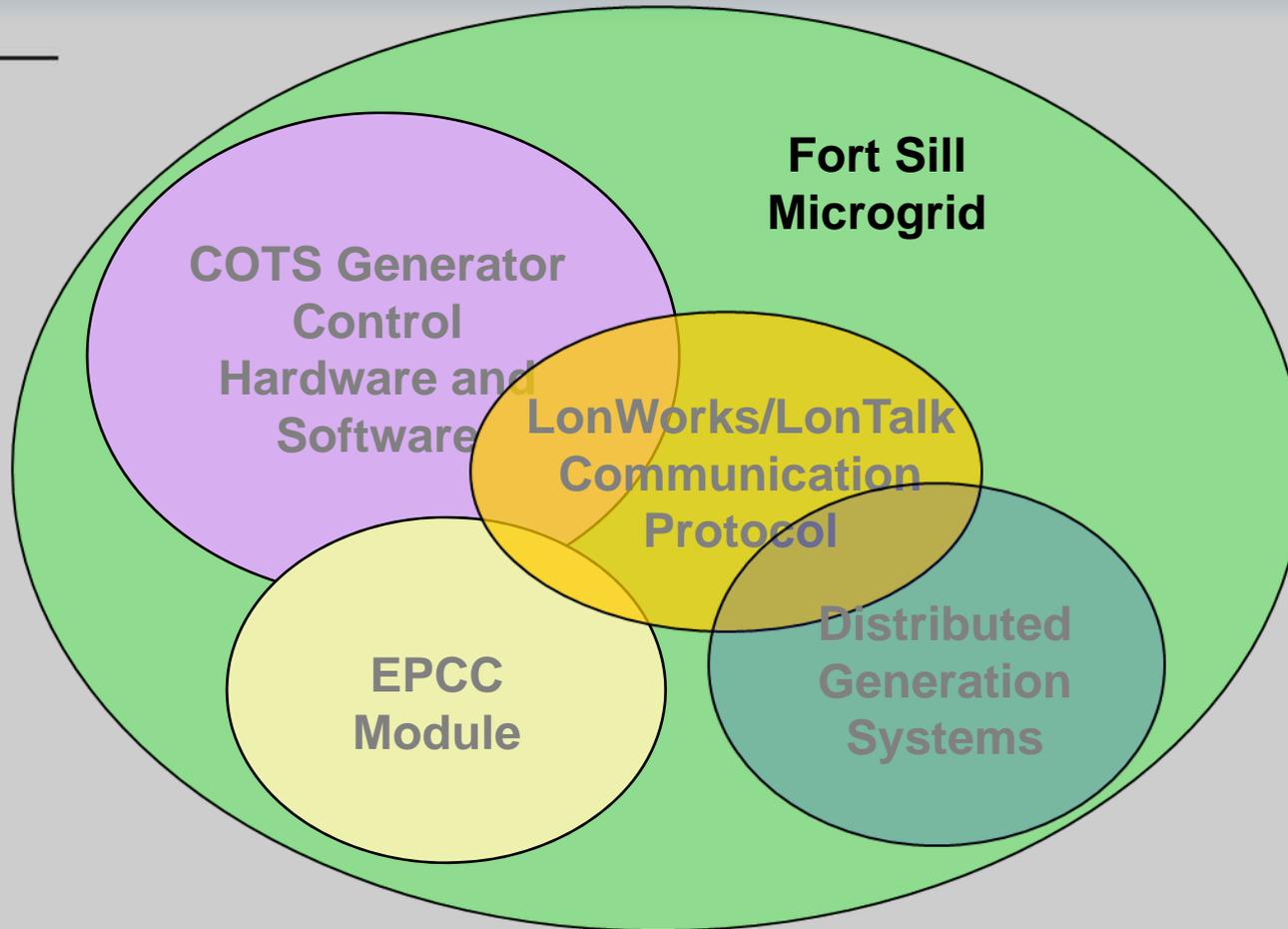
# The Fort Sill Microgrid Demonstration

The field-scale microgrid equipment will be installed and tested at Ft Sill for both grid-connect and island-mode operations, to develop system operational cost and performance data.





# The Fort Sill Microgrid Demonstration

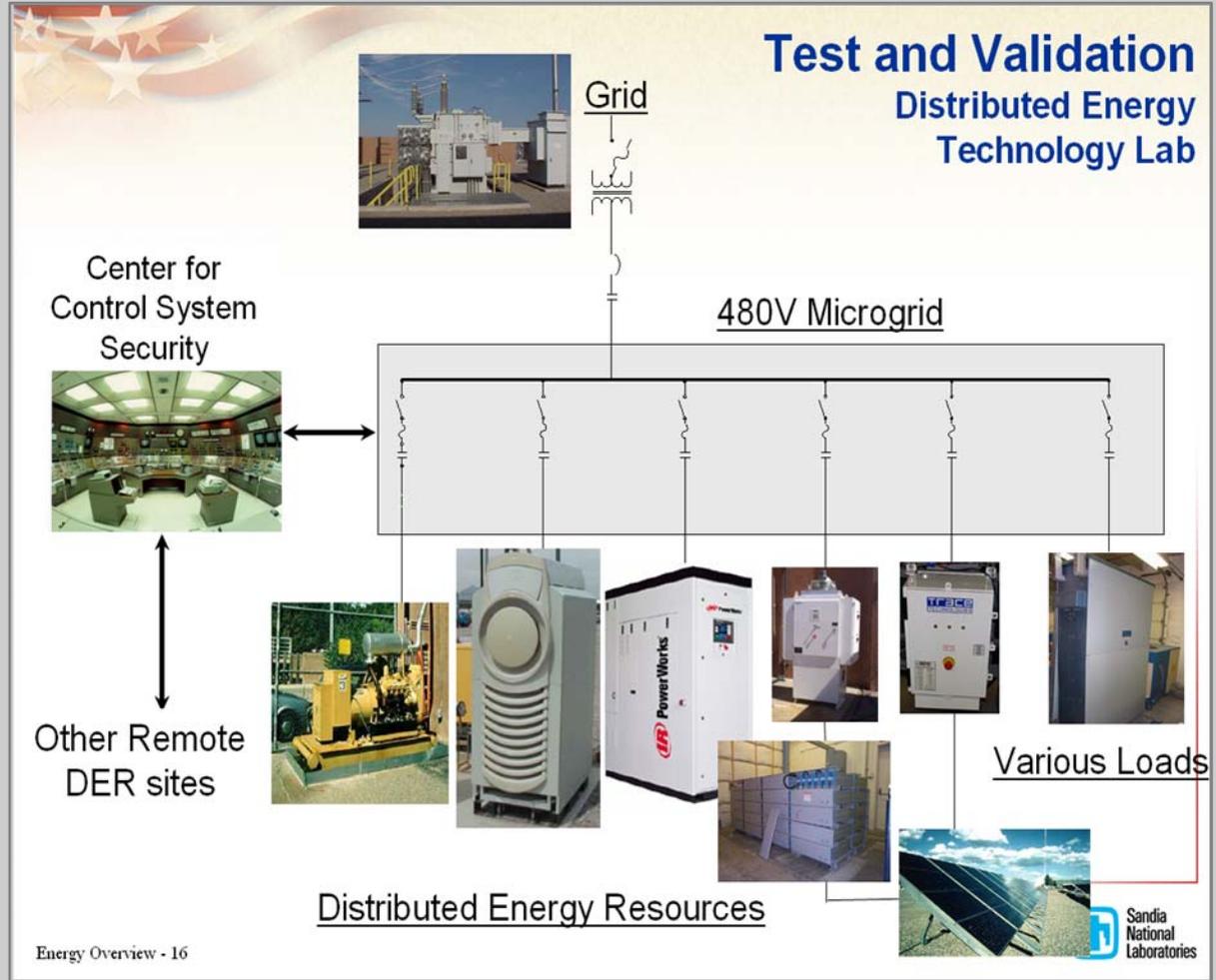


**Functional Schematic**



# The Fort Sill Microgrid Demonstration

The final control hardware and software and power conditioning technology design will be evaluated at the Sandia DETL, prior to field-scale implementation, with representative distributed energy and storage resources.





# The Fort Sill Microgrid Demonstration

Based on the results of the demonstration, design and operational requirements documentation will be developed for effective use and implementation of microgrids at DoD facilities.



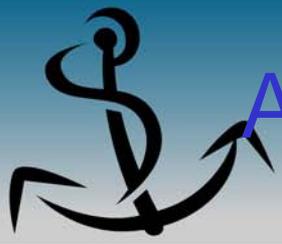


# Questions?



# Energy Policy Act of 2005

- Effective on August 8, 2005
- Federal Facilities Provisions
  - ☐ Energy Reduction Goals - 20% by FY 2015 (rel. to 2003)
  - ☐ Energy Efficient Buildings - 30% better than ASHRAE standards
  - ☐ Renewable Energy – Purchase 7.5% or more in 2013 and beyond  
(DoD Internal Guidance is 25% by 2025)
  - ☐ Energy Efficient Products – Install Energy Star or FEMP designated products



# Army Energy Strategy for Installations

- The 2005 Strategy sets the general direction for the Army in five major initiatives:
  - ☐ Eliminate energy waste in existing facilities
  - ☐ Increase energy efficiency in new construction and renovations
  - ☐ Reduce dependence on fossil fuels
  - ☐ Conserve water resources
  - ☐ Improve energy security



# Executive Order 13423

- Signed on January 24, 2007
- Federal Facilities Provisions:
  - ☐ Reduce Energy Intensity 30% by 2015 (rel. to 2003)
  - ☐ Reduce greenhouse gas emissions through reduction of energy intensity by 3% annually or 30% by 2015
  - ☐ At least 50% of current renewable energy purchases must come from new renewable sources (in service after January 1, 1999)
  - ☐ Construct or renovate buildings in accordance with sustainability strategies, including resource conservation, use, site criteria, and indoor environmental quality



# Energy Independence & Security Act

- Effective on December 19, 2007
- Federal Facilities Provisions
  - ☐ Energy Reduction Goals - 30% by FY 2015 (rel. to 2005)
  - ☐ Increased use of Energy Savings Performance Contracts (ESPCs – Third Party Financing)
  - ☐ Fossil Fuel Generated Energy Reduction (rel. to 2003 levels)
    - 55% by 2010
    - 65% by 2015
    - 80% by 2020
    - 90% by 2025
    - 100% by 2030