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SPIDERS Integrated Assessments and Operational Demonstration Results

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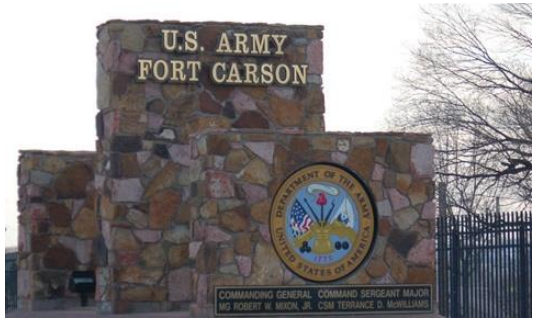
Overview

- Goals of the SPIDERS Phase 2 Operational Demonstration (OD)
- Results of the Phase 2 Utility Assessment Reports (UAR)
- Current Status of Phase 3 Integrated Assessment Plan (IAP)



Goals of the Operational Demonstration

- SPIDERS is a three year JCTD with a "crawl, walk, run" philosophy.

- There are four critical requirements listed in the Implementation Directive as being necessary to demonstrate enhanced power surety for national security:
  1) Protect task critical assets from loss of power due to cyber-attack.
  2) Integrate renewables and other distributed energy generation concepts to power task critical assets in times of emergency.
  3) Sustain critical operations during prolonged power outages.
  4) Manage installation electrical power and consumption efficiency, to reduce petroleum demand, carbon "bootprint", and cost.

Phase 2 Operational Demonstration

- The OD was conducted by PNNL, who was not part of the design or build team.
- The Integrated Assessment Plan (IAP) was developed by PNNL, in collaboration with all SPIDERS stakeholders, and was the official test procedure for the OD.
- The IAP called out 5 key Measured of Effectiveness (MOEs), that were supported by numerous Measures of Performance (MOPs):
  - Effectiveness
  - Efficiency
  - Renewables Integration
  - Suitability
  - Cyber Security
- The Phase 2 OD was a 74-hour demonstration, conducted between October 21st and 24th of 2013, to ensure that the system performed as designed.

Key Results of the Phase 2 Utility Assessment Report (UAR)

- Overall the Phase 2 OD was considered a success for the "walk" stage of SPIDERS, as indicated in the Utility Assessment Report.

- Key OD observations include:
  - Essential/uninterruptible facilities demonstrated the potential to operate 19.3% longer with a fixed amount of fuel.
  - CO_2 emissions were reduced by over 2250 lbs., approximately a 39% reduction over the traditional mode of backup operation.
  - The successful integration of renewables.
    - Renewables supplied 19% of the power during peak load conditions.
    - Renewables supplied 7% of the energy for the entire OD.
  - The reliability of the system was increased with SPIDERS.
    - Only two of the three SPIDERS enabled generators were needed at any given time to support load.
    - One generator is always available to be activated in case of maintenance or failure.
  - Increased load flexibility was proved to be possible.
  - Power quality was consistent with standards.

- The overall cyber security MOE received a passing assessment. A separate addendum was developed summarizing the cyber evaluation and testing. This addendum may be requested by contacting OSD. The combination of the UAR and the addendum represents the complete OD evaluation.

Lessons Learned from Ft. Carson

- Expand scenario-based training is essential (e.g., generator maintenance while microgrid is still activated). This allows for confirmation that all users are prepared to operate the SPIDERS system in each mode available to the facility.

- System testing should be performed in a manner that replicates the conditions for each mode that the microgrid is anticipated to operate (e.g., power loss, grid connected, generator testing). This type of testing is difficult due to the potential disruption of operations, but mandatory to ensure each component is functioning appropriately.

- The deployment of any new technology/system will be an added task for operator and maintenance staff, this commitment should exist at all levels.

- All future OD activities should include “active” evaluations of system operations.

Current Status of Phase 3 Integrated Assessment Plan (IAP)

- The Phase 3 OD is scheduled for October 2015 at Camp Smith.
- SPIDERS will support the entire installation.
- The Phase 3 OD will include a significant shift from a passive evaluation, to an active evaluation.
  - Scenarios have been developed and reviewed
  - The scenarios are events that would be expected to happen during normal operations
  - System operators are being trained to these scenarios

Continuing Transition Activities

- Microgrids are a technology that has the potential to address numerous operational problems faced by utilities. But there are barriers to adoption.

- SPIDERS provides a repository of information that can be used/evaluated by utilities to determine if microgrid solutions meet their needs. This includes not only technical issues, but lessons learned from:
  - Design process
  - Contracting
  - Interactions with third party entities
  - Construction
  - Operations
  - Evaluations

- Because of the large number of utilities in the United States, and the numerous regulatory structures, transition will focus on working with umbrella organizations:
  - Institute of Electrical and Electronic Engineers (IEEE)
  - National Rural Electric Co-operative Association (NRECA)
  - American Public Power Association (APPA)
  - Edison Electric Institute (EEI)
  - National Institute Of Standards and Technology (NIST)

Questions or Comments