Distributed Generation For Energy Surety

Dave Menicucci

Sandia National Labs

Outline of Talk

1) Background on Sandia
2) Distributed generation overview
3) What is energy surety
4) Energy surety in defense applications
5) Energy surety in civilian applications
6) Conclusions

Sandia National Laboratories (SNL)

- Largest DOE National Lab, 8000 staff, $1.4B
- Multi-program lab with defense emphasis
- 25 years in distributed energy
- Service to the nation is our priority

Distributed Generation Technologies

- IC Engines (1 – 10,000 kW)
- Combustion Turbines (300 – 10,000 kW)
- Wind (0.2 – 5,000 kW)
- Photovoltaics (.01 – 8 kW)
- Energy Storage (1 – 10,000 kW)
- Fuel cells (5 – 250 kW)
- Microturbines (30 – 250 kW)
- Others (1 – 50 kW)

Key: Conventional clean; Emerging clean; Existing polluting

Distributed Energy Technology Lab

Grid

Microgrid

Inverters

Sources

Loads

Storage

Specialized Tests

Energy Surety
What is it and why do we care?

- A measure of power reliability
- Bases and communities are vulnerable to terrorist attack or natural disasters
- Other critical infrastructures depend on energy
- New methods for insuring surety are emerging

How to Improve Energy Surety

- Disperse the generation
- Use generators that run full time
- Use proven equipment
- Apply multiple fuels

The DOD Energy Surety Wakeup Call

- Ft. Huachuca served by two feeders
- May 2002, fire takes out both feeders
- Base down for 16 hours
  -Cost $3M
  -Potential loss of mission capability

Base Energy Surety

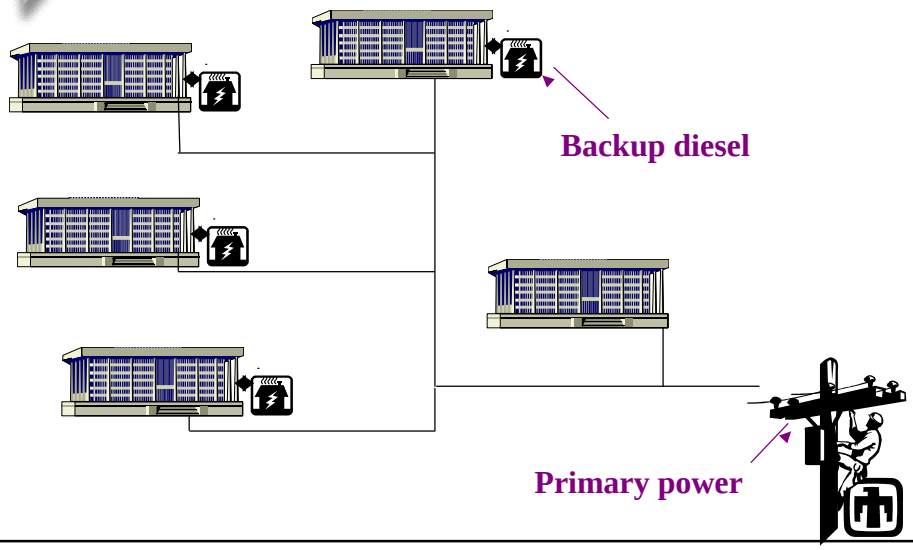
Traditional approach to base energy surety

Use diesels as the backup generation to protect strategic buildings on the base

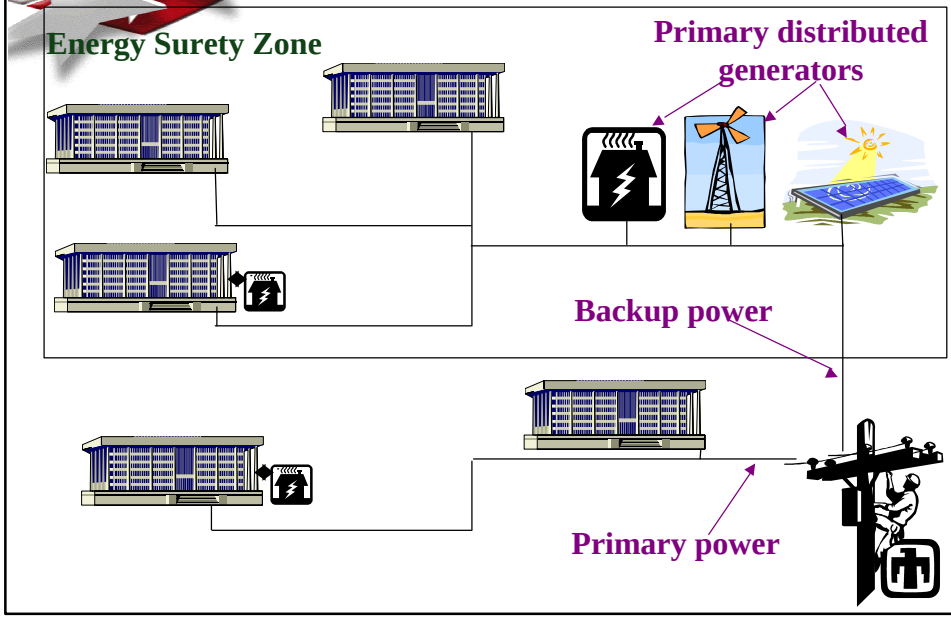
New concept for base energy surety

Use DER as the primary generation to protect strategic areas of the base

Traditional Energy Surety Approach



New Energy Surety Approach



Energy Surety Assessment

Outside Surety Zone:

Buildings without backup: 99.95% (5.3 hrs outage/year)

Buildings with backup: 99.99% (53 minutes outage/year)

Inside Surety Zone:

Buildings without backup: 99.999% (5 minutes outage/year)

Buildings with backup: 99.9998% (1 minute outage/yr)

Option Comparison Hospital Surety Zone

Technology	Installer	Gov NPV	Reliability	Annual outage
Single Backup	Government	<$1.6M>	99.99%	53 min
Duel Backup	Government	<$3.3M>	99.998%	10 min
Single DER	Government	$0	99.999%	5 min
Single DER	ESPC	$1.6M	99.999%	5 min

Caveats— Where can DER be an advantage?

- Where high levels of surety are needed
- Where the DER energy product is cheaper than market
  - -ESPC potential when difference is large
  - -Government financed when difference is small
- Where protected buildings are closely clustered

Note: DER is not the answer to all surety problems

Energy Surety Methodology (ESM)

1) Review existing vulnerability analysis
2) Identify logical surety zones
3) Identify reliability needs for each zone
4) Rank order each zone based on reliability needs
5) Determine load profile in each zone
6) Compare DER and/or BU technology options to meet goals for each zone
7) Select most appropriate technologies and develop financing options
8) Document energy surety plan
9) Implement DER projects, if appropriate

Surety Project at MCAGCC/29 Palms

7.6 MW CHP System

Army Energy Surety Project

- Goal: Develop a plan to use DER
- Team: ESG, ARMY/CERL, Sandia
- FY03 Funding: $500K ($100K to SNL)
- Sandia role: Assess military readiness of DER and develop micro-grid concept for base
- Project start: March 2003

DER and Energy Surety in Communities

- Adapt the military energy surety model to civilian communities
- Develop specific community based tools
- Field test the ideas (e.g., Tucson, Honolulu?)
- Document and report results
- Replicate in other cities

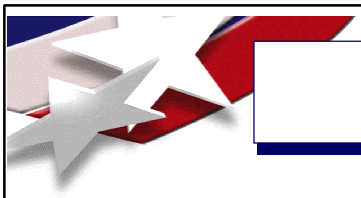
Military and Civilian Differences

1) Mission *vs*. Community identity
2) Protected perimeter *vs*. Open access
3) Command and control *vs*. Democratic governance

Surety Projects in Tucson, AZ

- 1.6MW Combined Heat and Power for fire/police HQ
- 40kW PV/hybrid for water treatment facility
- Implementing programs:
  --Power for Critical Resources
  --Power for safe haven
- Sandia to help develop comprehensive plan
- Coalition seeking grant funding

CHP System in Tucson



Summary

- DER technologies are proven
- Energy surety is a growing concern in country
- New concepts for applying DER may provide:
  - -more reliability for same cost as backups
  - -equivalent reliability for less cost as backups
- Sandia's ESM can be used to identify the best technologies to meet surety needs