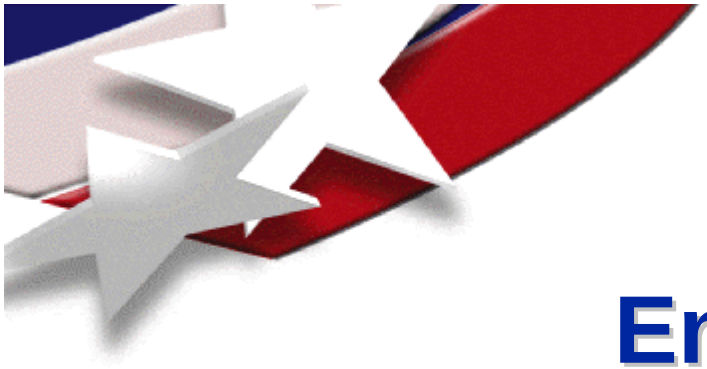

Energy Surety:

What it is and How to Assess it in Real Applications

Dave Menicucci

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Outline of Talk

1) Distributed energy technologies
2) The Energy Surety Methodology
3) Proposed plan for federal and civilian communities
4) Benefits and costs
5) Conclusions

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

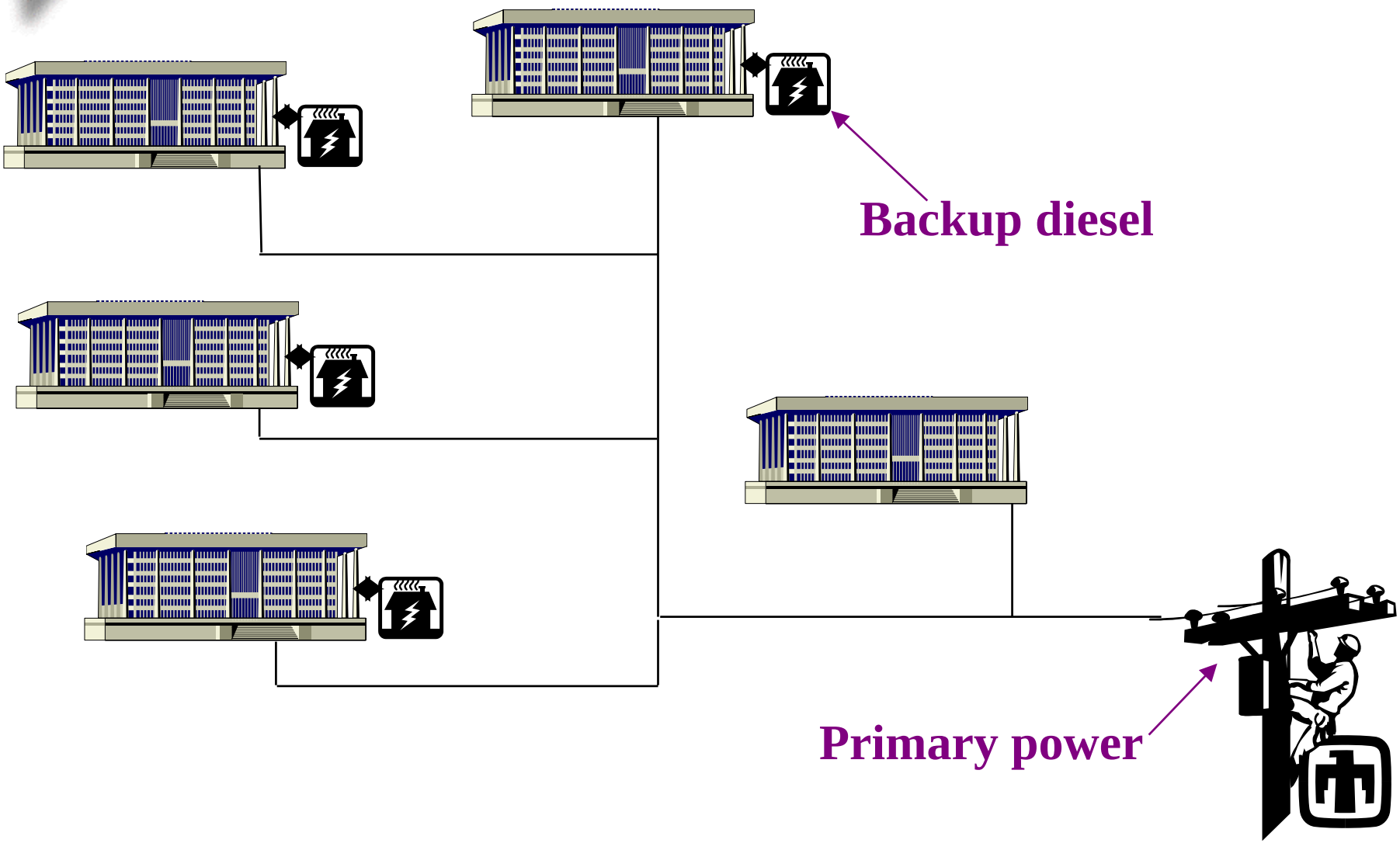
Distributed Generation Technologies

- IC Engines (1 – 10,000 kW)
- Combustion Turbines (300 – 10,000 kW)
- Combine heat and power
- Energy storage (1 – 10,000 kW)
- Wind (0.2 – 5,000 kW)
- Photovoltaics (.01 – 500 kW)
- Fuel cells (5 – 250 kW)
- Microturbines (30 – 250 kW)
- Diesel (1 – 50 kW)

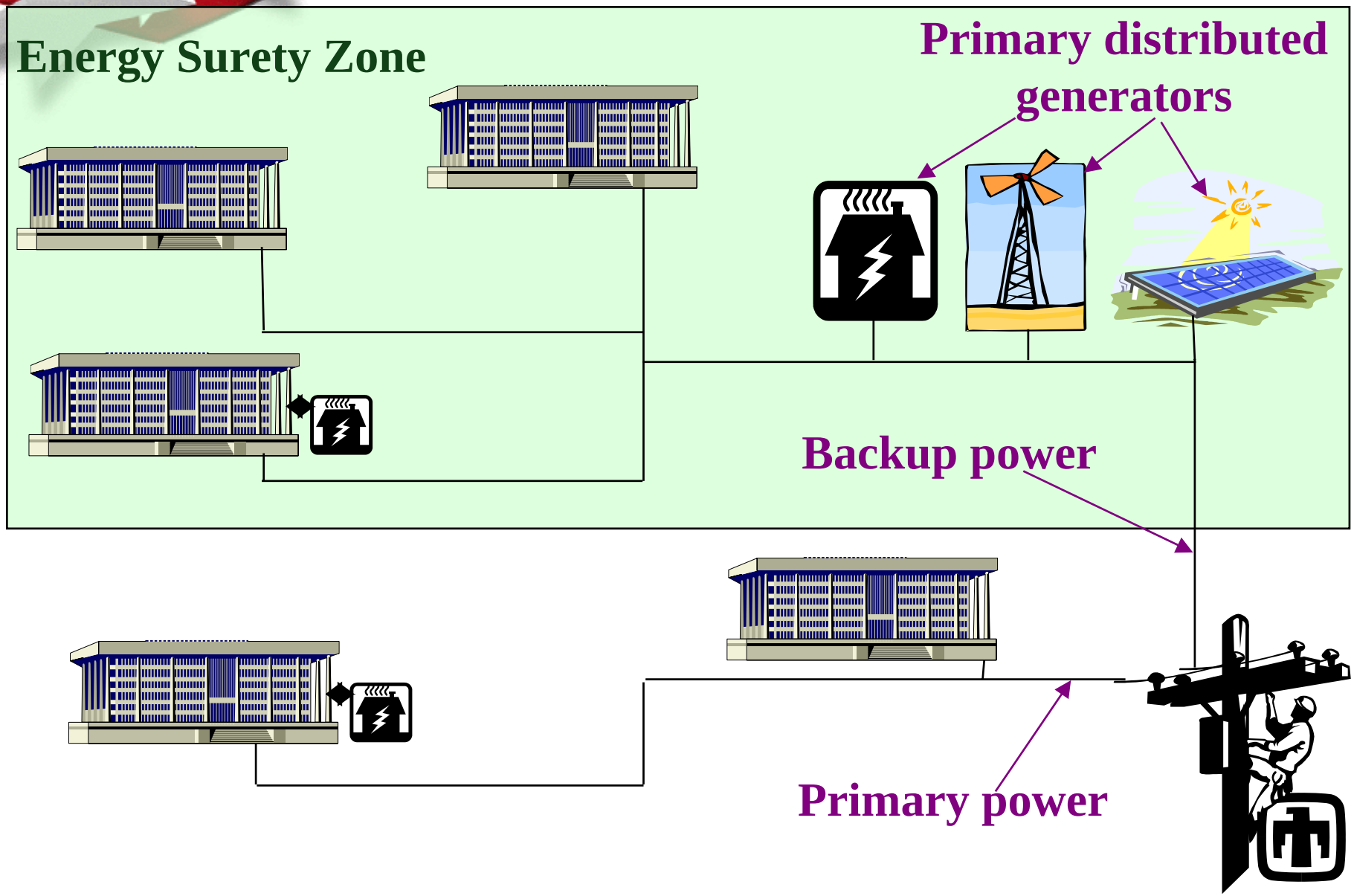
How to Improve Energy Surety

- Disperse the generation within a protected perimeter
- Use generators that run full time
- Use proven equipment
- Apply multiple fuels

Traditional Energy Surety Approach



New Energy Surety Approach



Energy Surety Assessment

Outside Surety Zone:

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

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

Inside Surety Zone:

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

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

Cost Analysis
One MW Hospital Surety Zone

All Government Installed Equipment

Dual 1-MW diesel

- 20 year life
- $3M installed
- $36K annual O&M
- ($3.3M NPV)
- 99.998% reliability

Full time operating DER

- 20 year life
- $3M installed
- $0.055/kWh net profit on elec/heat product
- $260K annual O&M
- $429K revenue
- $169K net cash flow
- $0 NPV
- 99.999% reliability

Option Comparison Example Hospital Surety Zone

Technology	Installer	Gov NPV	Reliability	Annual outage
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 (e.g., Y2K)
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 BU technology options for zones
7) Select most appropriate technologies and develop financing options
8) Document energy surety plan
9) Implement DER projects, if appropriate

Why Energy Surety is an Issue to the Federal Facilities

- Energy is critical to the mission, especially the military
- Energy loss affects mission readiness
- Some energy infrastructure is vulnerable, especially military bases
- Terrorist have created new surety dynamics

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

Where ESM is Being Applied or Considered in Federal Facilities

- Marine Base 29 Palms
  - 7.6 MW CHP
  - 1.1 MW PV, 1MW additional planned
  - Daylighting in 17 warehouses (load reduction)
  - Solar hot water in barracks/heads (load reduction)
- Marine Base Camp Pendleton requests assistance
- Navy Base Pearl Harbor is requesting assistance
- US Army studying energy surety

CHP Project at MCAGCC/29 Palms

7.6 MW CHP System

Load Reduction with RE at 29 Palms

Army Energy Surety Project

- Goal: Develop a plan to use DER for energy surety throughout Army
- Team: ESG, ARMY/CERL, Sandia
- FY03 Funding: $200K ($50K to SNL)
- Sandia role: Assess military readiness of DER and develop micro-grid concept for base

Federal Facility Plan

- Sandia leads a multi-lab team to apply ESM on federal facilities (DOD, VA, EPA etc.)
- Focus on distributed technologies, (CHP, renewables, storage, and load reducers)
- Develop surety plans and associated projects
- Publish successes and replicate nationally (via web site)

Why Energy Surety is an Issue to Civilian Communities

- Energy is critical economic development
- Energy loss affects business profits
- Health and safety are dependent on reliable power
- Reduce chaos from power disruptions, saves lives
- Tucson has begun a program; needs Sandia's help
- San Diego is considering a program

DER 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 requested to help develop comprehensive plan

Civilian Plan

- Sandia leads a multi-lab team to apply ESM in selected civilian communities (Tucson and San Diego)
- Focus on distributed technologies, especially CHP, renewables, storage, and load reducers
- Develop surety plans and associated projects
- Self-help web site for application in other communities
- Provide assistance in replication as needed

Benefits

- Focus on a national problem and provide some solutions
- Plan is focused on replication throughout nation
- Pilot the use of DER in new area--energy surety
- Field many DER devices communities
  - -DOD alone may apply over 3000 MW of DER, RE and storage
  - -Civilian potential may be 6000 MW

Will it Work?

- Timely idea: Federal and Civilian communities are concerned about surety. This is a workable plan.
- Seems to be working at 29 Palms
- Labs have much experience with DER/RE/storage

Risks?

- No interest; However, DOD and some communities are already interested
- It does not work; However, it is being applied now and seems to be working
- No support for the concept; However, we already have some sponsors and interested partners who have pledged support

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