

**MISSION ASSURANCE
DIVISION**



“Forewarned...Forearmed”

Infrastructure Decision Support
for Government and Industry



Naval Surface Warfare Center
Dahlgren Division

NSWCDD

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Energy Security: A Path to Viable Mission Assurance

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Agenda

- Short Mission Assurance Division Introduction
- What is “Energy Security”?
- Regional Case Studies
- Metrics - Thoughts
- Conclusions



MAD's Energy Experience

- The Naval Surface Warfare Center, Dahlgren Mission Assurance Division (MAD) has been engaged in Infrastructure/ Mission Assurance (IA) since 1994.
 - Initiated as Navy Special Program - Joint Program Office and funded jointly
 - Predominately focused on CONUS infrastructures until 2002
 - Performed over 300 assessments for sponsors, ranging from the OASD(HD&ASA) to NASA
- MAD is currently tasked by the OASD(HD&ASA).
 - Develop and perform “case studies” of DoD energy security
 - Provide program management of the DoD Industrial Control Systems (ICS) Mitigation Program – also know as “Aurora”
 - Support the OASD(HD&ASA) Electric Grid Security Executive Council
- Support to Defense Science Board Task Force on DoD Energy Security
 - Provided technical support to Task Force Policy Panel
 - Prepared overview of US grid and examples of DoD dependencies.
 - Supported writing of unclassified and classified reports – “More Fight; Less Fuel”.



Energy Infrastructure Issues

- Electric Power – “The Grid”
 - Limited Resiliency in Electric Power Grid
 - Complex Interdependencies – Virtually Every Aspect of Society Depends on Electric Power
 - **Most** DoD Missions/Activities Are Energy-dependent
- Electric Power Infrastructure Is Soft Target With Numerous Vulnerabilities
 - Physical Attacks (e.g., Transformer Destruction/Damage)
 - Minimal Input – a Bullet – Can Achieve Maximum Effect – Transformer Destruction
 - Insufficient Back-up Transformer Availability to Respond to Large-scale Attack
 - Electromagnetic Pulse (EMP)
 - Cyber Attacks
- Prevention Possible, but Very CHALLENGING
 - Short-, Medium-, and Long-term Mitigation Options Available
 - Continued Testing/Research Required to Fully Understand Risks/Vulnerabilities
 - “Aurora” mitigation tested and ready for installation

Regardless of the threat, vulnerabilities exist



Energy Security – Electric Power Case Studies

■ Objectives

- Support development of an OASD (HD&ASA) Mission Assurance Strategy
- Assist DoD policy development by identifying areas of unacceptable vulnerabilities resulting from DoD mission dependencies on the commercial power grid – including Industrial Control System (ICS) vulnerabilities
- Work with DoD, other USG, commercial power grid owners and other stakeholders to develop solutions to unacceptable grid vulnerabilities

■ Goal

- Assist in the development of coherent and technically relevant Electric Grid Security policy



Essential Elements of Energy Security

Energy Security = Reliability + Affordability

Availability

Adequacy

Delivery

Diversity

Sustainability

Resilience

Economic Efficiency

Economic Flexibility

**Environmental
Acceptability**

Political Orientation

Political Stability

Supplier Concentration

Supply-Demand

Energy Security Implementation Requires Both Reliability and Affordability



Benefits of Regional Case Study Approach

■ Reliability

- Increased generation and fuel diversity
 - Integrate commercial and DoD generation
 - Ready integration of renewable technologies
- Ability to sustain power for 6 months or more
- Improved redundancy in power delivery network
- Potential to reduce transmission congestion and strengthen grid by introducing distributed generation
- Enhanced Industrial Control Systems Security
 - Life-cycle security
 - Security certification by independent party

■ Affordability

- Grid improvements paid from revenues obtained from electric sales to the bulk power market
- Partner with local utility, generation developers, regional transmission operator, public utilities commission and other stakeholders to ensure all customers have fair electric rates
- Reducing transmission congestion lowers electric rates for all customers



Reliability

Installation

30 Days →

Greater than 6 Months

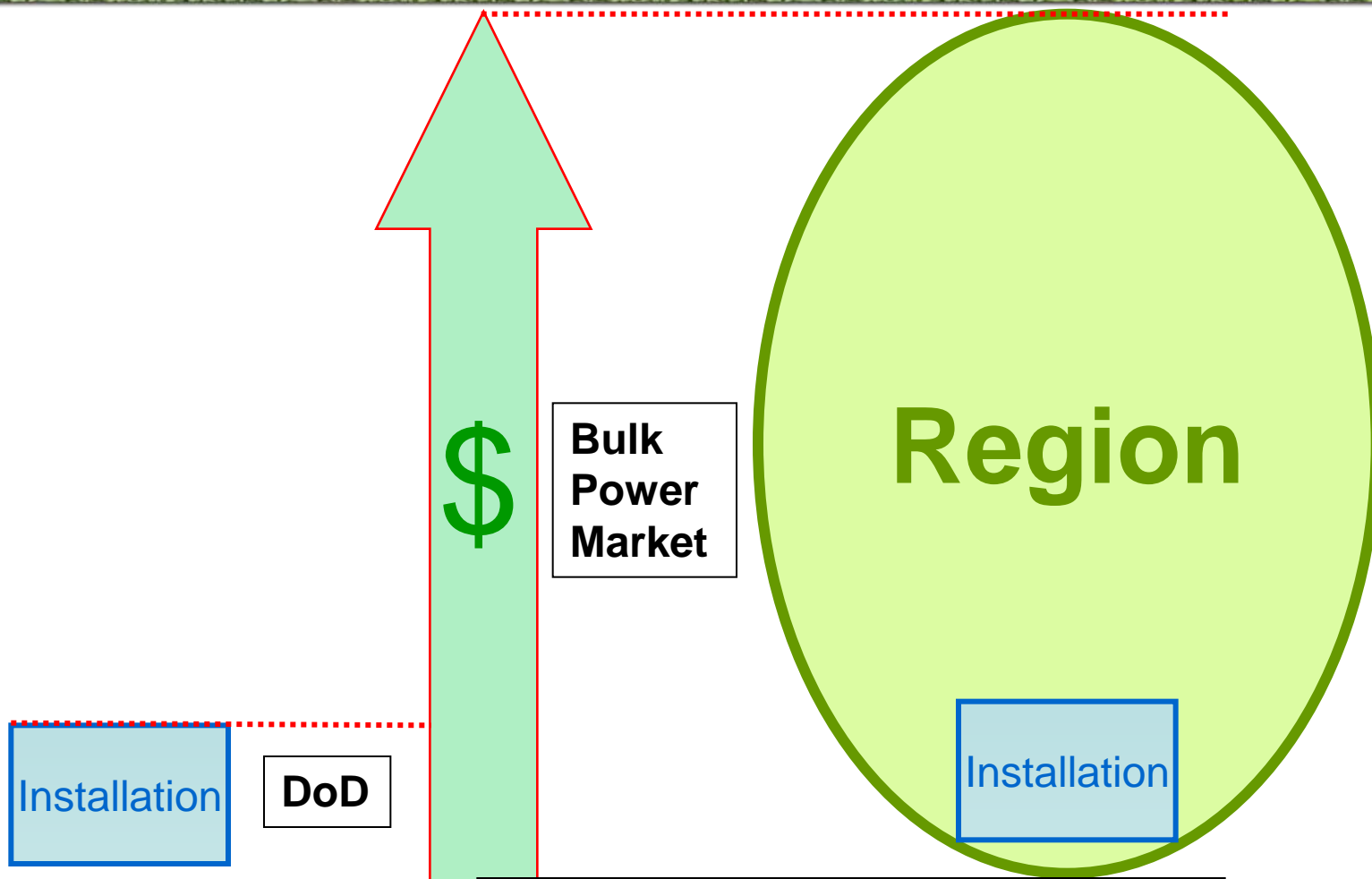
Installation

Region

LONG TERM reliability can be too challenging for all installations



Affordability

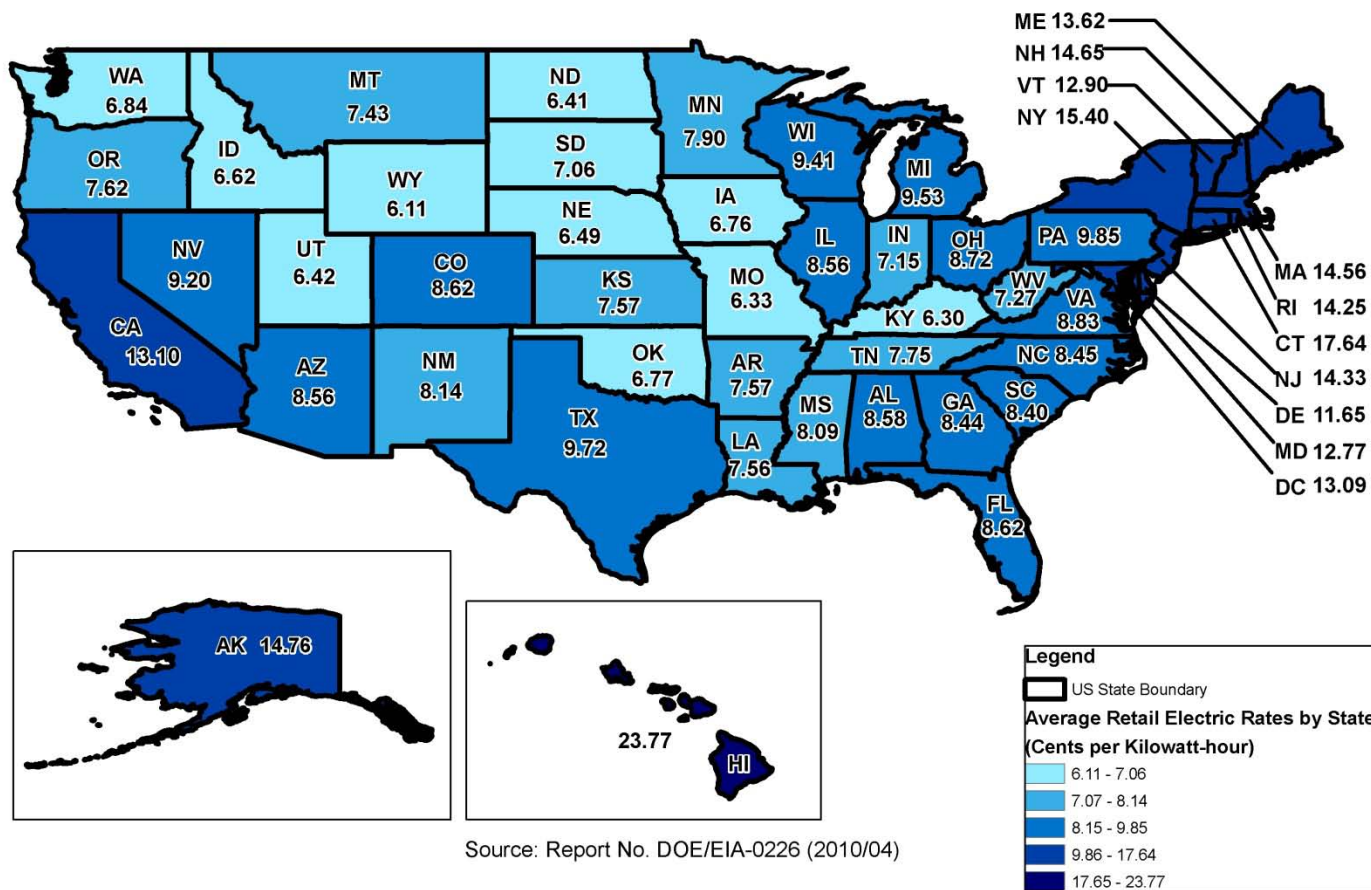


Low Cost Local Generation = Lower Rates for Local Customers



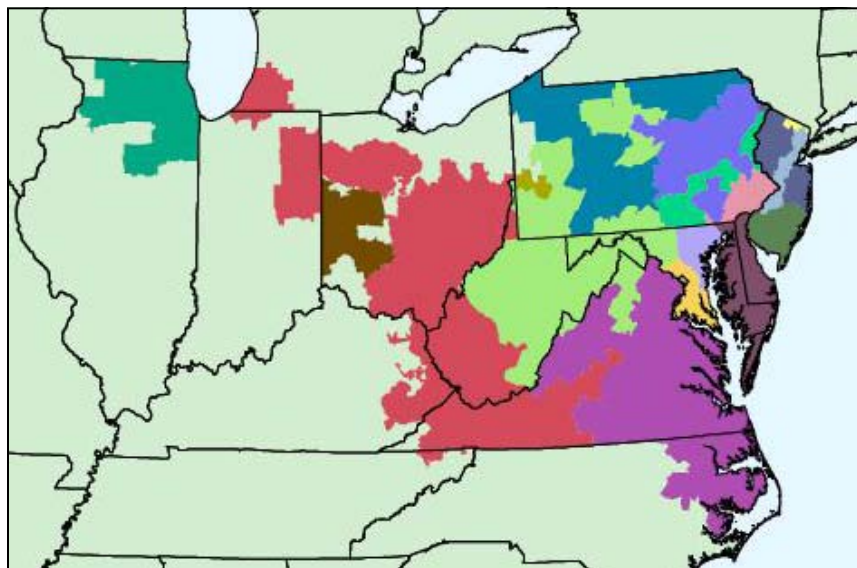
Average Retail Electric Rates

Average Retail Price of Electricity by State, Year-to-Date through January 2010





Regional Transmission Operators - PJM Example



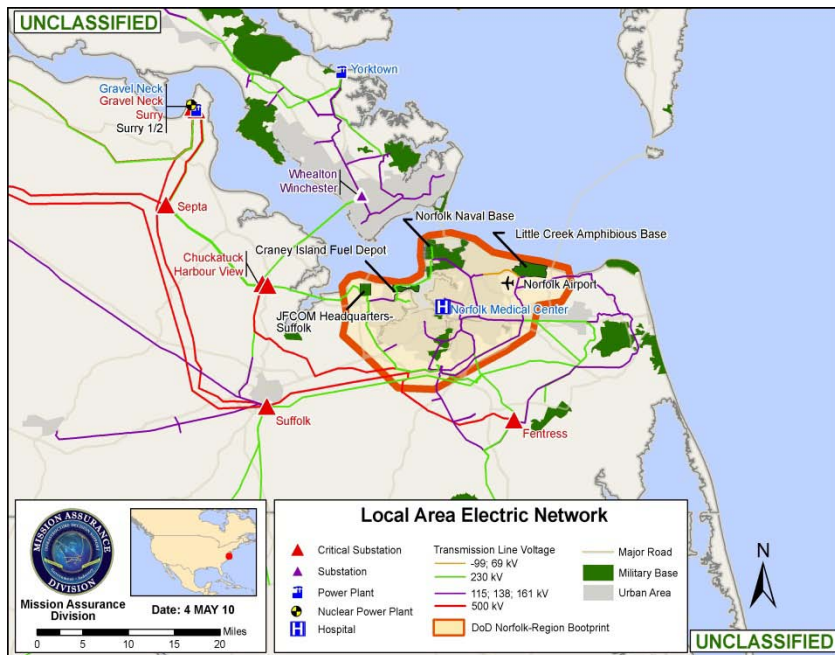
Legend	
PJM Zone	
Allegheny Power	Metropolitan Edison Company
American Electric Power Co., Inc.	PECO Energy Company
Atlantic City Electric Company	PPL Electric Utilities Corporation
Baltimore Gas and Electric Company	Pennsylvania Electric Company
Commonwealth Edison Company	Potomac Electric Power Company
Delmarva Power and Light Company	Public Service Electric and Gas Company
Duquesne Light Company	Rockland Electric Company
Jersey Central Power and Light Company	The Dayton Power and Light Co.
	Virginia Electric and Power Co.

- Regional transmission organization (RTO) is an independent grid operator
 - Operates the transmission system
 - Accommodates bulk power transactions
 - Covers all or parts of 13 States and DC
- Electric System
 - 163,500 MW of generation capacity
 - 56,350 miles of transmission lines

Generation Capacity Mix		
Coal	40.4%	67,065 MW
Natural Gas	29.2%	48,340 MW
Nuclear	18.3%	30,468 MW
Oil	6.5%	10,715 MW
Hydro	4.4%	7,476 MW
Wind	0.8%	1,278 MW
Solid Waste	0.4%	665 MW

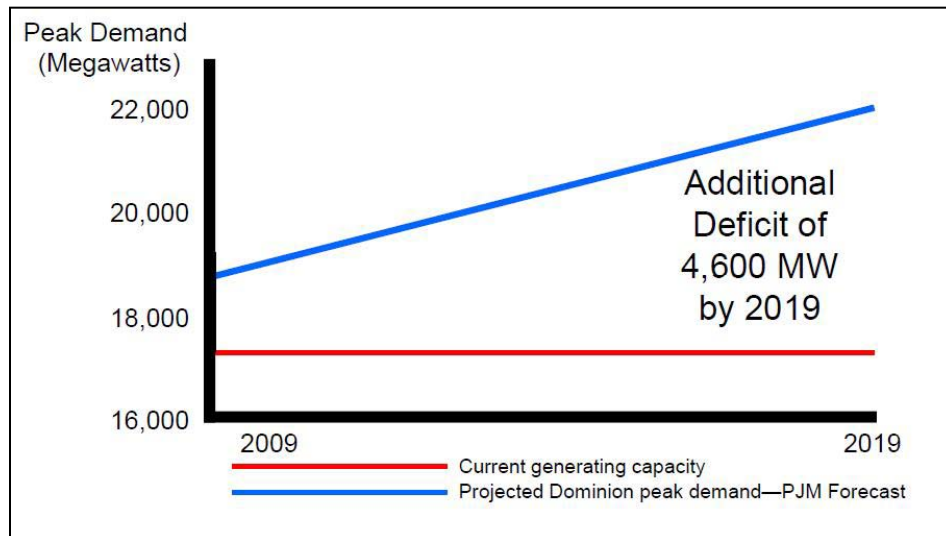


Dominion Virginia Power Overview



- Serves 2.3 million customers
- 18,000 MW for Virginia
- 20% of power is imported

Dominion Virginia Power 2008 Electric Capacity by Fuel		
Coal	25%	4,500 MW
Natural Gas	21%	3,780 MW
Nuclear	14%	2,520 MW
Oil	10%	1,800 MW
Hydro / Other	10%	1,800 MW
Imported	20%	3,600 MW





Reliability Metrics - Thoughts

- Reliability = Dependable, Steadfast. Not prone to random failure.
 - Mean Time Between Failure (MTBF)
 - % Up or Down-Time
 - Can be applied to:
 - System
 - Local Networks
 - Components
 - Ability to sustain (100% availability) required power for:
 - 1 week (24/7)
 - 1 month (24/7)
 - 6 months or more
- Resiliency = Ability of system to bend, but not break, under pressure
- Robustness = Strength, Sturdiness
 - Meets standards (NIST, etc)
 - Ability Integrate commercial and DoD generation
 - Ready integration of renewable technologies
- Enhanced Industrial Control Systems Security
 - Life-cycle security
 - Security certification by independent party



Affordability Metrics - Thoughts

■ Affordability Metrics

- Grid improvements paid from revenues obtained from electric sales to the bulk power market
 - Cost per kW/hr under current contract vs negotiated cost
 - Total unit cost of power sold for local utility use
 - Total unit cost of power used by local DoD customer
 - Power generated by “Prime Power” generator in lieu of “backup” generator
 - Power generated by on base renewables vs commercial power
- Partner with local utility, generation developers, regional transmission operator, public utilities commission and other stakeholders to ensure all customers have fair electric rates
 - Delta between pre- and post- islanded generation kW/hr costs (if any)
 - Annualized reduction in total installation electric power, and associated, costs
- Reducing transmission congestion lowers electric rates for all customers
 - Cost savings to local utility or transmission operator in congestion charges applied as rebate to negotiated rates
 - Cost savings in construction, when on base, to EP transmission connectivity



Energy Security Conclusions

- DoD dependency on the commercial power grid represents a critical asymmetric vulnerability that must be mitigated in partnership with industry.
 - Therefore, DoD can pursue a wide range of potential solutions through the case study effort to mitigate critical energy dependency.
 - Maximize commercial utilities/industry interests to produce energy with reasonable return on investments.
 - Use USG/DoD property to entice utilities to produce energy in close proximity to our mission needs.
 - Secure generation for relevant DoD and national missions to self-sustain for 6 months or more.
 - Embrace local alternative fuels technologies to fuel local generation.
 - Use these prototypes to increase positive working relationships with relevant regulatory agencies; e.g., FERC.
 - Tailor each solution based on a portfolio of generation, power delivery, and smart grid technologies that have proven track records and are new and innovative.



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