

Using Renewables and Energy Efficiency to Build a Robust Energy Infrastructure

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Our Current Energy Infrastructure is Difficult to Protect

- 158,000 miles of main electric transmission lines
- 5,000 power plants (totaling 800,000 megawatts)
- 2,000,000 miles of oil pipelines
- 1,300,000 miles of gas pipelines
- 2,000 petroleum terminals
- 1,000,000 gas and oil wells
- 150 oil refineries
- 300 tankers (ships)
- Plus much, much more!



U.S. Natural Gas Pipeline Systems and Liquefied Natural Gas Import Facilities 2001





Natural Gas Pipeline Capacity Serving the U.S. Marketplace





Electric Power Plants in the U.S.





U.S. Electric Power Transmission Grid



Our Current Energy Infrastructure Faces a Broad Spectrum of Threats

- **Physical** Terrorism, natural disasters, accidents, global warming, and aging infrastructure
- Cyber Malicious intrusion and inadvertent error
- System complexity– Cascading effects, critical nodes, and interdependencies



Trans-Alaska Pipeline Shooting Incident October 4, 2001



Alaska Oil and Gas Reporter



Trans-Alaska Pipeline Shooting Incident Damage and Losses

- 285,000 gallons of crude oil lost
- 2 acres of spruce forest severely damaged
- \$18 million in environmental cleanup costs
- \$8 million in lost royalties and taxes
- Cause: High-powered rifle bullet



Bellingham, Washington Gasoline Pipeline Explosion - 1999



City of Bellingham, WA



Bellingham, Washington Pipeline Explosion Damage and Losses

- 230,000 gallons of gasoline spilled
- 3 people killed, 1 home destroyed
- >100,000 fish and aquatic wildlife killed
- 26 acres of trees and 2.5 miles of vegetation destroyed
- \$37 million in fines paid to date
- Cause: Defective design



Blackout! It Can Happen To You. July 2, 1996









Can the U.S. Afford Power Disruptions?

Power outages and power quality disturbances cost the U.S. economy more than \$119 billion annually (Electric Power Research Institute, 2001)



Cost (\$) of Power Disruption per Hour Ranked by Industry





What is the Value of Electricity if you don't have any?

The Key to a Robust Energy Infrastructure

- Decrease domestic energy use
- Reduce dependence on imported fuels
- Maintain and protect the existing infrastructure
- Employ smart, resilient systems
- Diversify generation options
- Increase use of distributed generation



Let's Hear It for Energy Efficiency!

- Reduces stress on an overtaxed infrastructure
- Reduces dependence on imported fuels
- "...possible to raise energy efficiency by up to 50% and reduce U.S. oil consumption by more than 3 million bbl. a day." (*Business Week*)



"Every watt not used is a watt that doesn't have to be produced, processed, or stored."

Richard Perez, Home Power Magazine



Green Buildings Provide Energy Security







Pipeline Control and Monitoring





Refinery Protection/SCADA



Courtesy: Alternative Power Systems



Communications Power





Water Sampling





Air Sampling for Toxic Emissions





Emergency Operations





Distributed, Renewable Power Sources Provide Energy Assurance









Contact Information

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