



**SANDIA NATIONAL LABORATORIES**



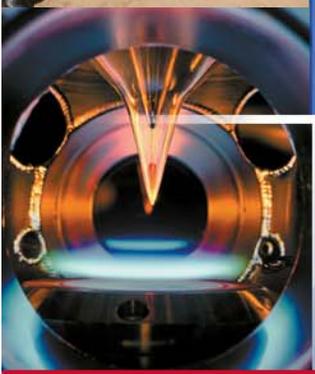
# Realizing America's Energy Future

## “A Role for Surety”

Wind Energy Reliability Workshop  
September 17, 2007



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# Sandia's Heritage



## Exceptional Service in the National Interest

THE WHITE HOUSE  
WASHINGTON

May 18, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

Mr. Leroy A. Wilson,  
President,  
American Telephone and Telegraph Company,  
195 Broadway,  
New York 7, N. Y.



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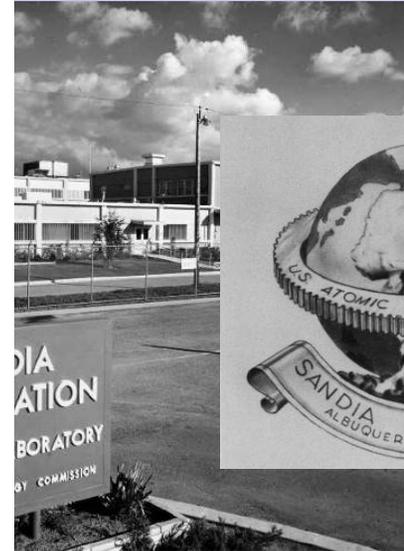
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# Sandia National Laboratories

*“Exceptional Service in the National Interest”*

- National Security Laboratory
- Broad mission in developing science and technology applications to meet our rapidly changing, complex national security challenges
- Safety, security and reliability of our nation’s nuclear weapon stockpile



Sandia National Laboratories

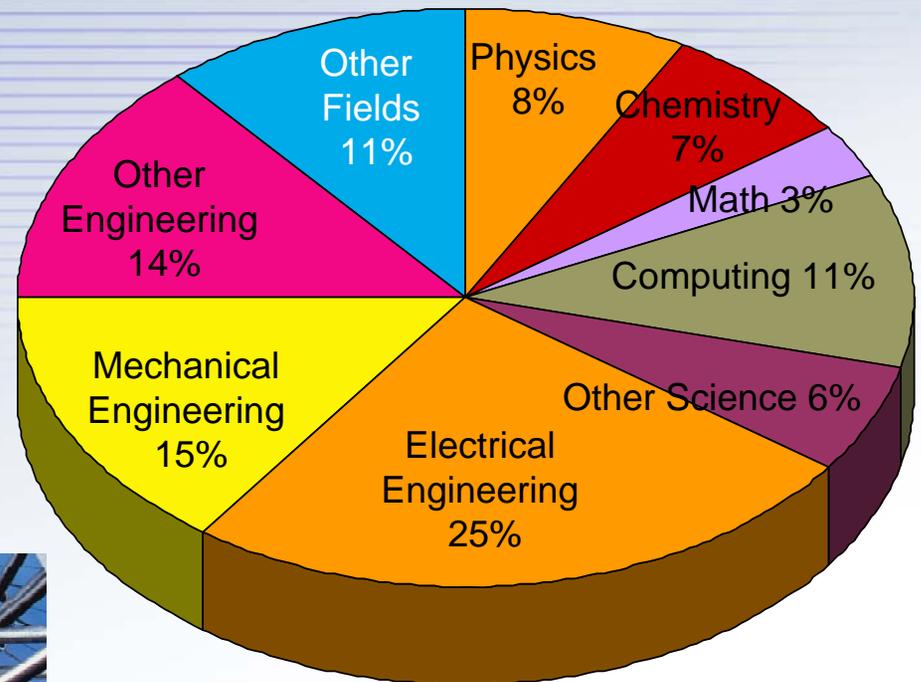
## Sandia VISION

helping our nation secure a peaceful and free world through technology

- ★ Integrity
- ★ Excellence
- ★ Service to the Nation
- ★ Each Other
- ★ Teamwork

**Our highest goal** is to become the laboratory that the U.S. turns to first for technology solutions to the most challenging problems that threaten peace and freedom for our nation and the globe.

# Sandia is Engineering Focused and Grounded in Science



- Over 8,500 employees
- Over 1,500 PhDs; over 2,500 MS/MA
- Over 1000 on-site contractors
- \$2.3 billion operating budget

# Science, Technology, and Engineering

## *“With an Impact”*

More than 50 years of *“exceptional service in the national interest”*



**The Clean Room,  
invented in 1963 . . .**

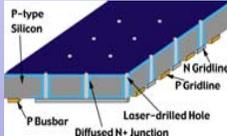


**revolutionized electronics and medicine**

**Maintaining national security and technological superiority**

# Partnerships with Industry are Critical to Our Mission

## “Examples of Technology Commercialization”

Discovery Research	Use-Inspired Research	Applied R&D	Demo	Market Entry	Market Penetration	Market Maturity
		<p>Rock/bit interaction modeling, cutter characterization, cutter attachment methods, design software, laboratory and field testing</p>				 <p>Many Companies</p>
<p>Science based modeling and testing of combustion phenomena</p>				 <p>Cummins</p>		
	<p>Solid-state hydrogen storage materials, systems design, codes and standards</p>		 <p>GM</p>			
		<p>Wind turbine blade innovation – adaptive concepts and new materials</p>		 <p>TPI and Knight &amp; Carver</p>		
<p>Semiconductor materials and physics, fabrication, systems optimization, manufacturing technologies</p>					 <p>Advent Solar</p>	
	<p>Compound semiconductor materials, processing and device packaging</p>		 <p>LumiLeds</p>			

# “A Rich Tradition of Reliability Studies on High Consequence Systems”



**Nuclear Weapons**



**Secure Transportation Systems**



**Satellite Systems**



**Electric Grid Reliability**

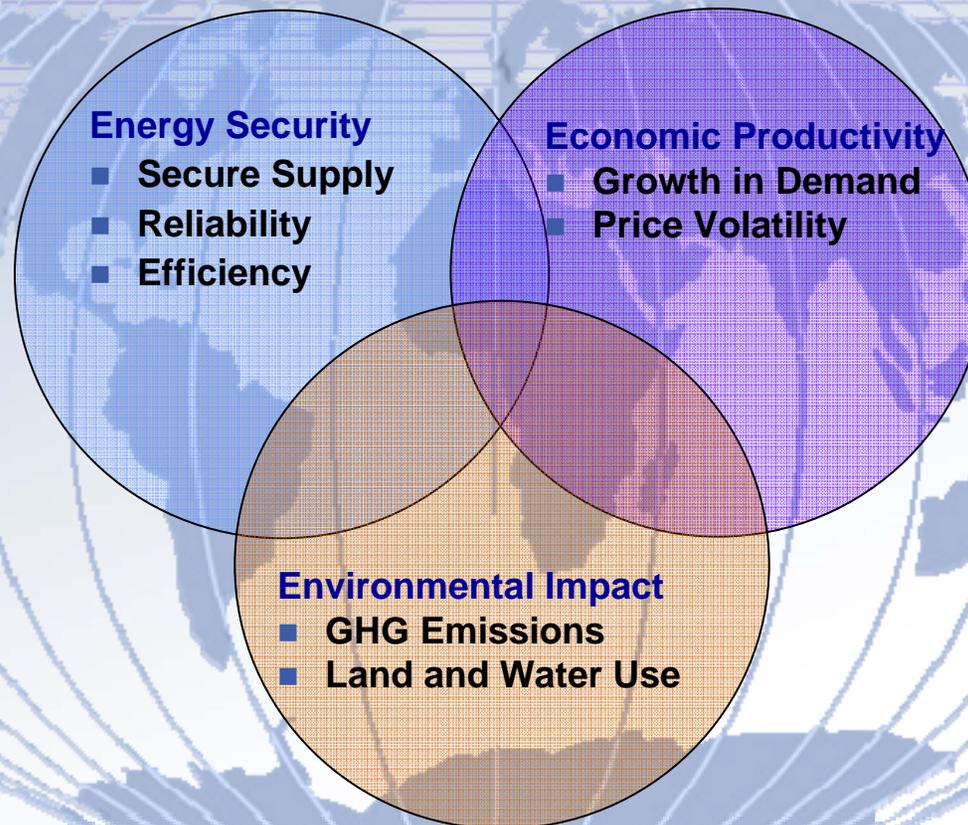


**Nuclear Power**



**Photovoltaics**

# Energy Challenges are Complex and Highly Interdependent



**All Three Imperatives Must Be Addressed**

# World-Wide Growth in Energy Demand Requires All Available Energy Technology Options

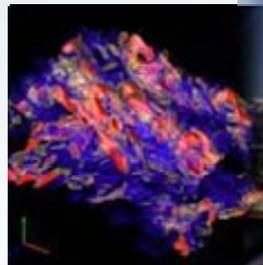
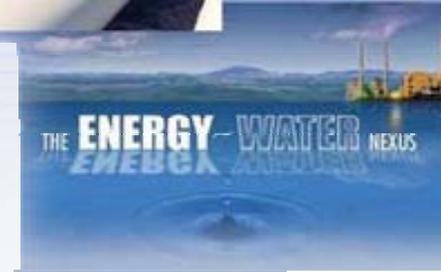
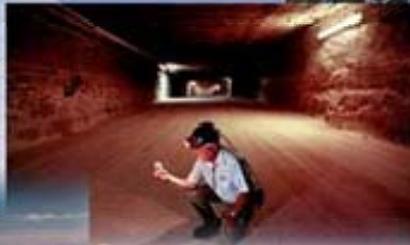
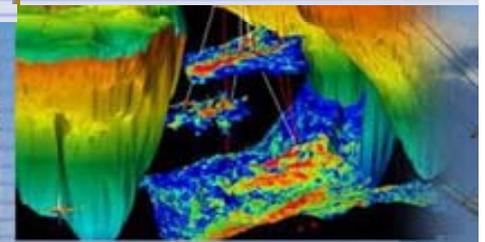


- A complete portfolio of supply options: renewables, fossil, nuclear
- Highly efficient and environmentally benign technologies
- Fault-tolerant, smart, self-healing infrastructures
- Enhanced physical and cyber security and safety



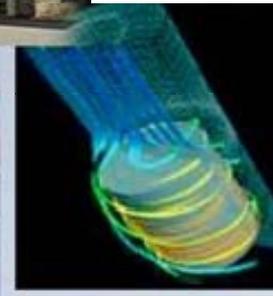
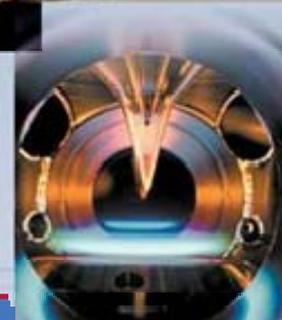
# The National Laboratories are Contributing to Our Nation's Energy Future

Energy Supply, Energy Efficiency, and Environmental Stewardship



Safe, Secure, Reliable Energy Supply and Infrastructure

Science and Technology



 Sandia National Laboratories

# “Some” Technology Innovation Challenges



## Wind

- Next Generation Wind Turbines
  - Improve Energy Capture by 30%
  - Decrease Capital Costs by 25%
  - Enhance Reliability

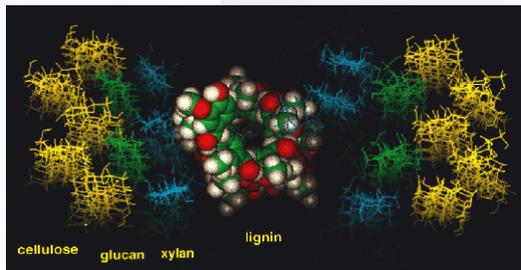


## Solar Photovoltaics

- Improved Performance Through
  - Process and Reliability Improvements
  - Better Materials
  - Harnessing Nanostructures

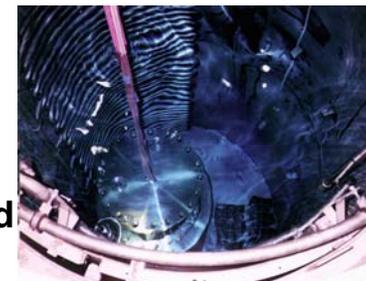
## Biofuels

- Next Generation Biofuels
  - New Feedstocks
  - Improved Energy Crops
  - Integrated Biorefineries

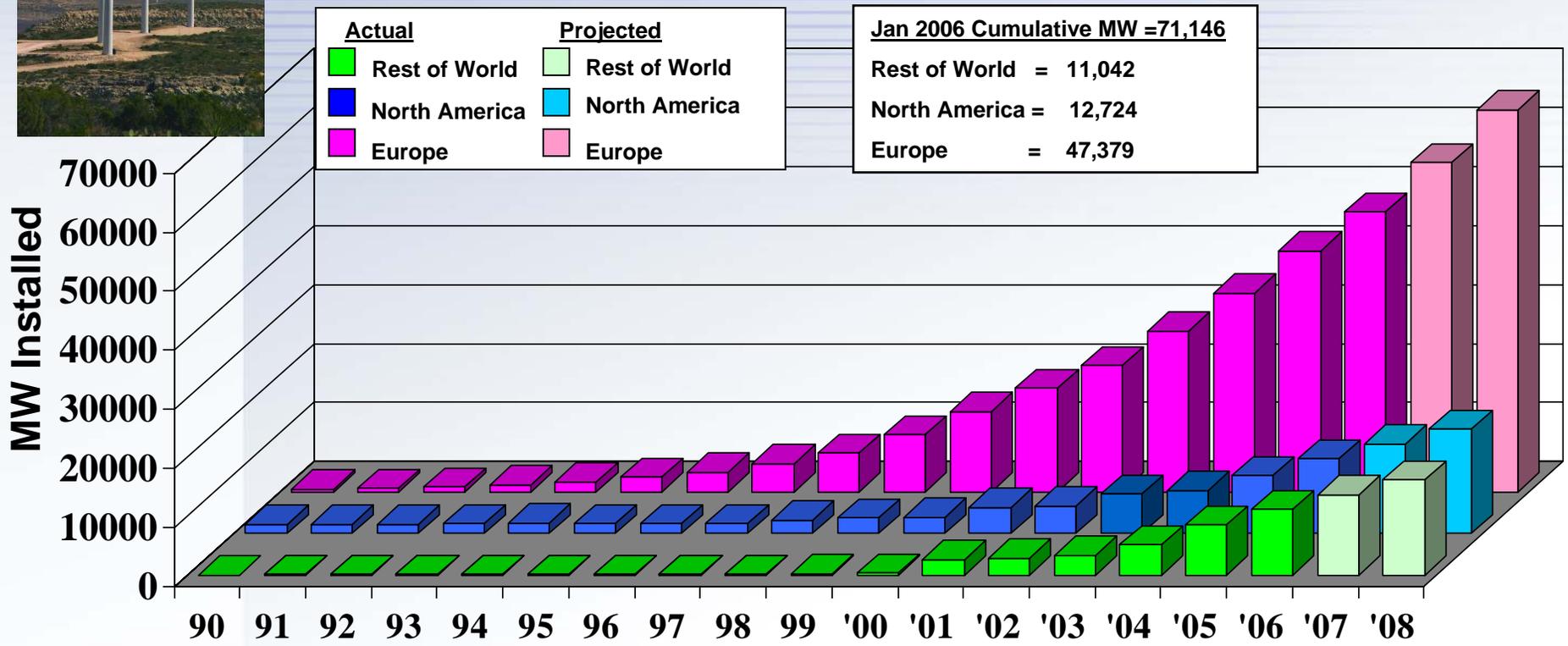


## Nuclear

- Closing the Fuel Cycle
- Advanced Reactor Development
- Reliability of Safety and Security Systems



# Growth of Wind Energy Capacity Worldwide



**Jan 2006 Cumulative MW = 71,146**  
 Rest of World = 11,042  
 North America = 12,724  
 Europe = 47,379

**Year End 2006 Cumulative MW\***  
 US = 11,698 (~22% incr.)

Sources: BTM Consult Aps, March 2006  
 Windpower Monthly, January 2007



# United States Wind Power Rankings

## The Top 20 States

Table 2. United States Wind Power Rankings: The Top 20 States

Cumulative Capacity (end of 2006, MW)		Incremental Capacity (2006, MW)		Approximate Percentage of Retail Sales*	
Texas	2,739	Texas	774	New Mexico	7.3%
California	2,376	Washington	428	Iowa	6.0%
Iowa	931	California	212	North Dakota	5.1%
Minnesota	895	New York	185	Wyoming	5.1%
Washington	818	Minnesota	150	Minnesota	3.8%
Oklahoma	535	Oregon	101	Oklahoma	3.5%
New Mexico	496	Kansas	101	Montana	3.3%
Oregon	438	Iowa	99	Kansas	3.1%
New York	370	New Mexico	90	Oregon	2.4%
Kansas	364	North Dakota	80	Texas	2.3%
Colorado	291	Oklahoma	60	Washington	2.3%
Wyoming	288	Colorado	60	California	2.1%
Pennsylvania	179	Pennsylvania	50	Colorado	1.7%
North Dakota	178	Hawaii	41	South Dakota	1.5%
Montana	146	Montana	9	Nebraska	1.0%
Illinois	107	Maine	9	Hawaii	1.0%
Idaho	75	Massachusetts	2	Idaho	0.7%
Nebraska	73	New Hampshire	1	New York	0.6%
West Virginia	66	Rhode Island	0.7	West Virginia	0.6%
Wisconsin	53	Ohio	0.2	Pennsylvania	0.3%
Rest of U.S.	156	Rest of U.S.	0.3	Rest of U.S.	0.02%
<b>TOTAL</b>	<b>11,575</b>	<b>TOTAL</b>	<b>2,454</b>	<b>TOTAL</b>	<b>0.85%</b>

**New Mexico leads the Country in the approximate percentage of retail sales**

***Reliable Wind Energy is Critical to New Mexico's Future!***

\*Assumes that wind installed in a state serves that state's electrical load; ignores transmission losses.

Source: AWEA/GEC database and Berkeley Lab estimates.

# Key Attributes of Future Energy Systems

*“Surety - Safety, Security, and Reliability”*

## Energy Surety Requirements

<b>Safe</b>	<b>Safely supplies energy services to end user</b>
<b>Secure</b>	<b>Resists malevolently caused disruptions</b>
<b>Reliable</b>	<b>Maintains delivery when and where needed</b>
<b>Sustainable</b>	<b>Matches resources with needs</b>
<b>Cost Effective</b>	<b>Delivers energy services at lowest predictable cost</b>

# Sandia National Laboratories

*It's all About People.....*



**End of Presentation**