SAND2011-6430P

Energy, Climate, & Infrastructure Security (ECIS) Overview

Rick Stulen, ECIS SMU Vice President

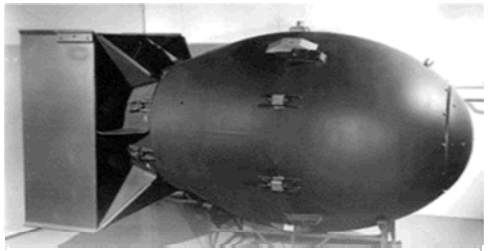
2011 Wind Turbine Reliability Workshop
August 2, 2011

Sandia National Laboratories is a multi program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

Sandia's History

"Exceptional service in the national interest"



THE WHITE HOUSE
WASHINGTON

May 13, 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. C. E. Buckley.

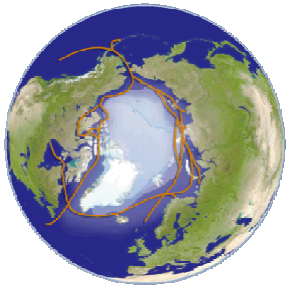
Very sincerely yours,

Harry Truman

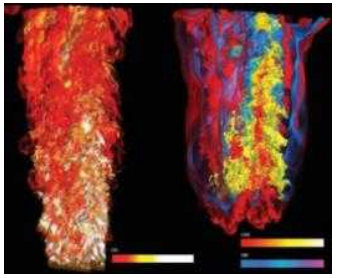
Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.

Sandia National Laboratories

Sandia is a science-based engineering research and development laboratory

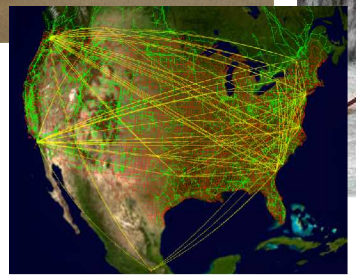


Energy, Climate & Infrastructure Security



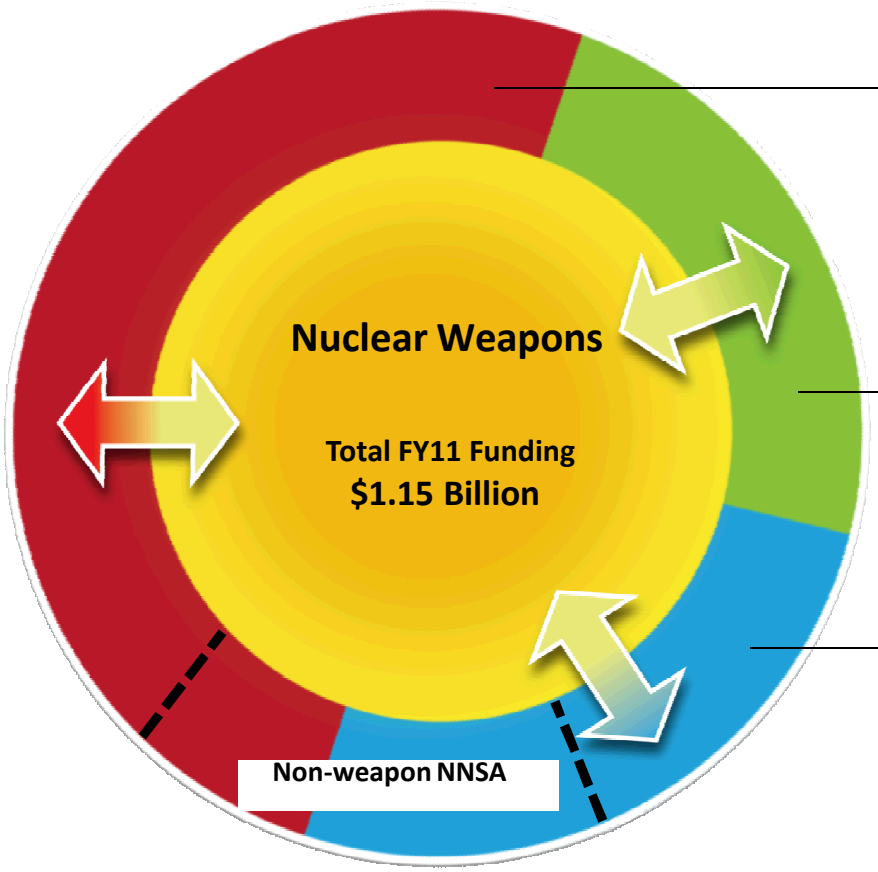
Nuclear Weapons

International, Homeland & Nuclear Security



Defense, Systems & Assessments

Our nuclear weapons capabilities enable broader national security missions



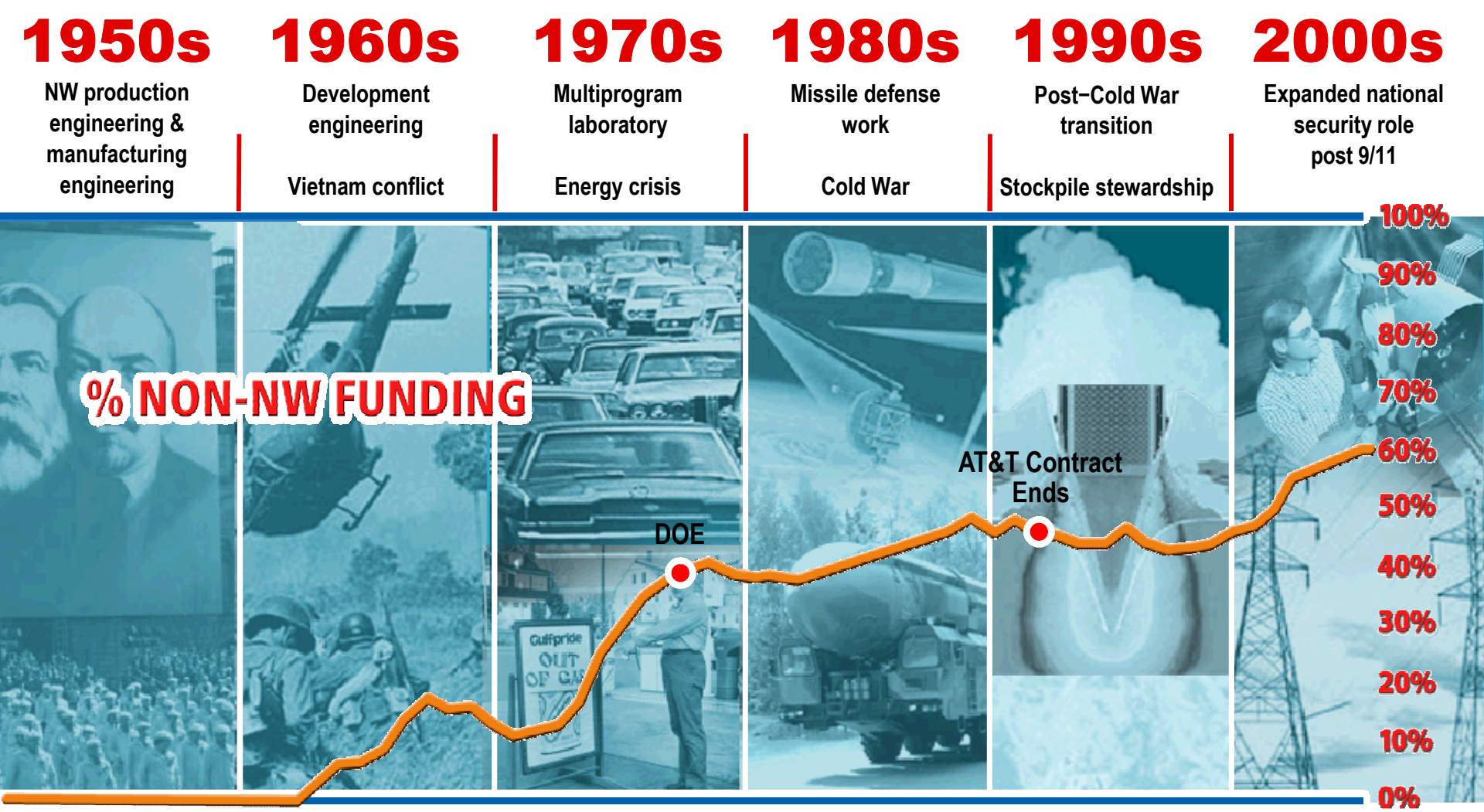
Defense Systems & Assessments
Department of Defense, Intelligence,
and Non-weapon NNSA
$728M

Energy, Climate & Infrastructure Security
Department of Energy, Non-NNSA
Department of Homeland Security
Department of Defense
$301M

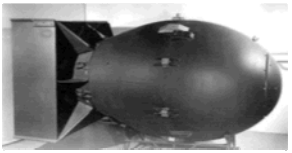
International, Homeland, and Nuclear Security
Department of Homeland Security,
Department of Defense,
Department of Energy,
Department of Health and Human Services,
and Federal Aviation Administration
$268M

High reliability, high consequence of failure, challenging environments, and technology solutions

Sandia's mission work reflects the nation's security challenges



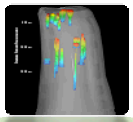
History of Sandia Energy Programs



Sandia was born as a nuclear weapons engineering laboratory with deep science and engineering competencies

Energy crisis of the 1970s spawned the beginning of significant energy work

Strategic Petroleum Reserve –geological characterization of salt domes to host oil storage caverns

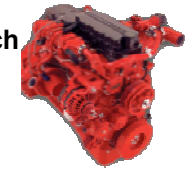


DOE's Tech Transfer Initiative was established by Congress in 1991

Advent Solar

Energy Policy Act of 2005

Combustions Research Facility (CRF) & Cummins partner on their newest diesel engine



Joint BioEnergy Institute

1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2007 | 2010

Our core NW competencies enabled us to take on additional large national security challenges

Vertical axiswind turbine

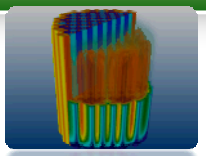
NRC cask certification studies & core melt studies

Solar Tower opens

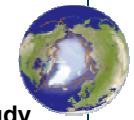
CRF opens to researchers

Power grid reliability study

Sunshine to Petrol Pilot Test



Consortium for Advanced Simulation of Light Water Reactors (CASL)



Climate study uncertainties to economies

SunCatcher™ partnership with Stirling Energy Systems

Large-scale pool fire tests of liquefied natural gas (LNG) on water

Combustion Research Computation and Visualization (CRCV) opens

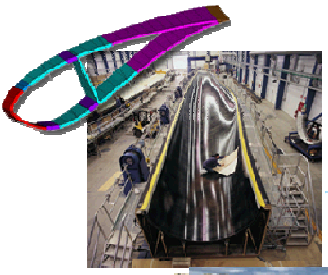
Distributed Energy Technology Laboratory (DETL) to integrate emerging energy technologies into new and existing electricity infrastructures

Program Areas

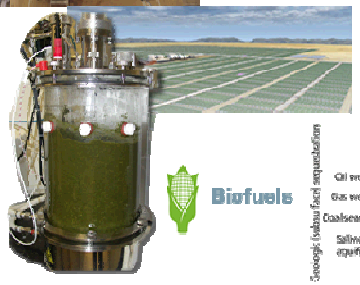
Energy	Climate	Infrastructure	Enabling Capabilities
Renewables	Sensing and Monitoring	Modeling Analysis	Discovery
Nuclear	Modeling and Analysis	Cyber	Systems Analysis
Transportation	Carbon Management	Electricity	Regulations and Policy
Efficiency	Water	Energy Assurance	ARPA-E
		International Assurance	

Energy Security Program

Renewable Energy



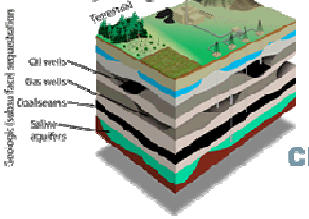
Wind



Biofuels

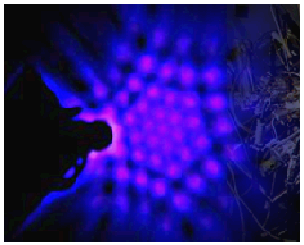
Solar

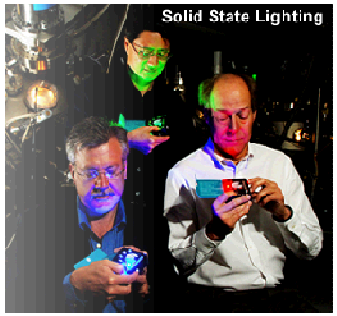
Geothermal



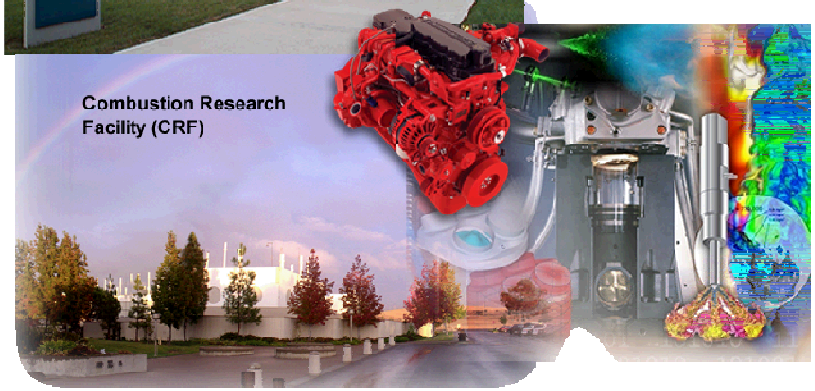
Clean Coal

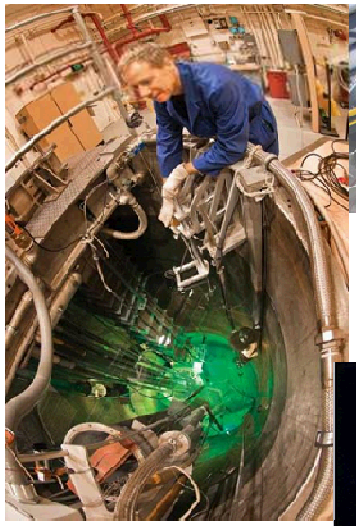
Energy Efficiency

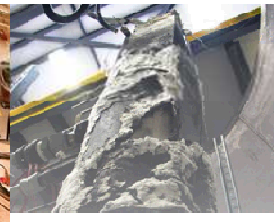


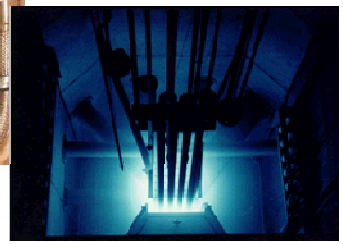


Energy for Transportation









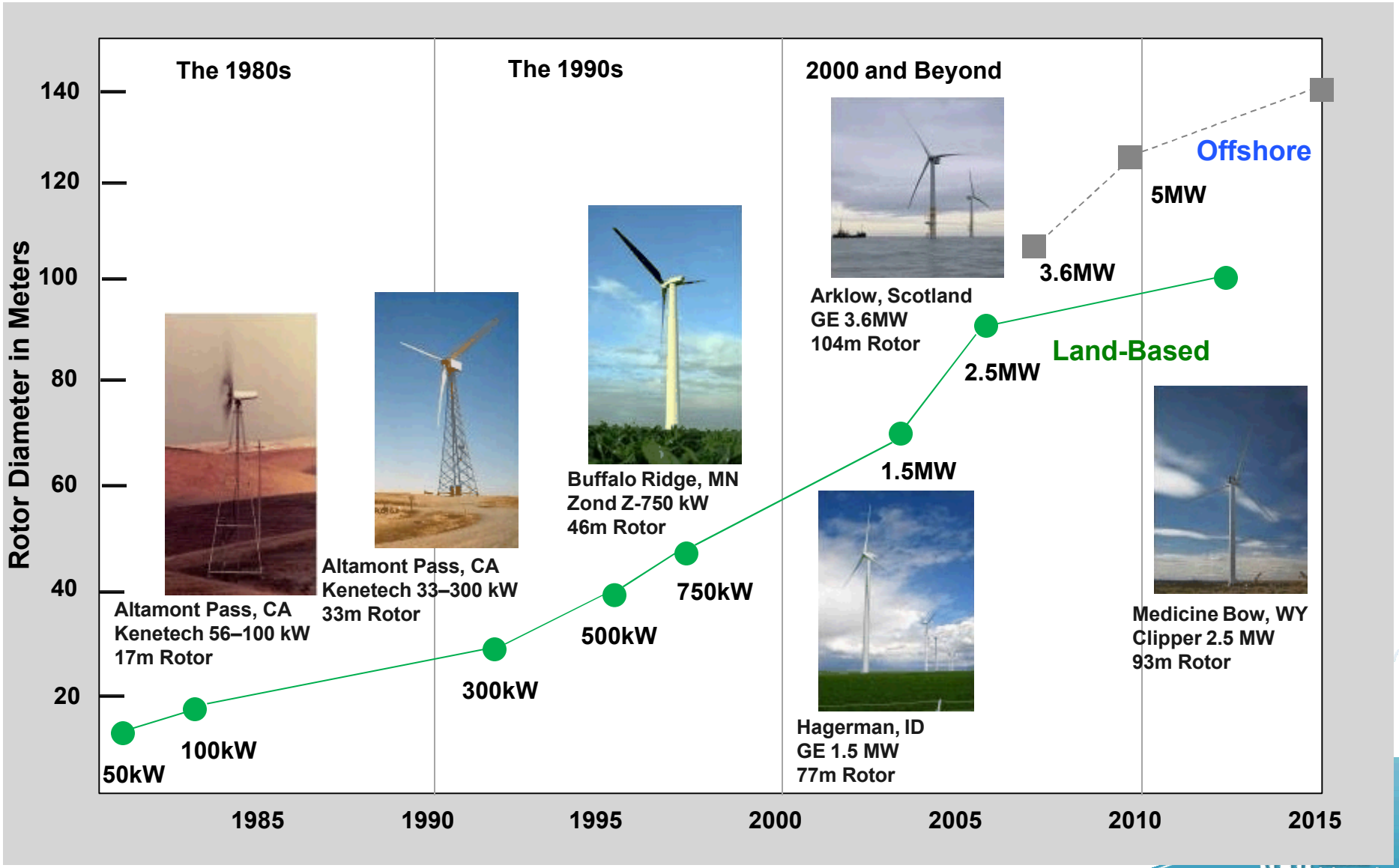
Nuclear Energy Systems

Sandia National Laboratories

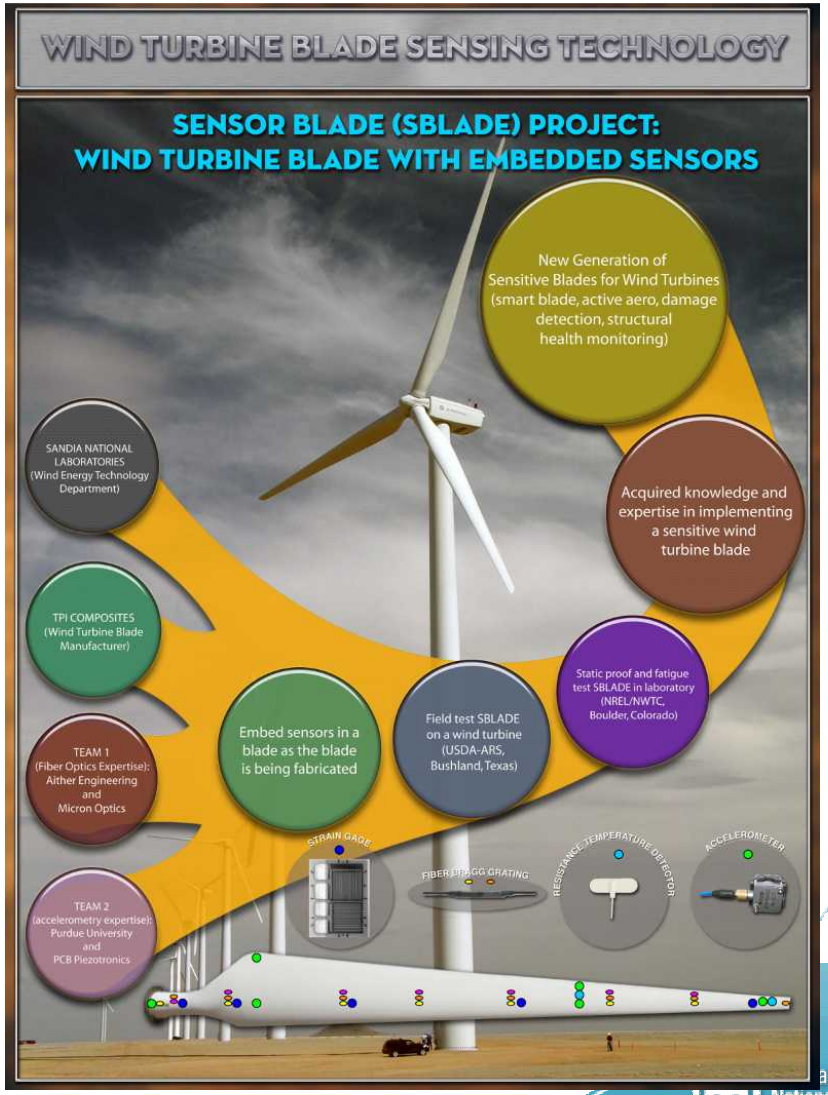
Energy Program Area Goals

- Develop advanced solar technologies to allow a domestic solar industry to deliver at less than 10 cents per KW/hr.
- Demonstrate 12.5% sunlight to syngas that will enable a > 10% lifecycle sunlight to fuel.
- Develop nuclear reactor designs for the deployment of Small Modular Reactors at DoD installations by 2021.
- Complete a deep borehole disposal system demonstration project with industry that will transform nuclear waste management.
- Provide new design tools necessary for industry to reduce CO_2 and petroleum footprint of the transportation sector by 25%.

U.S. Commercial Wind Technology



Smart Blades with Higher Efficiency
"Technology Enhancement"



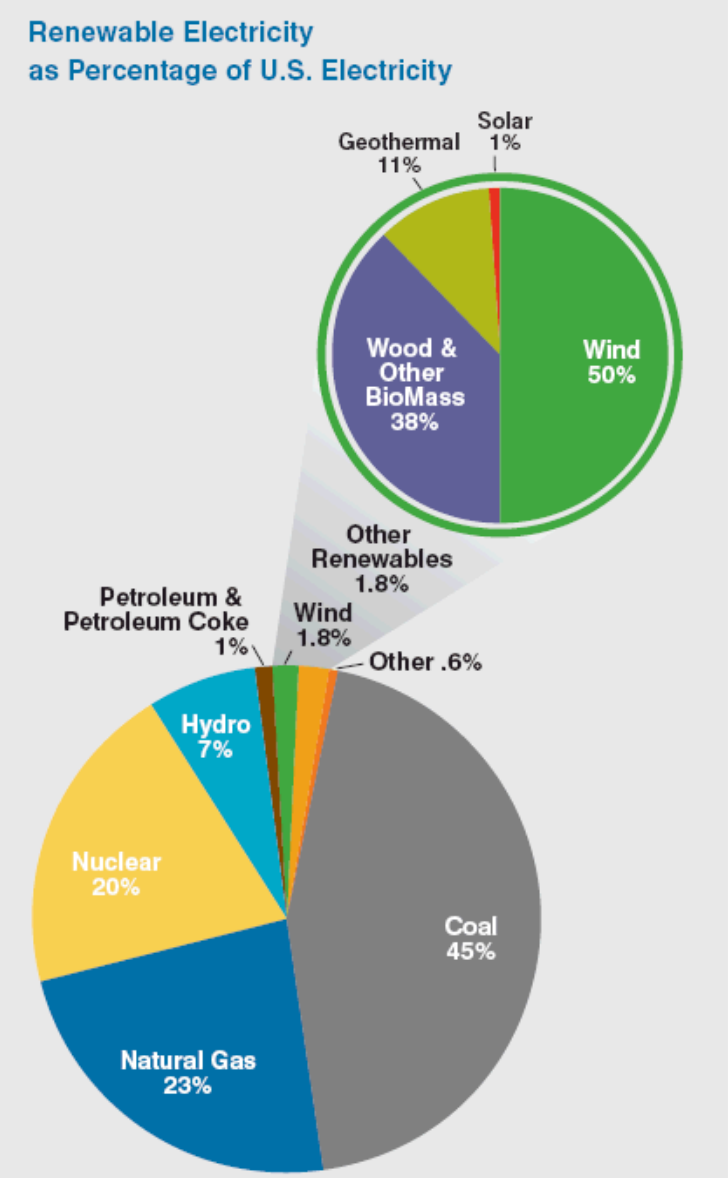
National Laboratories

Administration's National Green Goals

- Double renewable energy capacity by 2012
- 10% renewable energy by 2012
- 25% renewable energy by 2025
- Create 5 million new green jobs
- 80% GhG reduction (from 1990 levels) by 2050

Renewables have Strong Policy Support from Administration & Congress

Renewable Energy Today (U.S. Mix)

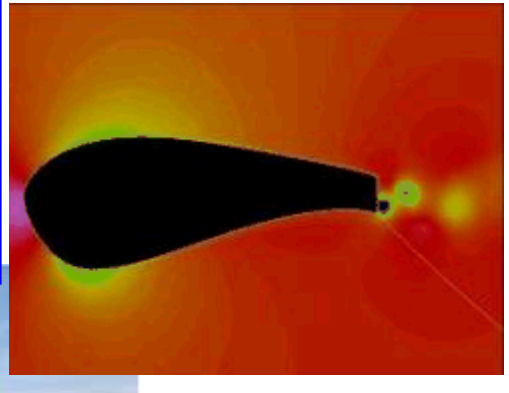


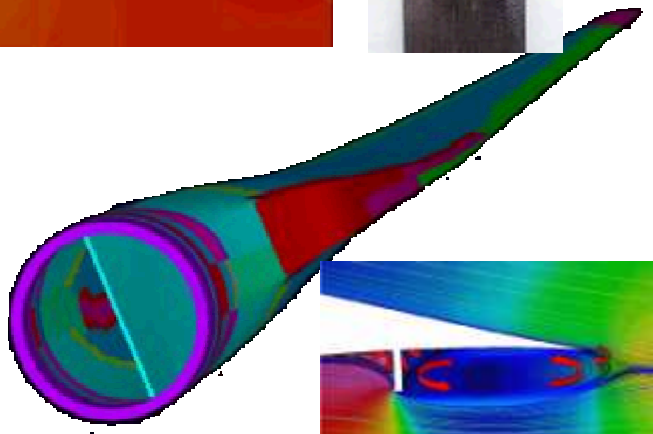
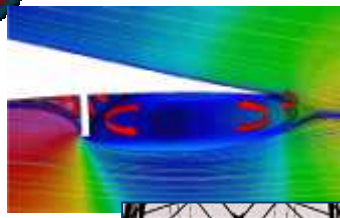
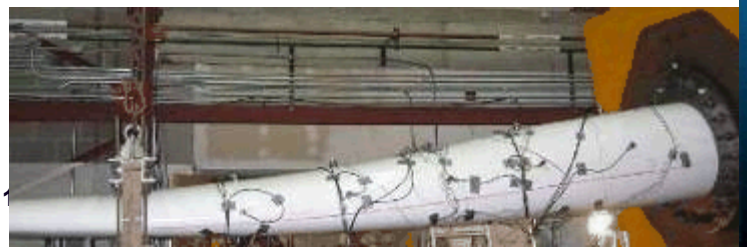
- All renewable energy sources provided 10.5% of the U.S. power mix in 2009
- Wind generation is approaching the two percent mark of the U.S. power mix, reaching 1.8% of U.S. generation in 2009
- Hydro generation is approximately 7%. DOE focus and investment in efficiency upgrades and water use optimization

Source: American Wind Energy Association U.S. Wind Industry Annual Market Report – Year Ending 2009

SNL's Wind & Water Power Program

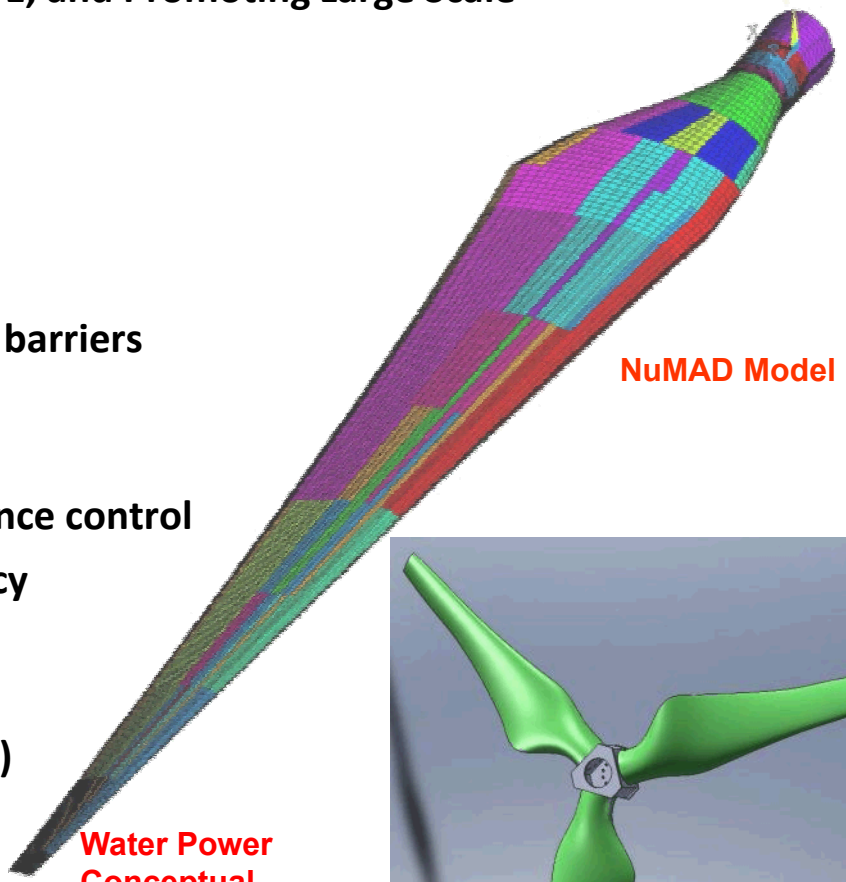
- **Wind Energy**
  - **Research Activities**
    - Materials and Manufacturing
    - Structural, Aerodynamic, and Full System Modeling
    - Sensors and Structural Health Monitoring
    - Advanced Blade Concepts
    - Lab - Field Testing and Data Acquisition
  - **System Reliability**
    - Industry Data Collection
    - Improve reliability of the existing technology and future designs
    - Blade Reliability Collaborative
  - **System Integration & Outreach**
    - Wind/RADAR Interaction
    - Integration Assessment
    - SNL Wind Farm Feasibility
- **Advanced Water Power**
  - Lead Lab for MHK Technology and Environmental Analysis
  - Supporting R&D on Conv. Hydro

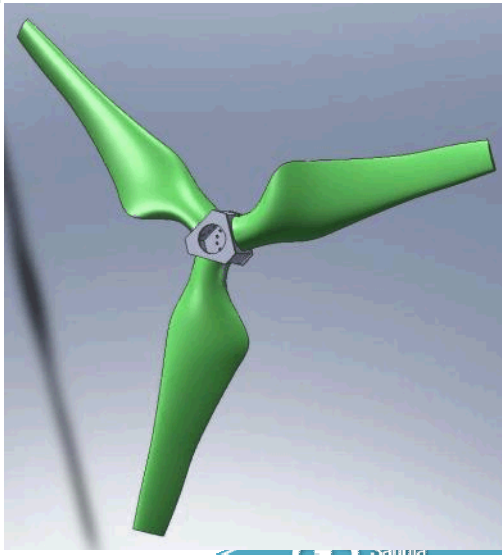






Program Focus

- **Program Focused on Industry Needs, Reducing COE, and Promoting Large Scale Deployment of Clean Affordable Energy**
  - **Higher fidelity modeling**
    - **Component structural modeling**
    - **Aerodynamics**
    - **Full system dynamics**
  - **Improve blade design to eliminate upcoming barriers**
    - **Transportation (segmented blades)**
    - **Siting: Wind Radar**
    - **Embed sensors in blades to enable advance control**
  - **Increase energy capture & improved efficiency**
    - **Active aerodynamic control**
    - **Advanced control research**
    - **Prognostic & Health Management (PHM)**
  - **Increase system reliability**
    - **National reliability database**
    - **Blade Reliability Collaborate (BRC)**
  - **Support Environmental Stewardship & Energy Independence**
    - **Renewable energy feasibility studies**
    - **Biological response analysis**



NuMAD Model



Water Power Conceptual Blade/Hub Interface

Working with Industry

System analysis identifies research initiatives with increasing industry involvement as it gets closer to the commercial product