

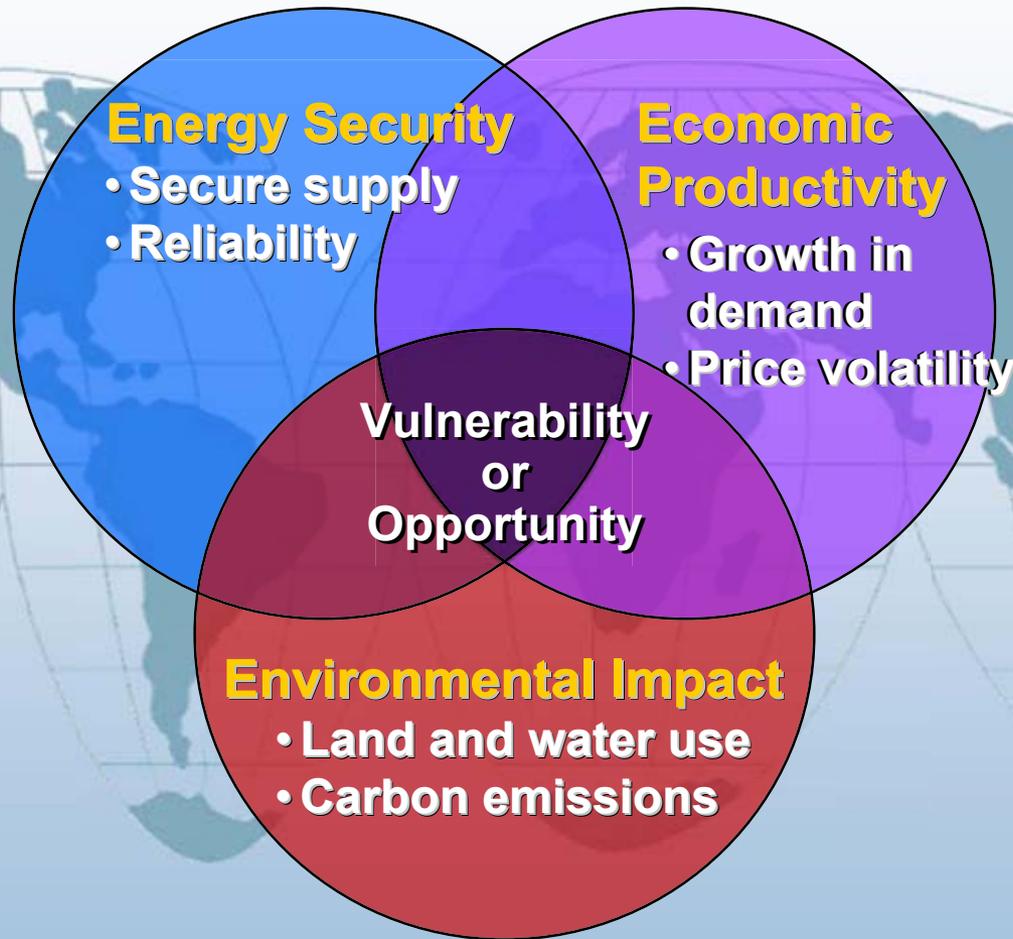
NREL Overview

DOE EPSCoR Annual Program Review and Workshop

July 24, 2008

Joseph M. Cleary
National Bioenergy Center
National Renewable Energy Laboratory

Energy Solutions Are Enormously Challenging



We must address all three imperatives

National Renewable Energy Laboratory

What Makes Us Unique?

- Only national laboratory dedicated to renewable energy and energy efficiency R&D
- Research spans fundamental science to technology solutions
- Collaboration with industry and university partners is a hallmark
- Research is market relevant because of a systems focus



NREL Energy Efficiency and Renewable Energy Technology Development Programs



Efficient Energy Use

- Vehicle Technologies
- Building Technologies
- Industrial Technologies



Renewable Resources

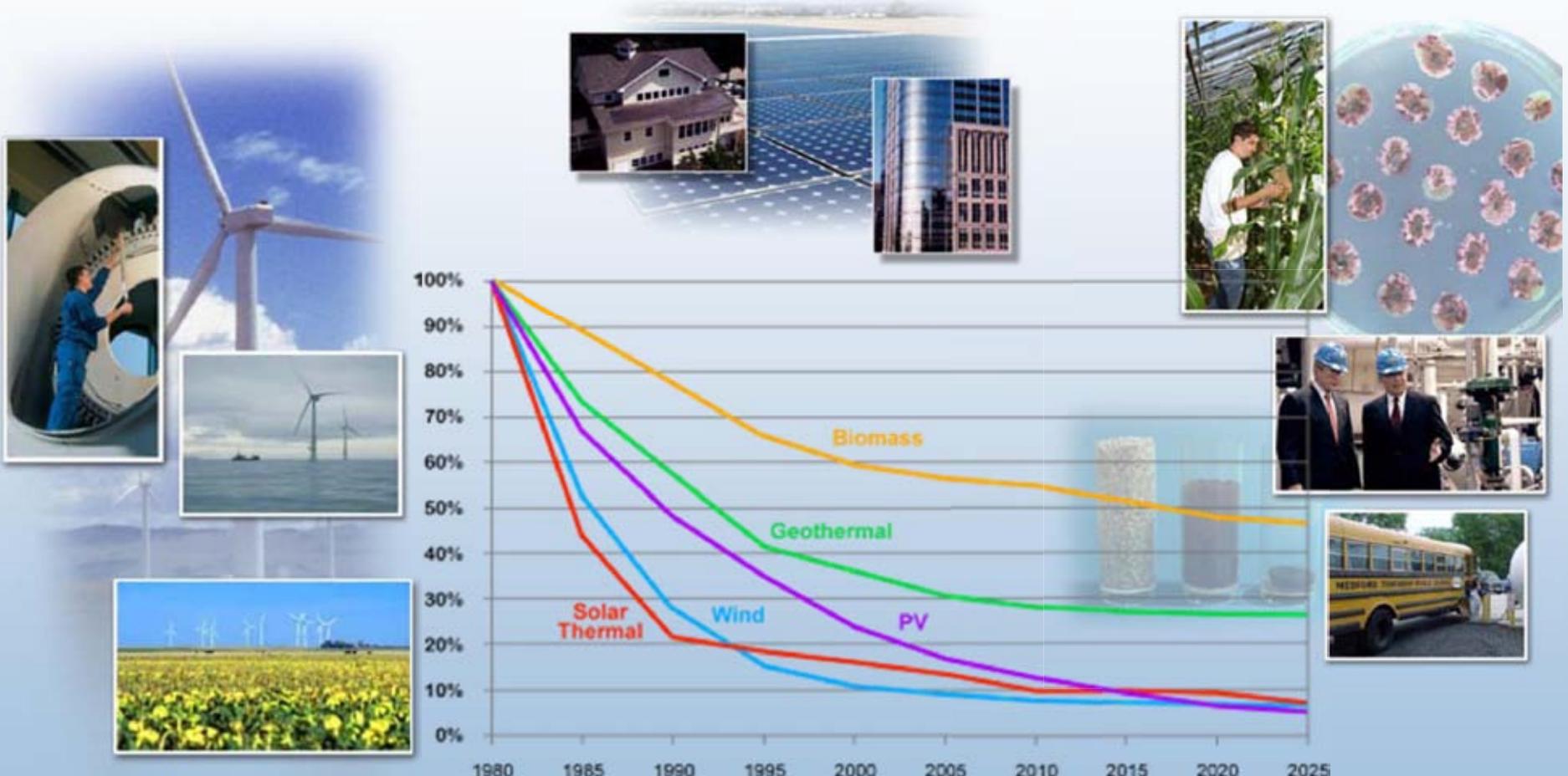
- Wind
- Solar
- Biomass
- Geothermal



Energy Delivery and Storage

- Electricity Transmission and Distribution
- Alternative Fuels
- Hydrogen Delivery and Storage

R&D Investments Have Yielded Impressive Cost Reductions



Wind

Today's Status in U.S.

- 11,603 MW installed at end of 2006
- Cost 6-9¢/kWh at good wind sites*

DOE Cost Goals

- 3.6¢/kWh, onshore at low wind sites by 2012
- 7¢/kWh, offshore in shallow water by 2014

Long Term Potential

- 20% of the nation's electricity supply

NREL Research Thrusts

- Improved turbine performance and reliability
- Distributed wind technology
- Drivetrain reliability
- Utility grid integration



* With no Production Tax Credit

Updated 1/07, validated 7/07

Source: U.S. Department of Energy, American Wind Energy Association

Solar

Photovoltaics and Concentrating Solar Power

Status in U.S.

PV

- 565 MW
- Cost 18-23¢/kWh

CSP

- 420 MW
- Cost 12¢/kWh

Potential:

PV

- 11-18¢/kWh by 2010
- 5-10 ¢/kWh by 2015

CSP

- 8.5¢/kWh by 2010
- 5-7¢/kWh by 2020

NREL Research Thrusts:

PV

- Partnering with industry
- Higher efficiency devices
- New nanomaterials applications
- Advanced manufacturing techniques

CSP

- Next generation solar collectors
- High performance storage



Source: U.S. Department of Energy, IEA, Solar Energy Technologies Program Multi-Year Plan 2007

Updated July 2007

Buildings

Status U.S. Buildings:

- 39% of primary energy
- 71% of electricity
- 38% of carbon emissions

DOE Goal:

- Cost effective, marketable zero energy buildings by 2025
- Value of energy savings exceeds cost of energy features on a cash flow basis

NREL Research Thrusts

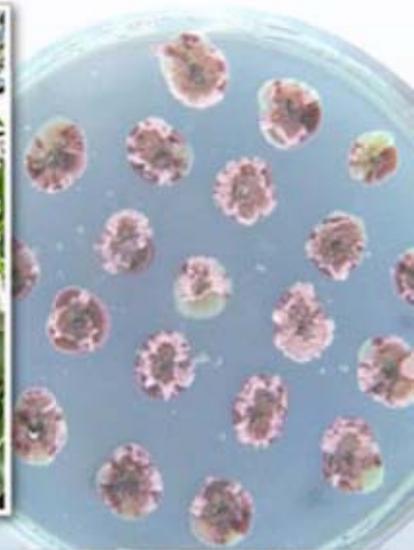
- Whole building systems integration of efficiency and renewable features
- Computerized building energy optimization tools
- Building integrated PV



Biofuels

Current Biofuels status

- Biodiesel – 1.3 billion gallons/yr capacity¹
- Corn ethanol
 - 121 commercial plants²
 - 6.3 billion gal/yr. capacity²
 - Additional 6.2 billion gal/yr planned or under construction
- Cellulosic ethanol (current technology)
 - Projected commercial cost ~\$3.50/gge



Key DOE Goals

- 2012 goal: cellulosic ethanol ~\$1.62/gge
- 2017 goal : 35 billion gal alternative fuel – President
- 2022 goal: 36 billion gal renewable fuel – Congress/draft
- 2030 goal: 60 billion gal ethanol (30% of 2004 gasoline)



NREL Research Thrusts

- The biorefinery and cellulosic ethanol
- Solutions to under-utilized waste residues
- Energy crops



Updated July 2007

Sources: 1- National Biodiesel Board, 2 - Renewable Fuels Association, all other information based on DOE and USDA sources

The U.S. Department of Energy's National Renewable Energy Laboratory

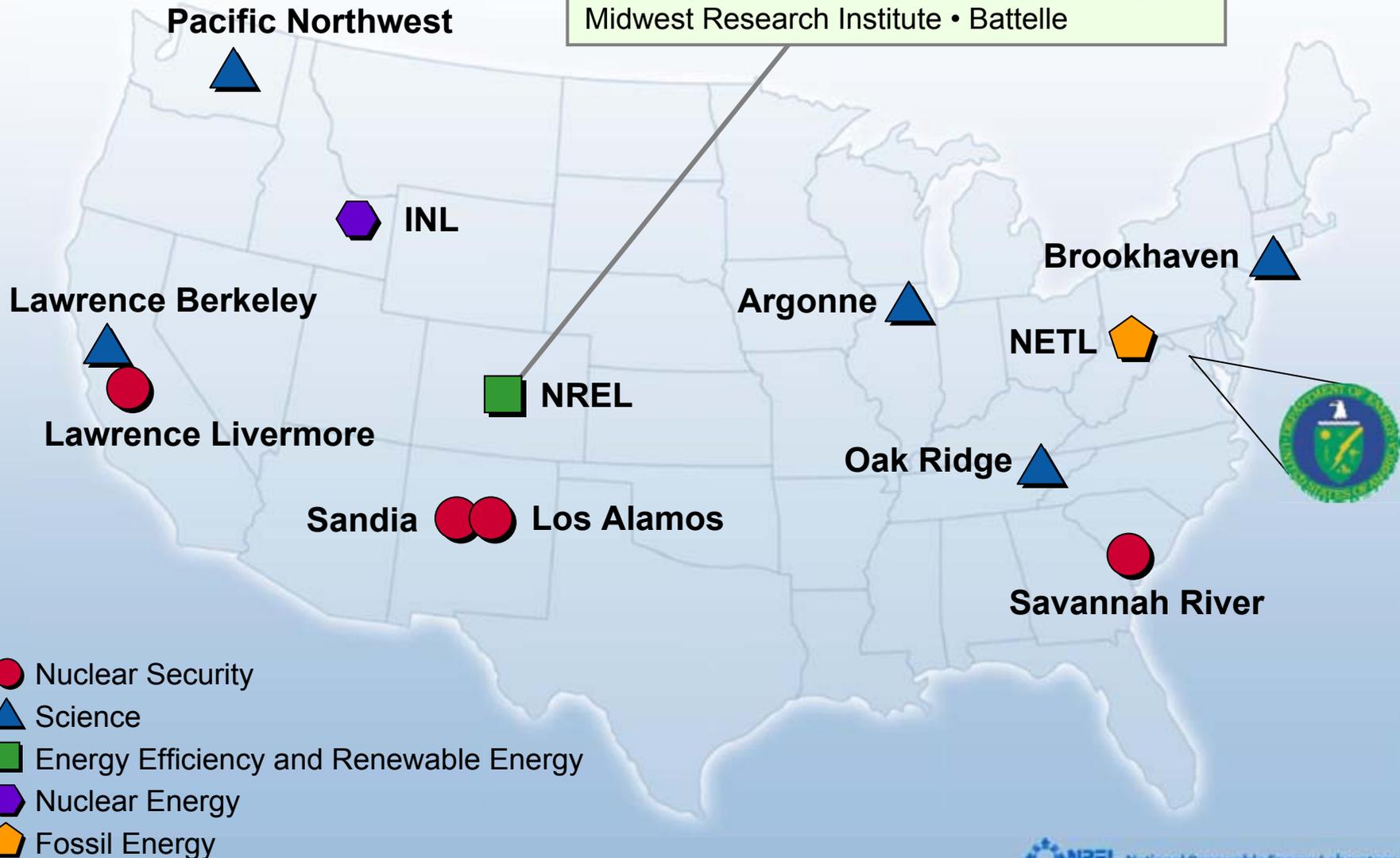
www.nrel.gov



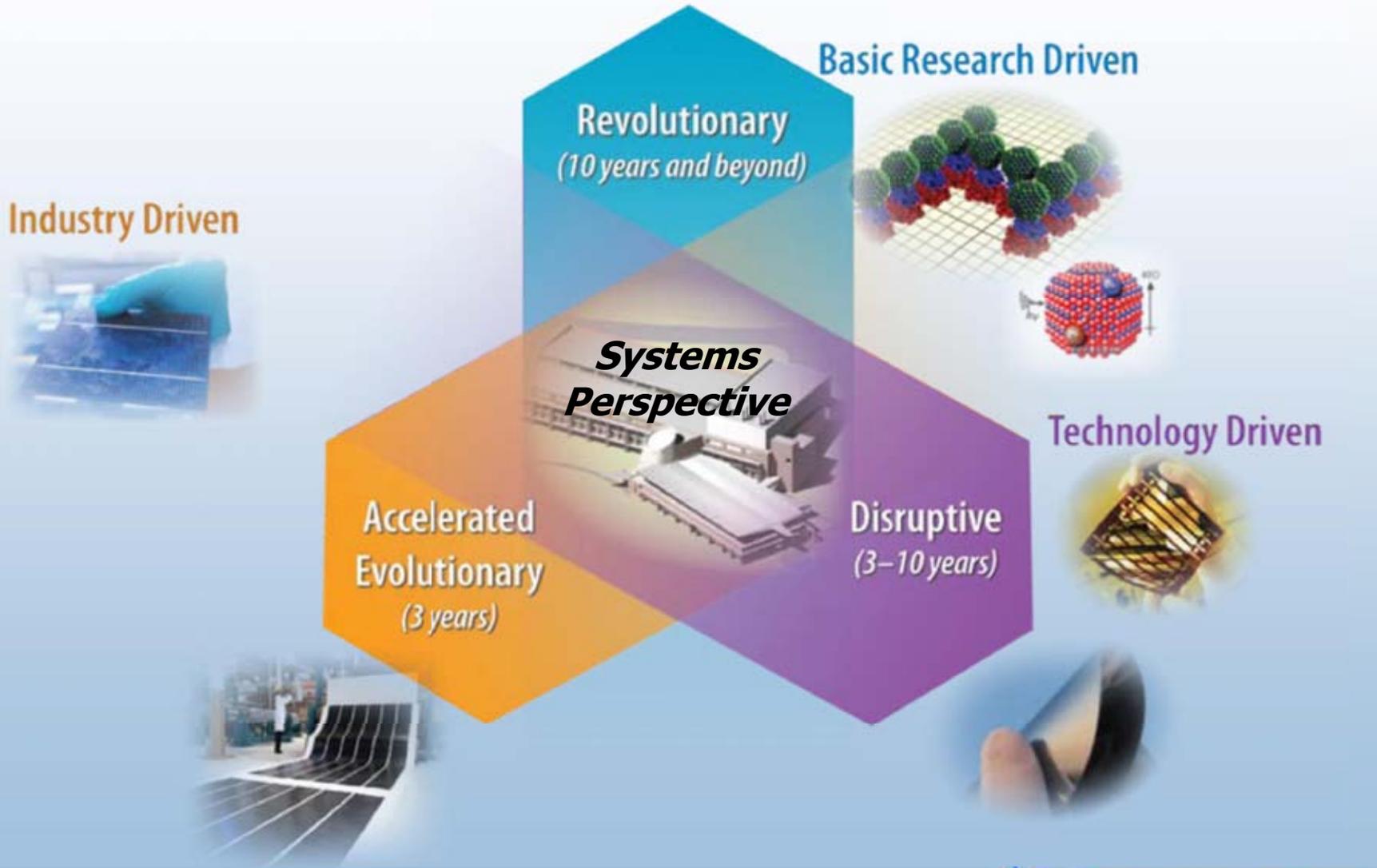
Golden, Colorado

Major DOE National Laboratories

Operated for the U.S. Department of Energy by
Midwest Research Institute • Battelle



Accelerating Progress



Positioning NREL to Meet Emerging Challenges

- Infrastructure buildout and workforce development
- National roles for DOE and NREL
 - DOE
 - Promoting innovation
 - Harnessing market forces
 - Leading by example
 - NREL's unique role
 - Innovator – accelerating benefits by working at the interface of research and markets
 - Technical integrator – systems level solution orientation
 - Credibility and objective advisor – providing technical risk assessments for markets and policy

NREL: A Model for Energy and Environmental Leadership

Science and Technology Facility achieves LEED 'Platinum'

- First Federal building
- One of only three laboratory facilities
- One of only 28 buildings worldwide

NREL Site is "Carbon Neutral"

- Onsite renewables (PV and Wind)
- Renewable Energy Certificate (REC) purchases

Renewable Fuel Heating Plant In Progress

- Will offset 75% of current South Table Mountain campus natural gas use (significant on-site RE project)
- Financed and installed through Energy Savings Performance Contract (ESPC)

Energy Policy Act and Executive Order Requirements

- Currently exceeding EAct requirements
- Expect to meet or exceed new Executive Order requirements

Vehicle Fleet

- 48 vehicles, 34 (71%) are alternatively fueled
- Fleet petroleum reduced ~45% since 2000

