

Energy and Environment R&D at Pacific Northwest National Laboratory

Mike Davis, Associate Laboratory Director
Energy and Environment Directorate

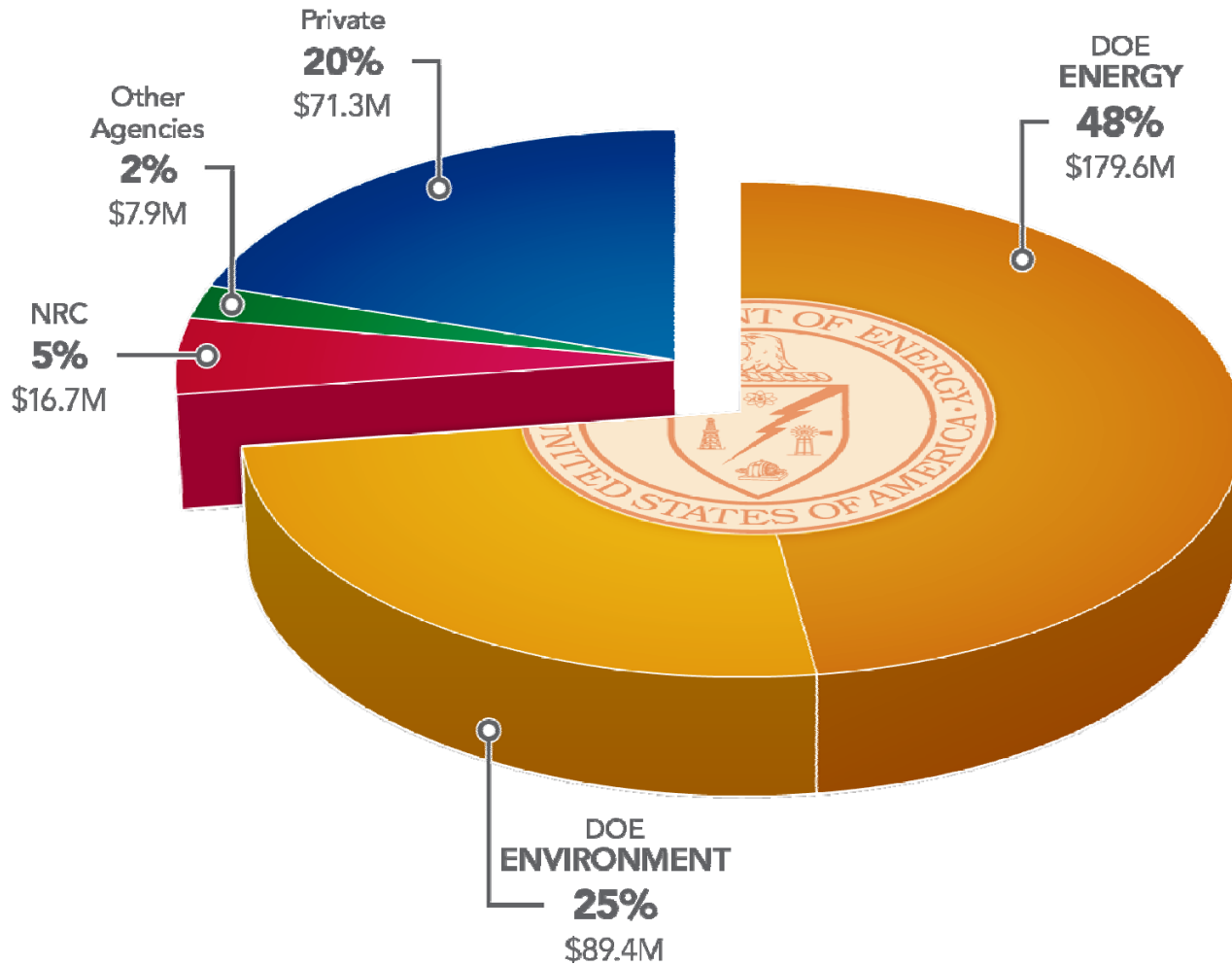


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Energy and Environment Business at PNNL

FY2010 Sales: \$365M



- Business areas include:**
- Clean Fossil Energy
 - Electricity Infrastructure and Energy Reliability
 - Energy Efficiency and Renewable Energy
 - Environmental Health and Remediation
 - Nuclear Energy
 - Nuclear Regulatory



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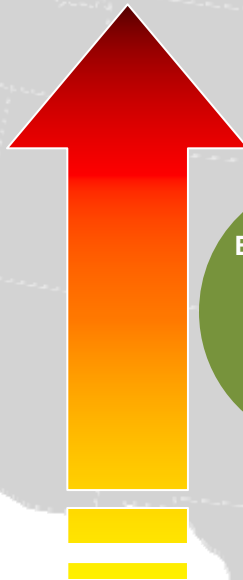
The nation and the world are not solving the big problems fast enough



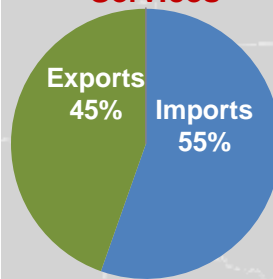
Environmental Challenges

Reduce environmental effects of human activity and create sustainable systems

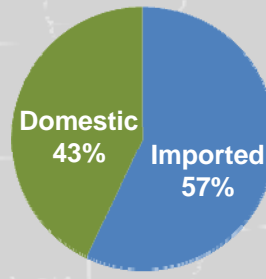
Carbon Emissions



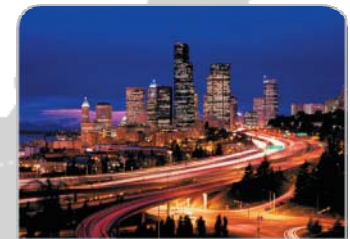
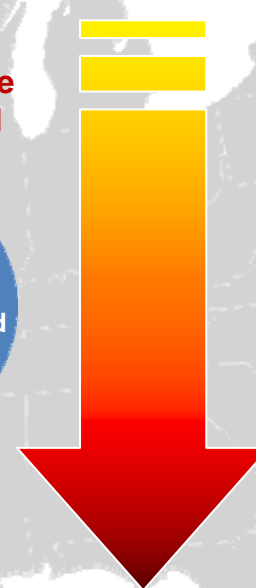
U.S. Goods and Services



U.S. Dependence on Imported Oil



Domestic Content



Energy Challenges

Increase U.S. energy capacity and reduce dependence on imported oil

How can science and technology provide a clearer understanding of these challenges and advance innovation to reverse the trends?

EED Roadmap to:

- » Build a great organization
- » Deliver national impact
- » Act with a sense of urgency

THOUGHT LEADERSHIP

- » Test ideas
- » Build advocacy
- » Solidify value propositions
- » Shape opportunities
- » Build partnerships

PLANNING & ASSESSMENT

- » Allocation of resources
- » Measurement of performance and outcomes
- » Goal setting

LEADERSHIP TARGETS



Emissions Capture & Storage



Grid of the Future



Buildings Energy Efficiency



Nuclear Power

OPPORTUNITY LANDSCAPE

- » Energy Innovation Hubs
- » Advanced Research Projects Agency-Energy
- » Energy Frontier Research Centers
- » Customer program plans

LEAN FOSSIL ENERGY



ELECTRIC INFRASTRUCTURE



ENERGY EFFICIENCY AND RENEWABLE ENERGY



ENVIRONMENTAL HEALTH AND REMEDIATION



NUCLEAR ENERGY



NUCLEAR REGULATORY



CORE BUSINESS AREAS

Mission Outcomes

Increase U.S. Energy Capacity and Reduce Dependence on Imported Oil

Reduce Environmental Effects of Human Activity and Create Sustainable Systems

We are accelerating discovery and deployment in areas of significant impact



Emissions Capture & Storage

Accelerating CCS deployment through integrated emissions management



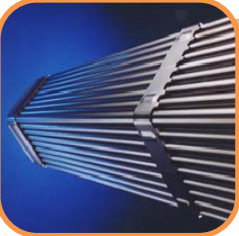
Grid of the Future

Leading the Nation's transformation to the future smart grid



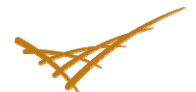
Buildings Energy Efficiency

Removing barriers and accelerating solutions to smart and efficient buildings



Nuclear Power

Enabling a sustainable energy future with clean base load power



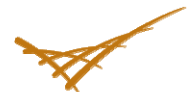
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Emissions capture and storage



- ▶ Process modeling to evaluate the cost and performance benefits of separating CO₂, SO_x, NO_x and the implications on geological storage integrated emissions
- ▶ Materials discovery, design, synthesis and evaluation for emissions capture
- ▶ Subsurface science and modeling for integrated sequestration systems design, risk assessment and monitoring
- ▶ Partnerships for first-of-a-kind demonstrations



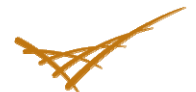
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Grid of the Future



- ▶ Real-time, wide-area situational awareness and data management
- ▶ Data-driven models, simulation, visual analytics and accurate energy forecasting to accelerate penetration of plug-in hybrids vehicles, distributed and large-scale renewable generation, and energy storage
- ▶ Network architecture for a dynamic, secure, real time “data highway”
- ▶ Cyber security tools compatible with real-time operations
- ▶ Tools for long-term grid planning and evaluation of new paradigms



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Buildings and community efficiency



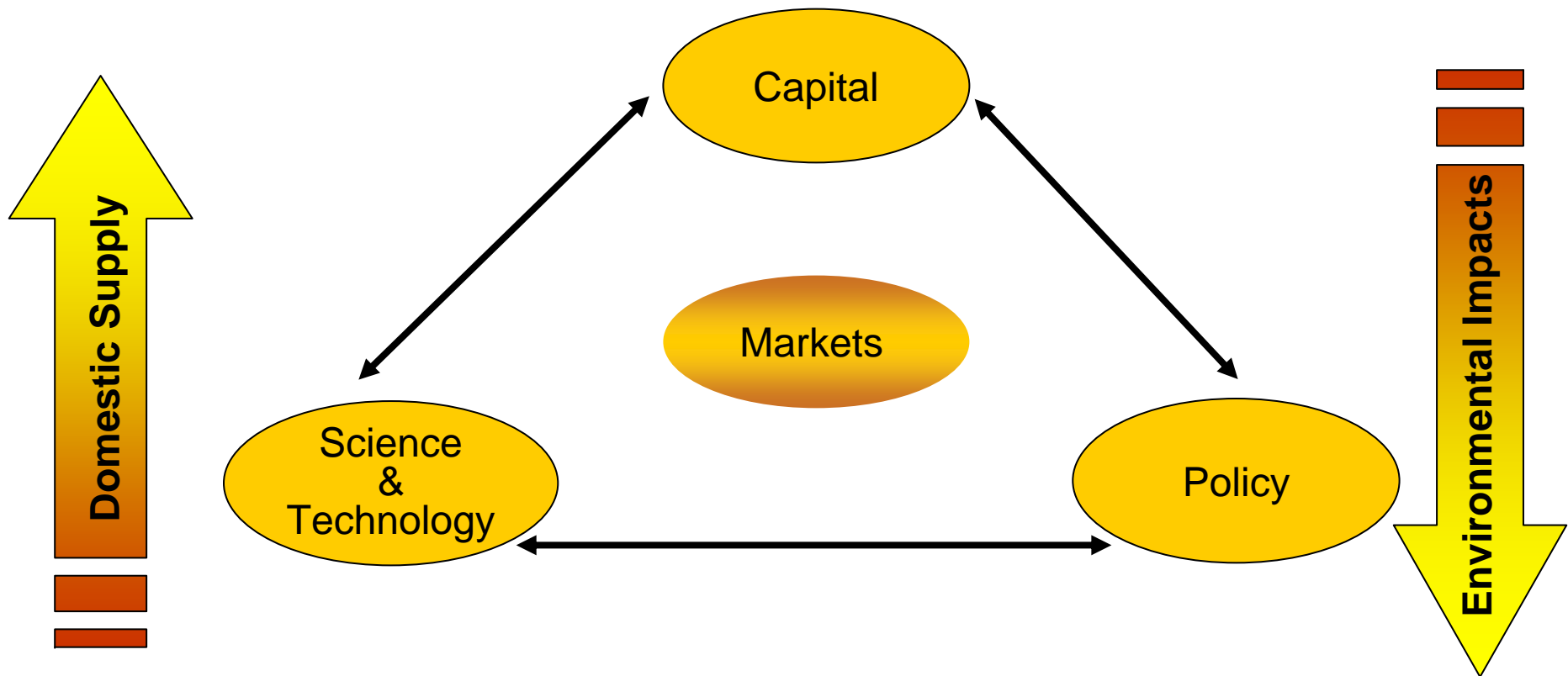
- ▶ Technologies to combine smart and efficient building operations
- ▶ Multi-disciplinary approach to address technological, financial, policy and sociological barriers to building energy efficiency
- ▶ Energy codes and standards for commercial and residential buildings and appliances
- ▶ Efficiency monitoring technology
- ▶ Materials design and synthesis and market transformation for advanced lighting

Nuclear Power



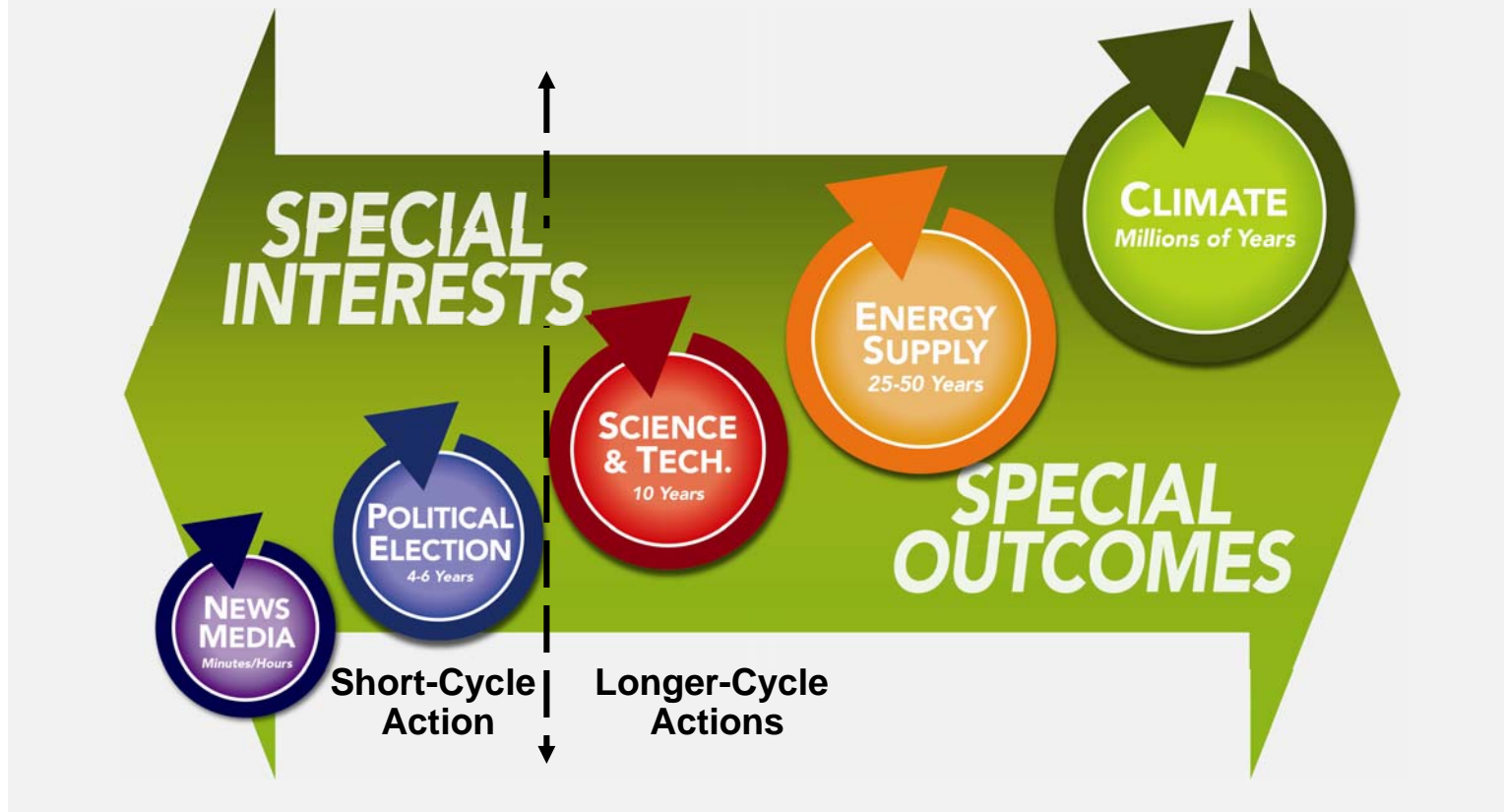
- ▶ Real-time performance of fuels, materials, waste forms, and radiochemical processing
- ▶ Real-time feedback for R&D to enable rapid development of fuel cycle concepts
- ▶ Transition from reactive to proactive look at fuels and materials to enhance reliability
- ▶ Technologies to facilitate the remote, near-real time assay safeguard demands of the next generation reprocessing
- ▶ Validated performance models for storage and disposal environments

We recognize the critical and interlocking roles of policy, capital and S&T in delivering meaningful impact



Delivering national impact requires enhanced focus and engagement of all three elements of change

We can shift policy, technology and capital from special interests to special outcomes



Energy conversion and environmental control systems are long life-cycle assets that require long cycle development, design, siting, permitting, financing and construction

We can invent the future. *Let's pick our shots...*

Our research, development and leadership are:

- ▶ Revolutionizing how nations with extensive coal reserves can meet growing energy demand while simultaneously reducing emissions
- ▶ Transforming the existing electricity generation and transmission infrastructure to optimize the assets we have today
- ▶ Designing the grid of the future to be amenable to intermittent and variable renewable generation
- ▶ Exploring how to use electricity and alternative fuels to cost-effectively meet the needs of a cleaner transportation sector while addressing our dependence on imported oil
- ▶ Leveraging information and communication technology to make end use of electricity both smart *and* efficient
- ▶ Helping DOE reduce the cost and risk of cleanup
- ▶ Enabling a safe and secure acceleration of nuclear power as a critical part of the U.S. and global energy portfolio

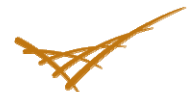


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Questions?



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