



U.S. DEPARTMENT OF
ENERGY

Engineering & Technology Update

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Office of Engineering and Technology

**Waste Management 2009 • Phoenix, AZ
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EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

www.em.doe.gov

Challenges

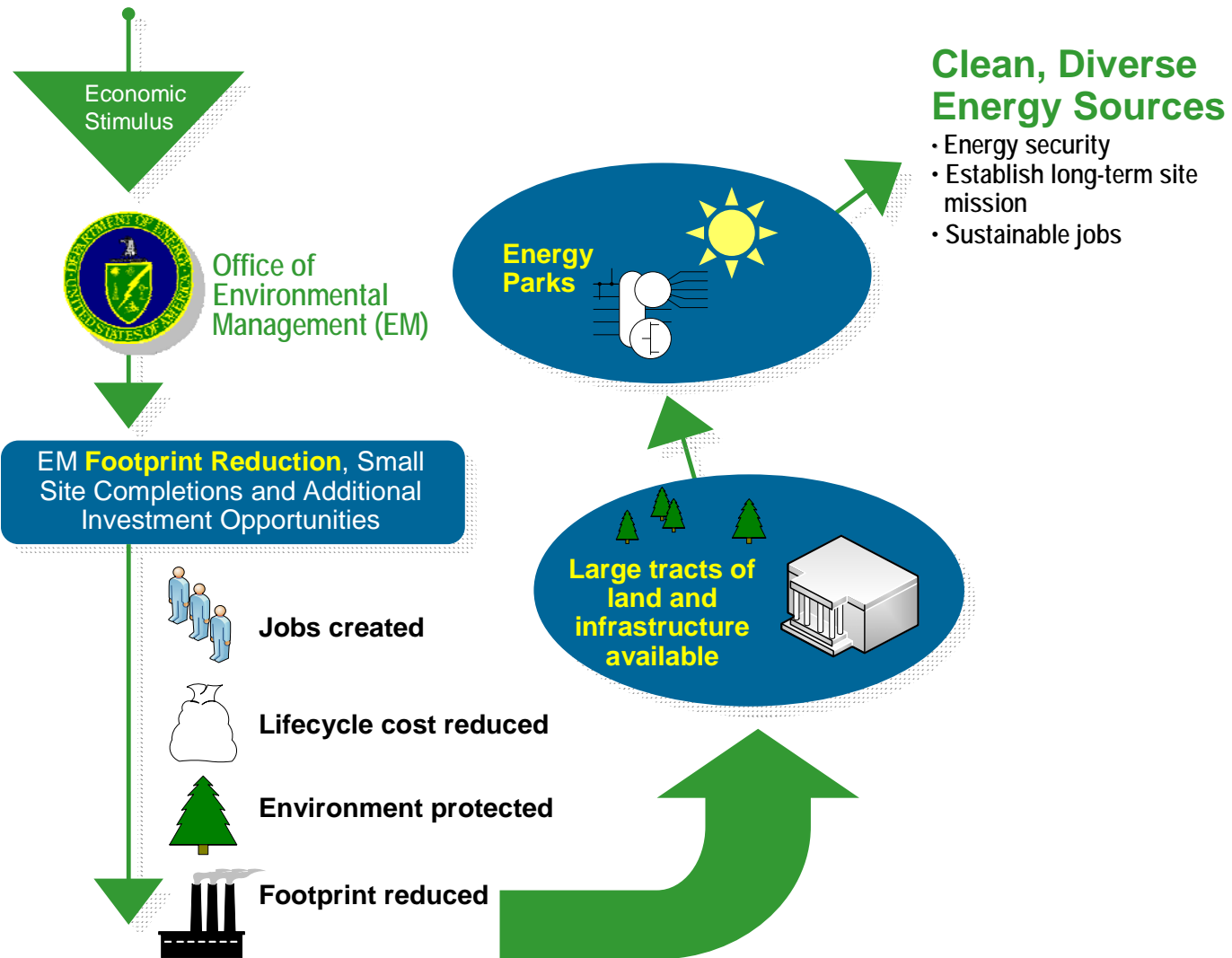
- **Provide solutions to reduce technical uncertainty, especially for first-of-a-kind technologies.**
- **Improve engineering and scientific capabilities.**
- **Develop policy, strategies, and guidance for facility management and land redevelopment and for improvement of energy efficiency and conservation.**
- **Determine the investment level needed by EM to address the engineering and technology challenges of the future.**



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Footprint Reduction

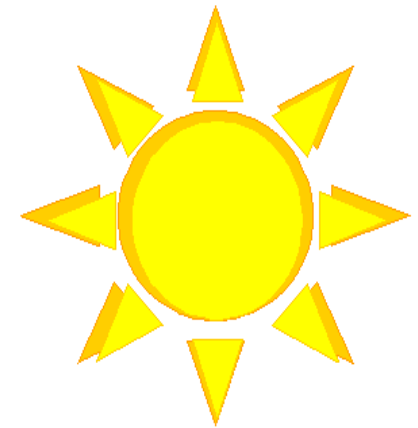


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Energy Parks Initiative



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Energy Parks Initiative: A bold and innovative concept

. . . to leverage assets and create opportunity to enable rapid development of large-scale energy-related facilities.

. . . particularly those with significant potential of sustained progress towards energy independence, regional economy, national security, environmental sustainability, and other national concerns.



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Energy Parks Initiative: Summary

- **A teaming of DOE, industry, and regional stakeholders, to enable rapid development of certain large-scale facilities at specific sites.**
- **DOE generates opportunity by designating valuable assets (including land), requesting expressions of interest, and negotiating to maximize the value and impact of opportunity.**



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Energy Parks Initiative: Why EM?

- **Facilitates EM mission execution**
 - **Transition to beneficial use**
 - **Engages stakeholders as partners**
 - **Leverages liabilities into opportunity**
 - **Supports “industrial use” standards**
 - **Reduces “EM footprint”**
 - **Averts life-cycle costs**
- **Attractive assets help meet national goals**
- **Increases taxpayer return-on-investment (ROI)**



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Energy Parks Initiative: Kind of Assets

- ✓ **Infrastructure** (roads, buildings, equipment, utilities, barge & rail access, transmission systems, and specialty features and capability)
- ✓ **Natural Resources** (land, water, and renewable energy)
- ✓ **Institutional Controls** (clear land title, physical control, water rights, NPDES and other permits, buffer area, environmental & seismic characterization, and security)
- ✓ **Human and Economic Capital** (knowledge of regulatory environment, highly trained workforce, transition to succeeding missions, and return of valuable assets to the local tax base)
- ✓ **Diversity, Size, and Remoteness** (allows consideration of many uses, and protection of critical infrastructure)
- ✓ **Applied Tools** (technology, loan guarantees, purchasing power)



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Energy Parks Initiative: Technology

Options include conventional & advanced energy technologies, such as:

- ✓ **Renewable energy: solar, wind, biomass, geothermal**
- ✓ **Fossil fuels: clean coal, gas turbines**
- ✓ **Electricity generation, transmission, & distribution**
- ✓ **Hydrogen generation**
- ✓ **Emission controls, carbon sequestration**
- ✓ **Specialty manufacturing**
- ✓ **Nuclear: power, fuel cycle, waste management**



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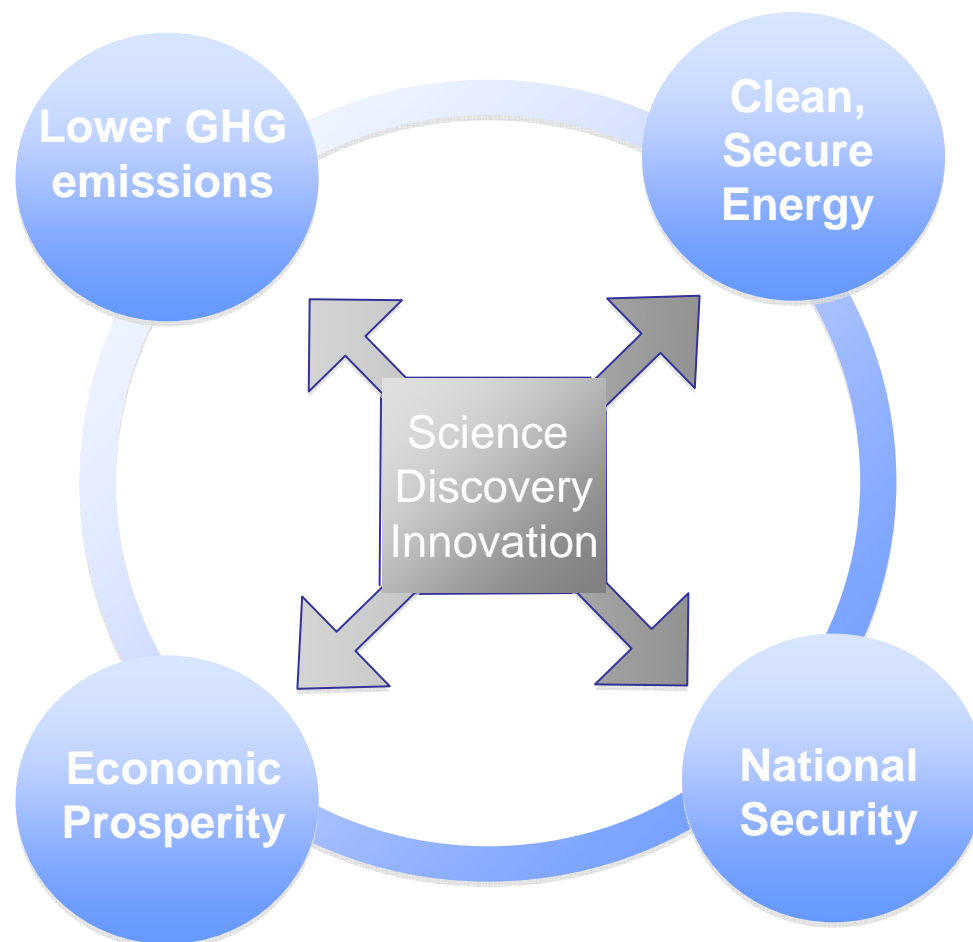
Related Activity: Supports Energy Parks Initiative

... from “**greening**” of energy supply
to teaming with community reuse organizations & industry

- **Hanford:** shares infrastructure with nuclear utility; 71 acres transferred for development
- **Savannah River:** working on leasing 2,500 acres for electric production; large-scale demonstration of new energy technologies and manufacturing of energy generation equipment
- **Oak Ridge:** private-sector business and industrial park; transferred 50 acres and much site infrastructure
- **WIPP:** RFI for 16 square miles of solar resources
- **Mound and Fernald:** ongoing site conversion



Strategic Framework: *Science & Discovery at the Core*



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EM's

Technology Roadmap:

Advice from

The National Academies of Science

Advisors to the Nation on Science, Engineering and Medicine



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NAS Advice on DOE's Cleanup Technology Roadmap: Gaps and Bridges

National Academies Interim Report Observations – February 2008

- **Complexity and enormity of cleanup task require . . . significant, on-going R&D program.**
- **EM Roadmap can be an important tool for guiding R&D investments.**
- **National Laboratories at each of the four major sites have special capabilities that are needed to address EM's long-term needs.**



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NAS Advice on DOE's Cleanup Technology Roadmap: Principal Science and Technology Gaps

Waste Processing:

- 1. Substantial amounts of waste may be left in tanks after their cleanout—especially those with obstructions or associate piping. (High Priority)**
- 2. Low-activity streams from tank waste processing could contain substantial amounts of radionuclides. (Medium Priority)**
- 3. New facility designs, processes usually rely on pilot-scale testing with simulated rather than actual wastes. (Medium Priority)**
- 4. Increased vitrification capacity may be needed to meet schedule requirements of EM's HLW programs. (High Priority)**
- 5. The baseline tank waste vitrification process significantly increases the volume of HLW to be disposed of. (Medium Priority)**
- 6. A variety of wastes and nuclear materials do not yet have a disposition path. (Low Priority)**



NAS Advice on DOE's Cleanup Technology Roadmap: Principal Science and Technology Gaps

Groundwater and Soil Remediation:

- 1. The behavior of contaminants in the subsurface is poorly understood. (High Priority)**
- 2. Site and contaminant source characteristics may limit the usefulness of EM's baseline subsurface remediation technologies. (Medium Priority)**
- 3. The long-term performance of trench caps, liners, and reactive barriers cannot be assessed with current knowledge. (Medium Priority)**
- 4. The long-term ability of cementitious materials to isolate wastes is not demonstrated. (High Priority)**



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NAS Advice on DOE's Cleanup Technology Roadmap: Principal Science and Technology Gaps

Facility Deactivation and Decommissioning (D&D):

- 1. D&D work relies on manual labor for facility characterization, equipment removal, and dismantlement. (High Priority)**
- 2. Personal protective equipment tends to be heavy, hot, and limits movement of workers. (Low Priority)**
- 3. Removing contamination from building walls, other surfaces can be slow and ineffective. (Medium Priority)**



Improving EM's Roadmap

- **FINDING:** *The EM technology Roadmap is an important and much needed tool for guiding DOE headquarters investments in longer-term R&D to support efficient and safe cleanup.*
- **FINDING:** *The current Roadmap describes technical risks in the EM site cleanup program and R&D initiatives to mitigate these risks. However, it does not connect these initiatives to major milestones in the EM cleanup program.*



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Improving EM's Roadmap

- **FINDING:** *EM is the DOE office designated to clean up the nuclear materials production sites of the Cold War. Cleaning up these legacy sites nevertheless remains a responsibility for all of DOE and the Nation. EM cannot complete its mission without the active cooperation of other DOE offices and Federal agencies. The Roadmap can be improved by specifying opportunities for cooperative work with the National Laboratories and other DOE and Federal agencies.*
- **FINDING:** *The scientific and technical state-of-the-art will evolve during the next 30 years of the EM site cleanup program, as will public expectations for the cleanup goals. A robust EM science, engineering, and technology program will be required to keep up with these evolutions, to provide up-to-date bases for EM's cleanup decisions, and to maintain a skilled workforce.*



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Closing EM's Science and Technology Gaps

- **FINDING:** *The unique chemical, physical, and radiological properties of waste and contamination at the EM cleanup sites, and the unique subsurface characteristics of the sites themselves, require special capabilities of the sites and their associated National Laboratories to sustain long-term R&D for EM's 30-year cleanup program. These special capabilities include qualified, experienced personnel and facilities for radiochemical, engineering, and field experiments. It is Congress' and DOE's responsibility to maintain the National Laboratories' capabilities, not only for cutting-edge scientific research, but also for research applied to national problems such as DOE's Cold War legacy cleanup.*



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CONCLUSION

- At the beginning of the study the NAS Committee understood that the Roadmap would be a ‘living’ document to help plan, justify, and increase the effectiveness of EM’s R&D program in support of its site cleanup mission.
- The Committee found that the Roadmap can be an important tool for enhancing EM’s R&D efforts and has recommended detailed improvements and periodic updates of the Roadmap.



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