

# Panel: Exploring the Options for SNF/UNF in Light of US and International Decisions

**Michaele Brady Raap, PhD**  
**Pacific Northwest National Laboratory**

**Waste Management 2012**  
**February 27, 2012**



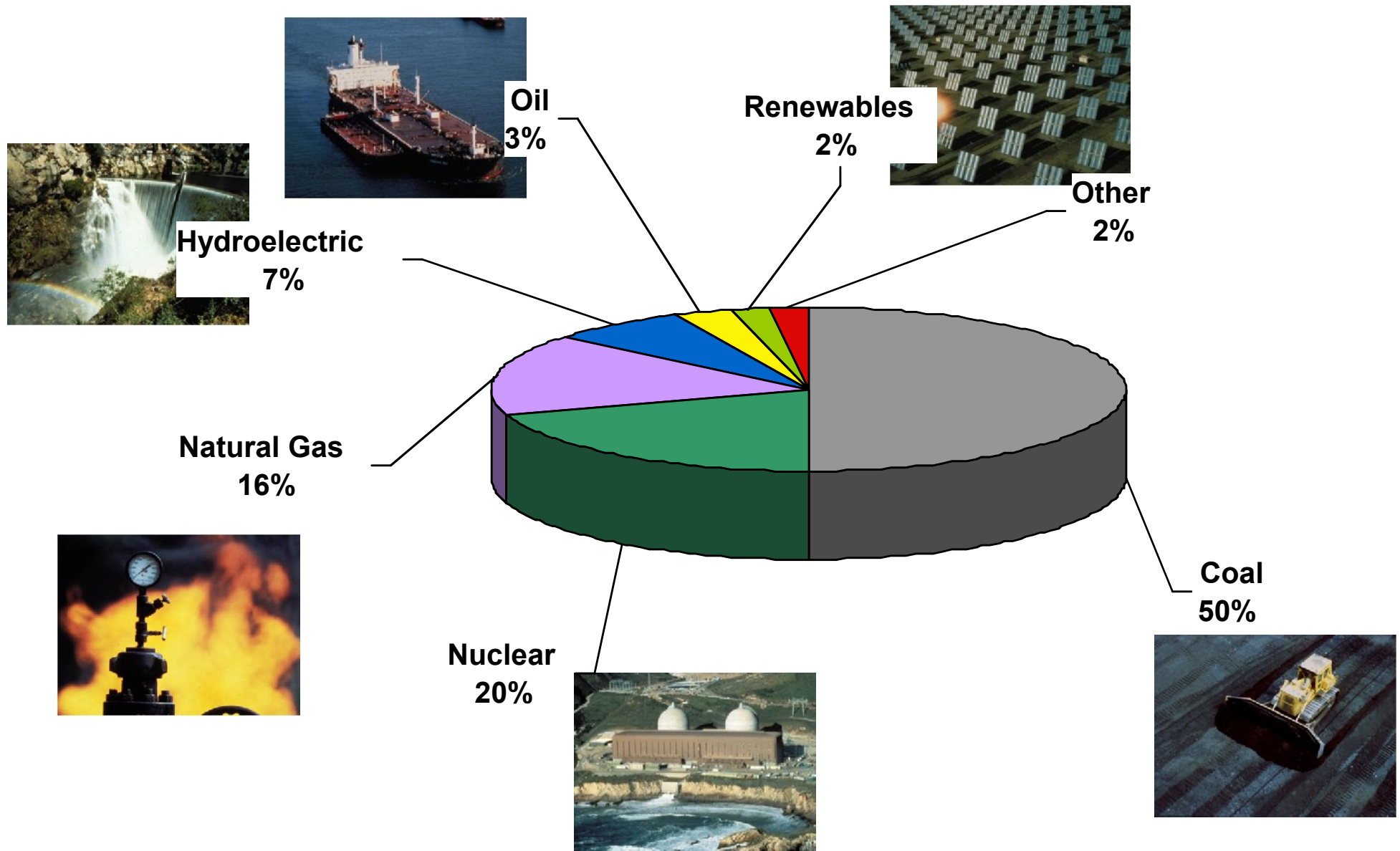
*Proudly Operated by Battelle Since 1965*

## President Obama's State of the Union message:

“Nuclear power is a vital part of our energy mix and we must do everything we can do to develop it in a safe and secure manner.”

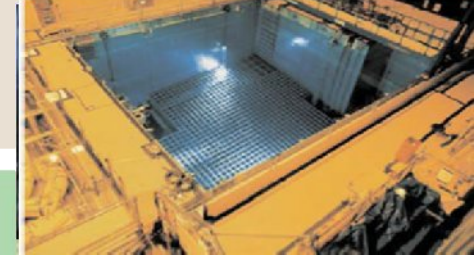


# U.S. Electricity Sources



# U.S. Nuclear Energy Facts

- 104 nuclear plants
- 20% of the nation's electricity
  - Displaces 680 million metric tons of CO<sub>2</sub>/yr
  - Equivalent to 131 million passenger cars/yr
- 62,500 tonnes Used Fuel Safely Stored at Reactors
- 2011 Certification of the AP1000
- 2012 Approved COL Vogtle
- ??? Integrated Used Fuel Management



# Options for Used Nuclear Fuel Management

Bounding nuclear growth scenarios: no growth, nuclear supplies 50% of growth in electricity demand between 2010 and 2100

Options for Storage: wet and dry storage at-reactor; centralized interim storage

Options for Ultimate Disposition as a function of fuel cycle: once-through; limited recycle to LWRs; full recycling into fast reactors

Source: **REPORT OF THE AMERICAN NUCLEAR SOCIETY PRESIDENT'S SPECIAL COMMITTEE ON USED NUCLEAR FUEL MANAGEMENT OPTIONS, January 30, 2011**



  
**Pacific Northwest**  
NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

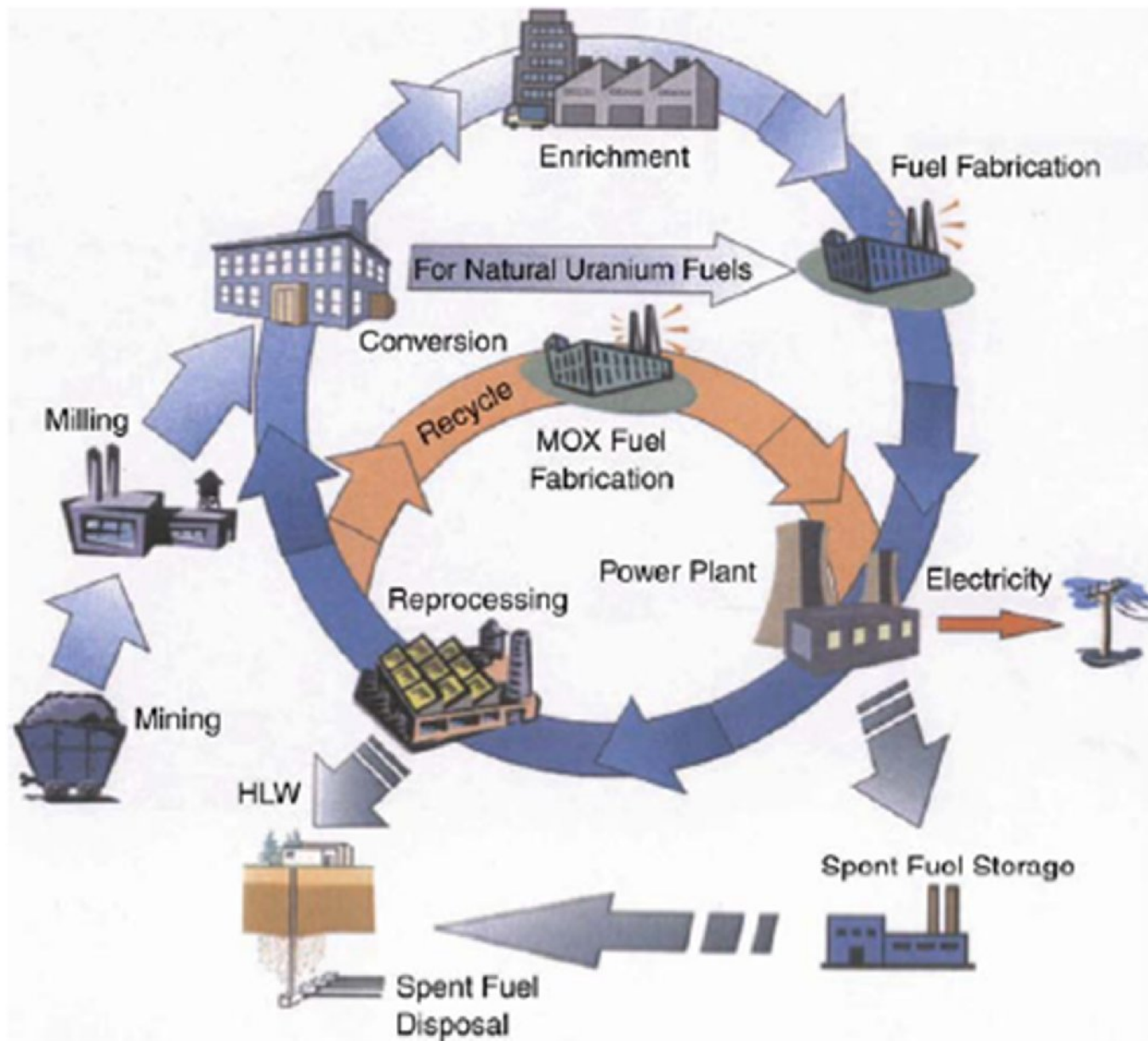


Fig. 12. LWR fuel cycle options: once-through and partial recycling.



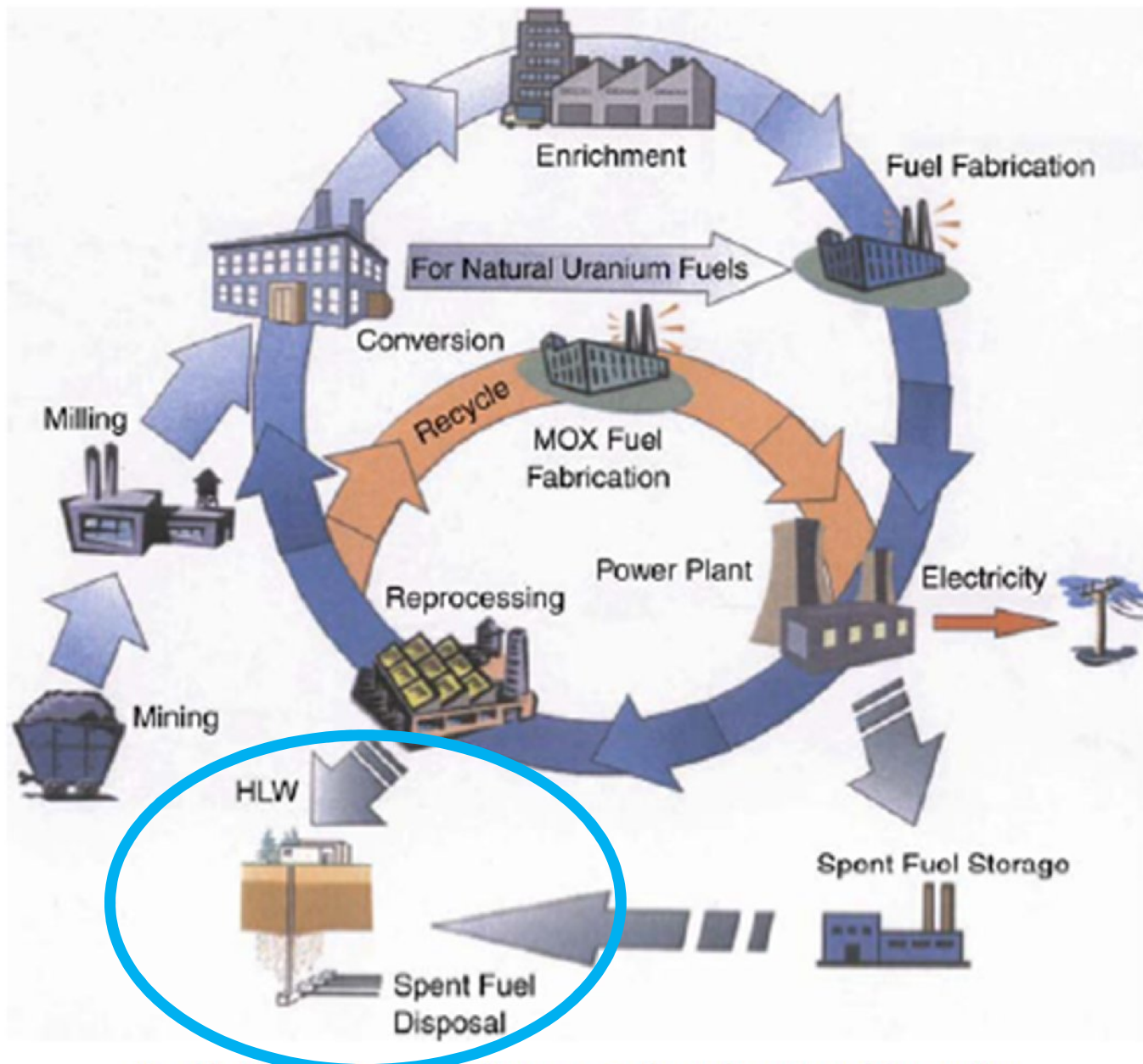


Fig. 12. LWR fuel cycle options: once-through and partial recycling.



# September 11, 2001

In 2004, U.S. Congress asked the National Academies to provide independent scientific and technical advice on:

- Potential safety and security risks of spent nuclear fuel stored in cooling pools at commercial nuclear reactor sites.
- Safety and security advantages, if any, of dry cask storage versus wet pool storage at these reactor sites.
- Potential safety and security advantages, if any, of dry cask storage using various single-, dual-, and multipurpose cask designs,
- The risks of terrorist attacks on these materials and the risk these materials might be used to construct a radiological dispersal device.

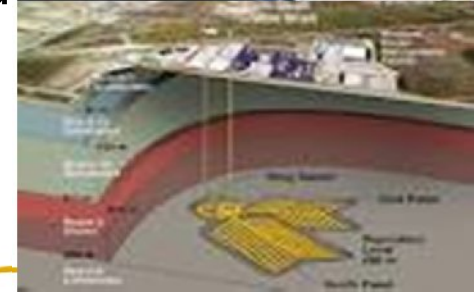
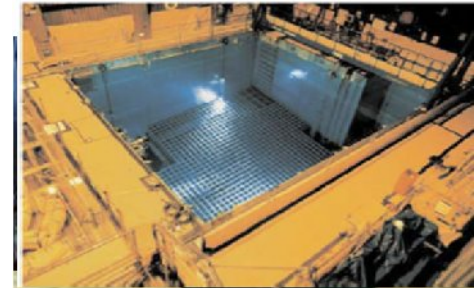
**Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report (2006)**

National Academies Press



# Used Nuclear Fuel Management in Other Countries

- ▶ France, Japan, Russia and the UK currently reprocess with no permanent HLW disposal site but are pursuing geologic repository concepts
- ▶ India, China and South Korea have announced their intention to pursue reprocessing
- ▶ Sweden and Finland have significant programs to develop geologic repositories
- ▶ Swedish plans include Centralized Interim Storage
- ▶ In 2002, a European Commission (EC) Directive said that geological disposal of radioactive wastes was preferred and that "A regional approach, involving two or more countries, could also offer advantages"
- ▶ Belgium, Germany, Canada, South Korea also pursuing
- ▶ Centralized Interim Storage in Belgium, Germany, Switzerland, Sweden, Russia, soon in South Korea, Spain



**Pacific Northwest**  
NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

# Comparisons with German Experience

- ▶ Chose geologic disposal as preferred option
- ▶ Focused research on a single site for more than 2 decades
- ▶ Large-scale local public opposition
- ▶ Research moratorium imposed in 2000, putting a stop to research into whether the salt dome was suitable for use as a storage site for nuclear waste
- ▶ Developed an above-ground interim storage facility associated with proposed repository site
- ▶ Public protests in response to campaigns to transport fuel to the interim facility

# International Cooperation

- ▶ International Framework for Nuclear Energy Cooperation (IFNEC), “fuel supplier nations”
- ▶ OECD/NEA- coordinate safety case for geologic disposal, waste management strategies and public involvement in decision making
- ▶ IAEA - promotes joint training and technical capacity building including repository design, performance assessment, site investigation and framework for multinational repositories
- ▶ ERDO, European Repository Development Organization formed to collaborate on nuclear waste disposal including regional waste repository concepts



**IAEA**

International Atomic Energy Agency



**Pacific Northwest**  
NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

# Blue Ribbon Commission Recommended Strategy Includes:

- ▶ **Consent-based approach to siting future nuclear waste management facilities.**
- ▶ **Prompt efforts to develop one or more geologic disposal facilities.**
- ▶ **Prompt efforts to develop one or more consolidated interim storage facilities.**
- ▶ **Support for continued U.S. innovation in nuclear energy technology and for workforce development.**
- ▶ **Active U.S. leadership in international efforts to address safety, waste management, nonproliferation, and security concerns.**



**Pacific Northwest**  
NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

# Path Forward?

- ▶ **Develop an US Energy Roadmap with nuclear role**
- ▶ **Learn from history and experience**
  - **WIPP is a positive example for public and local government interaction**
  - **YMP provided large amounts of technical data that supported the development of the first NRC license application (LA) for a geologic repository including a detailed performance assessment.**
  - **The LA was never tested against the NRC's Standard Review Plan (SRP)....*how did it stack up? What would we do differently next time?***
- ▶ **Continue involvement in international programs to share experiences on both technical and socio-political issues**
- ▶ **The shared repository concept for Europe is likely to be face challenges consistent with those in the US dealing with interstate transportation**