Changing the Game for Nuclear Energy

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On America's Nuclear Future

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Presidential Memorandum of January 29, 2010

This review should include an evaluation of advanced fuel cycle technologies that would optimize energy recovery, resource utilization, and the minimum of materials derived from nuclear activities in a manner consistent with U.S. nonproliferation goals.

– President Barack Obama

Changing the Game for Nuclear Energy

Key National Issues

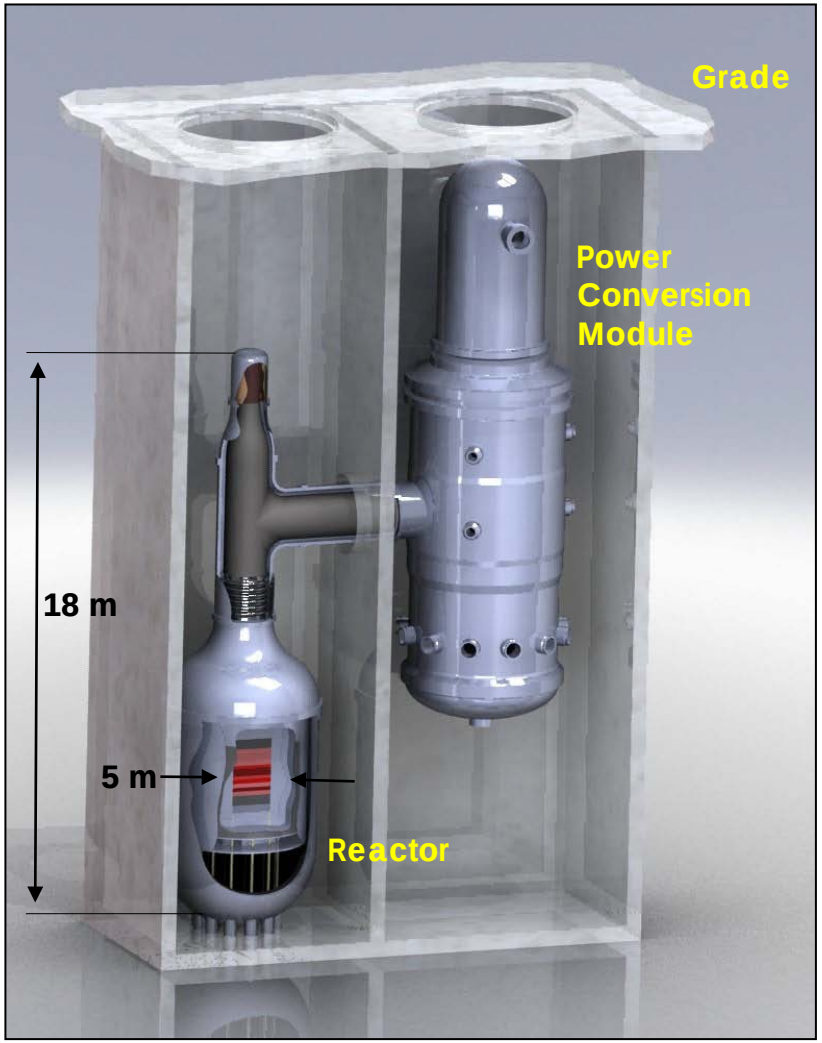
1. Used Nuclear Fuel
2. Economics
3. Non-Proliferation
4. Energy Security
5. Human Dimension

EM²™ Goals

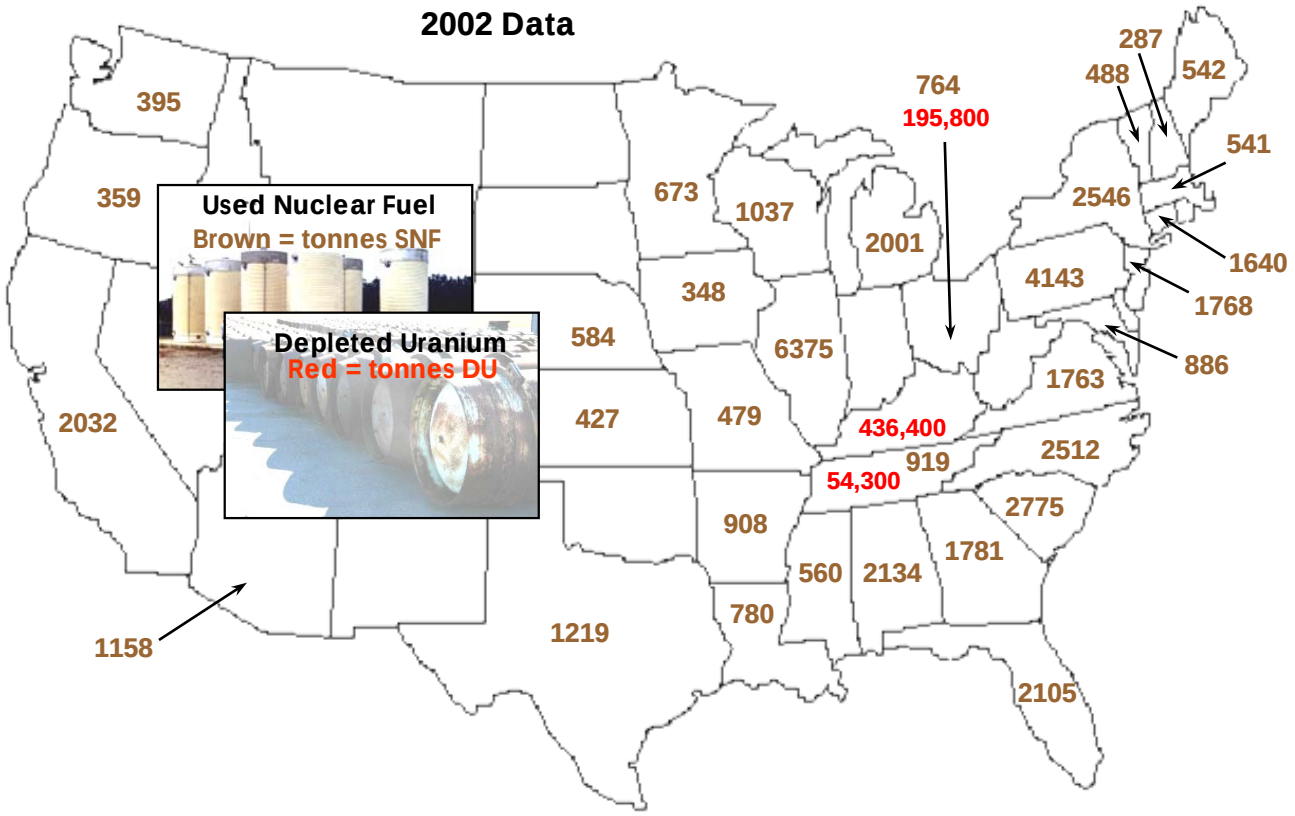
- Consume & reduce used nuclear fuel inventory, i.e. minimize need for long-term repositories
- Reduce capital investment and power cost by 30% compared to ALWRs
- Reduce need for uranium enrichment; eliminate conventional fuel reprocessing
- Advance electrification through site-flexibility & process heat applications; to reduce foreign energy imports
- Attract eager minds to a challenging new enterprise

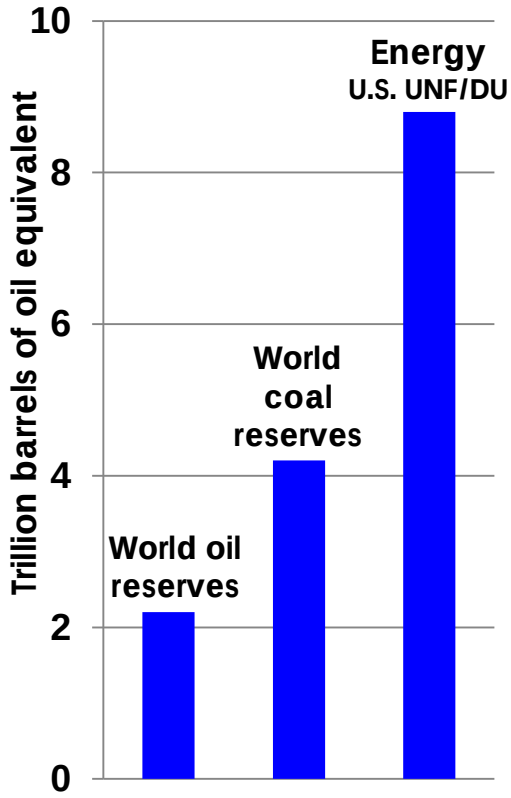
Technical Description

- Grid capable: 500 MWt ➔ 240 MWe with gas turbine
- Gas-cooled fast reactor (850ºC)
- Utilizes depleted-U and/or used nuclear fuel w/o conventional reprocessing
- Passively safe, underground sited
- Modules factory manufactured & shipped by commercial trucks
- No refueling or fuel reshuffling for 30 years



Used Nuclear Fuel and DU Availability

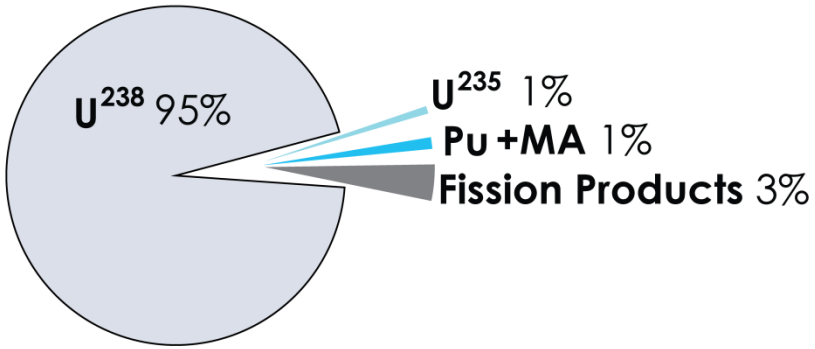




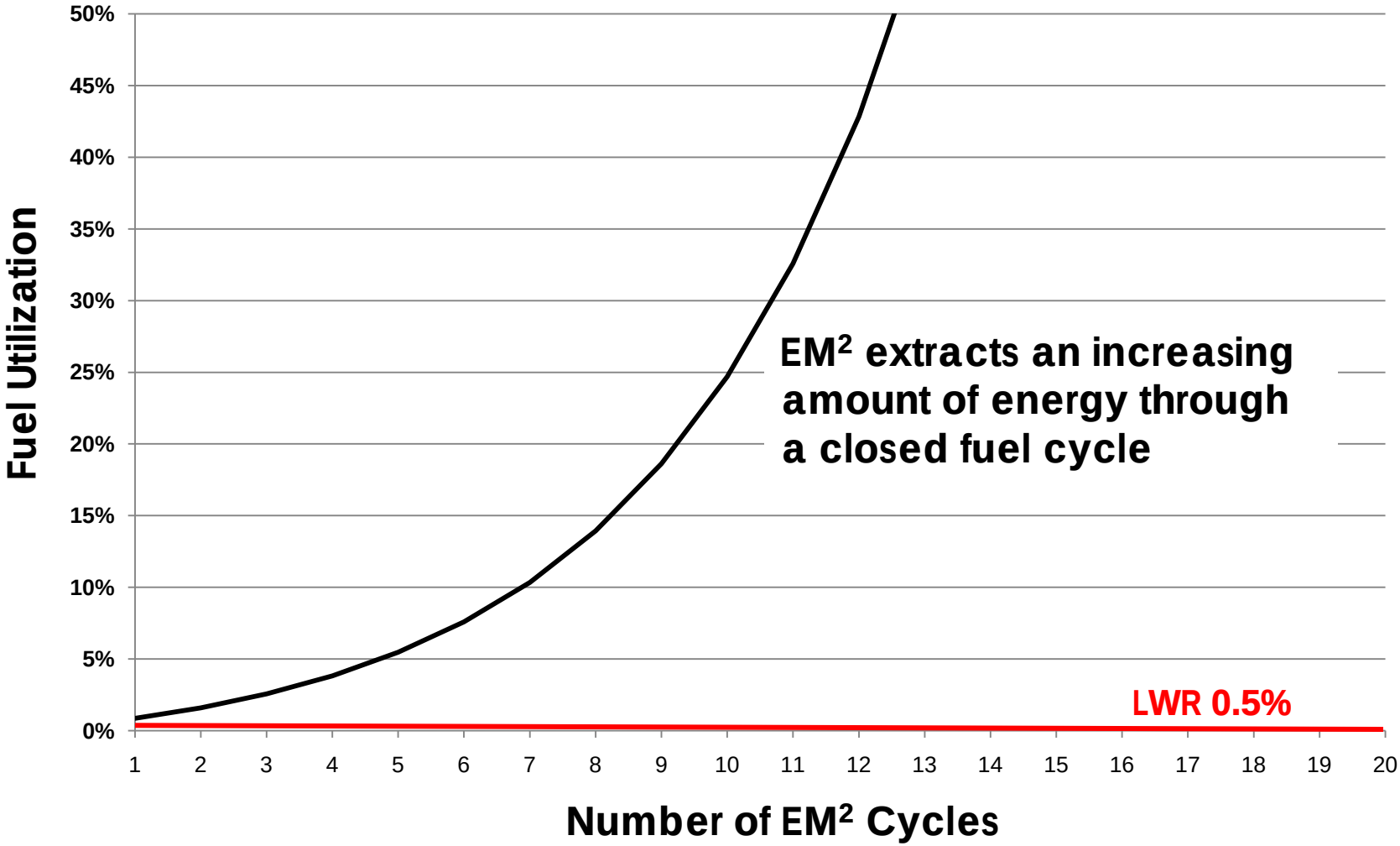
Used nuclear fuel is an increasing resource, while the others are declining.

EM² Improves Uranium Utilization and Minimizes Impact on Long-term Repositories

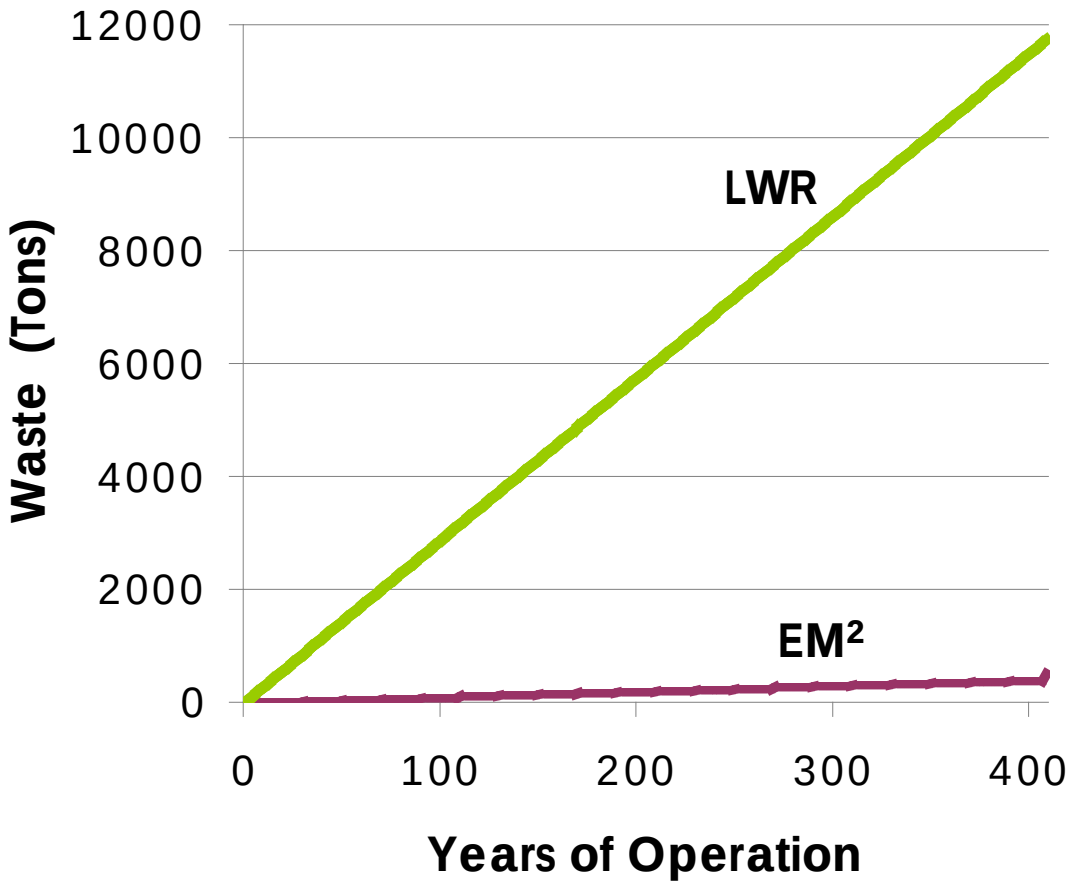
Spent Nuclear Fuel as EM² Fuel



Fuel Utilization Improves With Number of Cycles



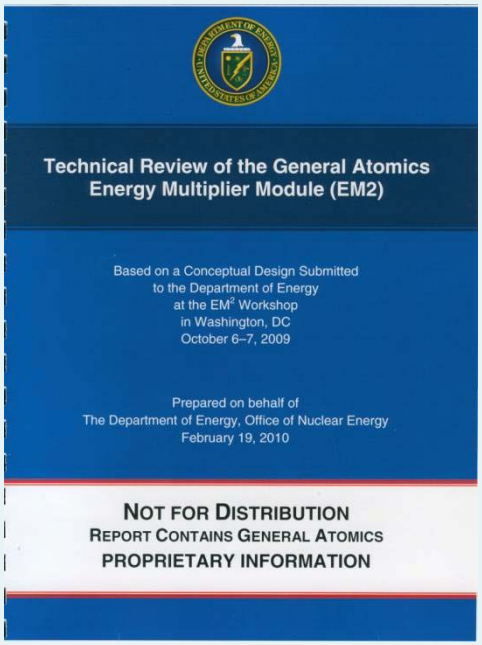
Waste Produced — EM² vs. Today's Reactors



- **Total waste for 1.2 GWe Energy**
  - LWR ~12,000 tons of UNF
  - EM² ~450 tons of fission products

DOE-NE Sponsored a Comprehensive EM² Peer Review

Argonne National Laboratory
Oak Ridge National Laboratory
Idaho National Laboratory



- Core physics and depletion
- Core thermal hydraulics
- Fuels
- Fission product transport
- Used fuel management
- Structural materials
- Balance of plant
- Safety
- Non-proliferation
- Cost/economics

Key findings:

- Most significant risks are associated with 30-yr core in fast neutron fluence including fuel thermal-chemical performance and dimensional stability, SiC clad integrity, and fission product transport
- Report affirms the reactor physics design and that EM² supports all five DOE-NE goals

Summary of Actions Needed to Facilitate Commercial Development and Deployment

- **In order to realize reactors like EM², the Federal government should adopt a policy that encourages new concepts that address concurrently the key national issues of used nuclear fuel, economics, non-proliferation, energy security and attracting eager minds to a challenging new enterprise.**

- **The Federal government should fund the research required to resolve the major challenges involved in turning these new concepts into potential commercial options.**