Exploring the Options for Used Nuclear Fuel in Light of U. S. and International Decisions: Interim Storage, Recycling and Tomorrow's Workforce

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9 Billion inh

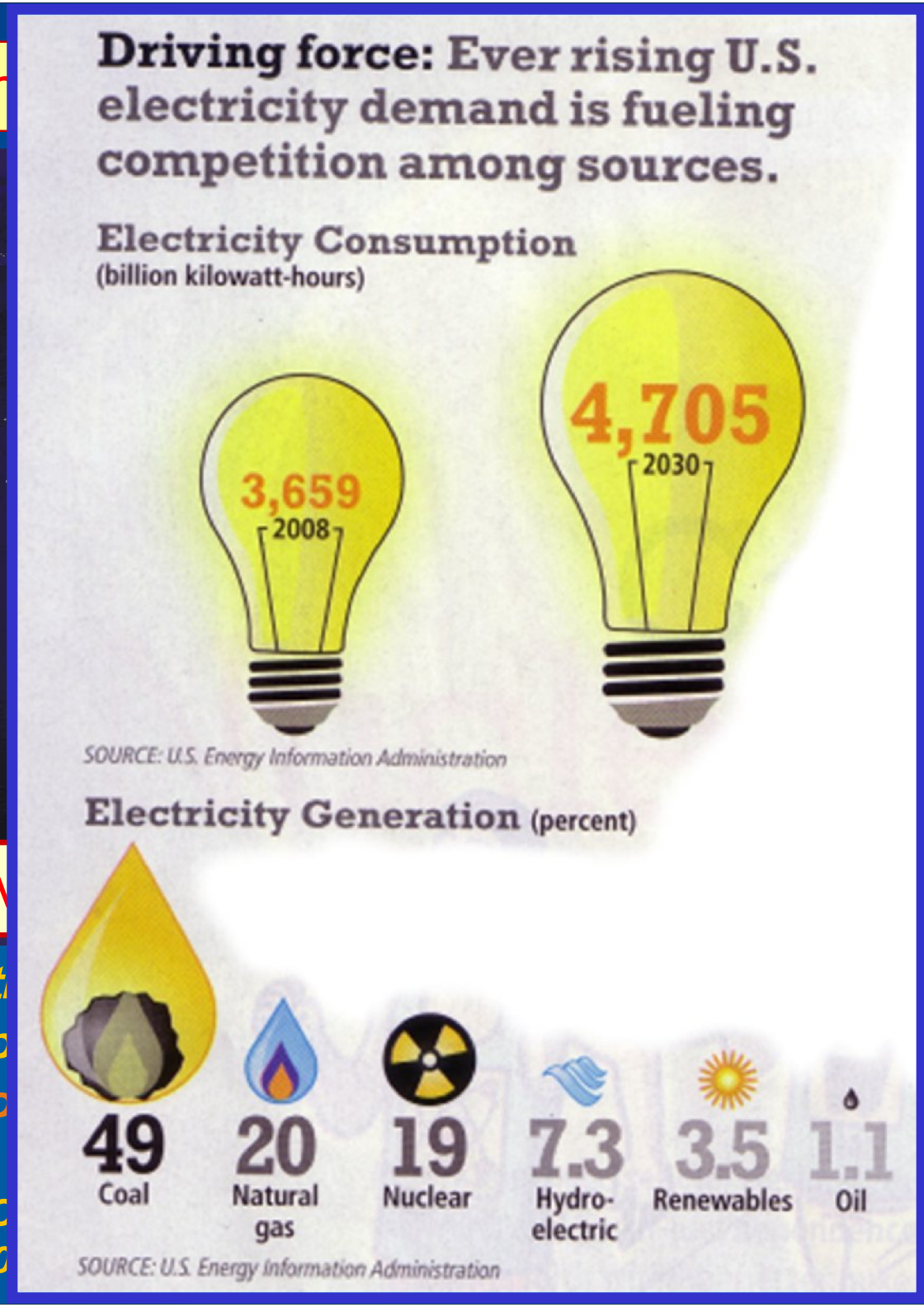
1.7 billion people (24%) hav

Current global power consumpt

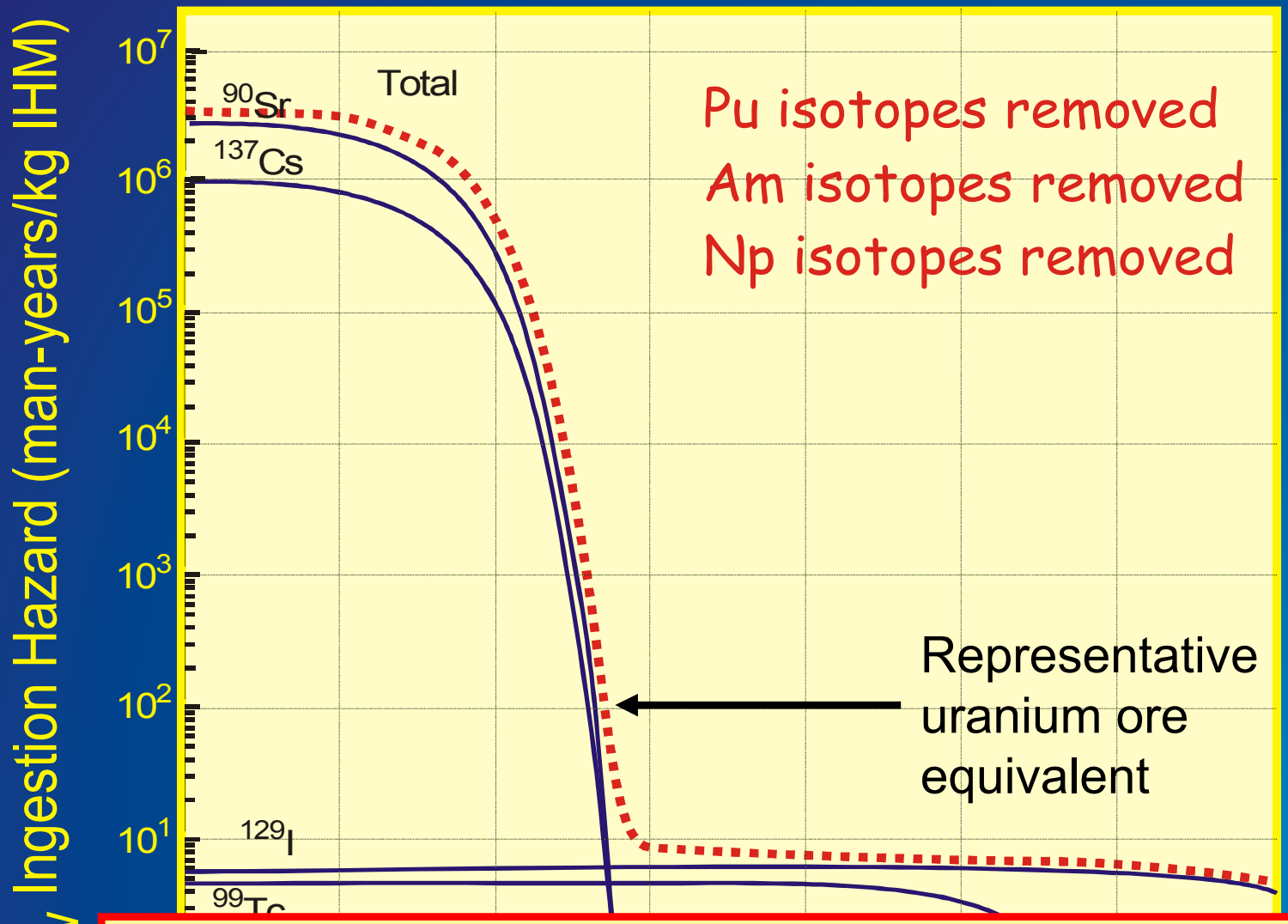
Atmospheric CO_2: 1900 - 270 pp

To stabilize at 550 ppm, 15 TW c

"Advance Technology Paths to Global C
M. J. Hoffert et al. Science 298, 981 (200



Radiotoxicity as Ingestion Hazard



French estimate is that 6% increase in cost of nuclear power will support a closed nuclear fuel cycle with transmutation of wastes

In_w (where A is activity in Bq and ALI is the Annual Limit for Ingestion)

A Few Facts of the Matter

- Partitioning and recycle of Pu (MOX) extends the fuel supply
- Breeding of additional fuel further extends supply
  - Developing a Th/U breeder more than doubles the supply
- Actinide partitioning and transmutation reduces long-term radiotoxicity
- Used fuel in storage probably not as proliferation resistant as previously thought (65,000 tons, growing by 2,000 tons/year)
  - Keeping actinides in the fuel cycle increases self-protection effect
- Industrial separations ended (in the U.S.) 20 years ago

What We Know

- PUREX – more than 60 years international experience
  - Hands-on expertise disappearing in the U.S.
  - politically unacceptable to do PUREX (pure Pu stream diversion issues)
- Options for managing U/Pu/Np mixtures (UREX, COEX…)
- Removing actinides technologies established (TRUEX, …)
- Recycling and transmuting actinides decreases long-term radiotoxicity
- Fast reactors needed for transmutation have been demonstrated (EBR-II, Phenix, Super Phenix…)
- Nuclear science/technology research infrastructure is ageing (or perhaps aged) – work is challenging
- Interest among educated youth is high (for the moment)

What We Need

- A proven method to separate trivalent actinides from fission product lanthanides
- Integration of proliferation resistance into processing options
- International cooperation on research and information sharing
- A rebuilt workforce (which will require…)
  - A commitment to build/rebuild industrial-scale infrastructure
  - More academic opportunities
  - Cooperation/collaboration between universities and DOE Labs/other research organizations
  - More investment in research for the future – strengthening of both scientific and technological base
- **Commitment to the nuclear option going forward**