A View of Fuel Recycling

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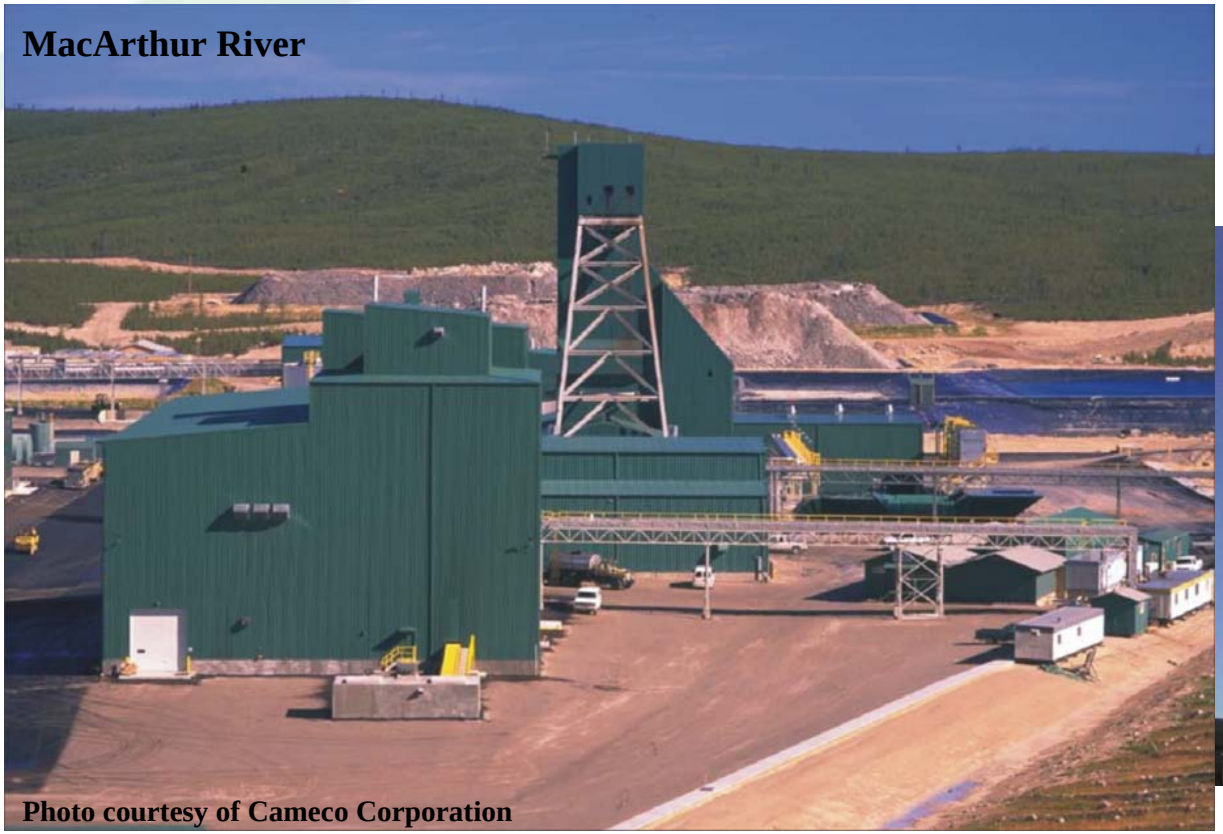
Drivers

- **Enabling nuclear power to expand**
- **Addressing the waste confidence issue**
- **Reducing the amount and radio toxicity of HLW requiring disposal**
- **Utilizing more of the energy in nuclear fuel**
- **Security of energy supply for the US**
- **Enabling carbon emissions to be reduced near term**
- **Changing economic conditions**

Drivers:

- **Allows nuclear option to expand**

Reduces reliance on fresh uranium



and reduces carbon emissions

Drivers:

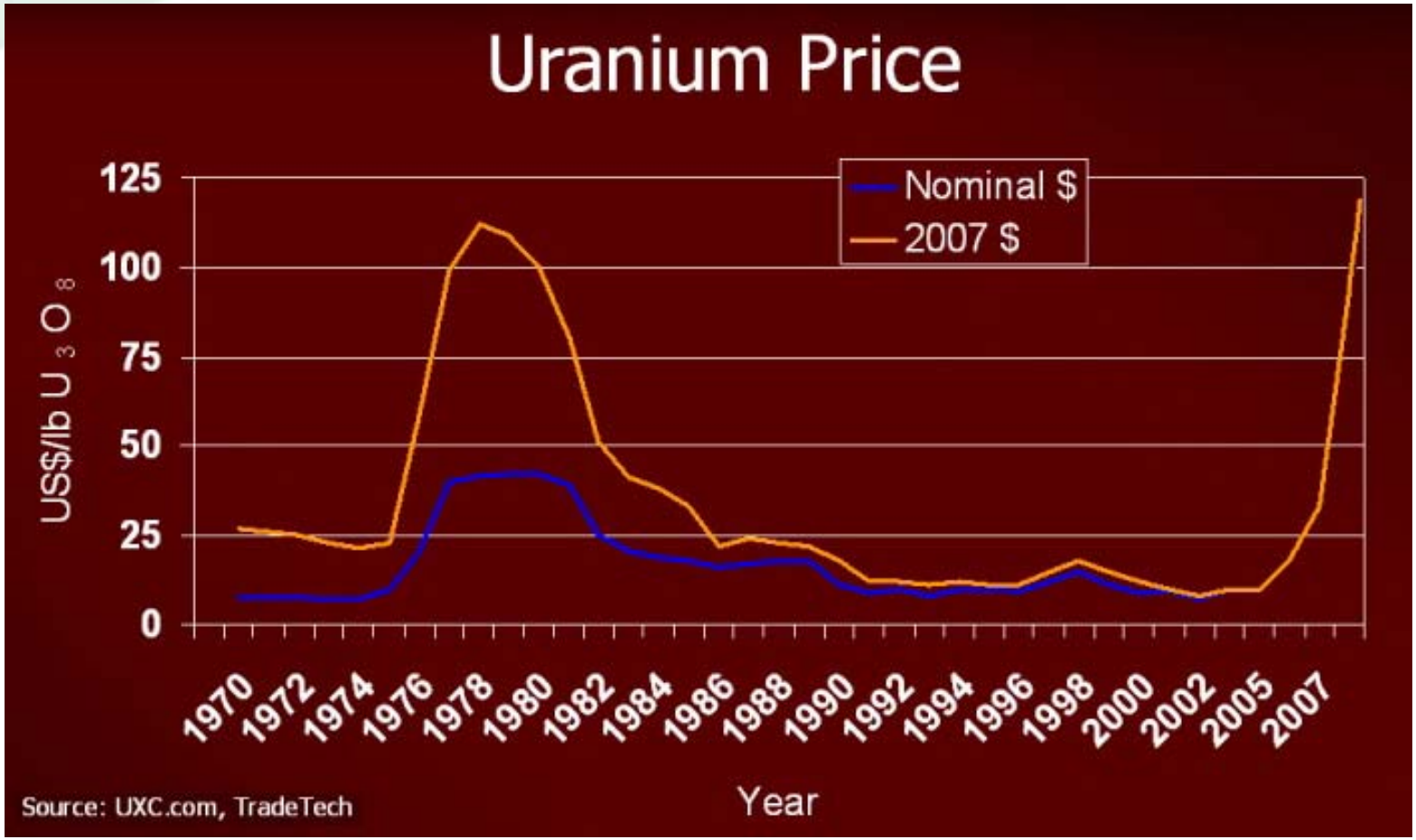
- **Disposal – No outstanding technical issues**
  Increased confidence in waste disposal

Delay store vitrified HLW

Utilize salt deposits close to WIPP

Drivers:

- **Changing Economic Environment**
  Rising uranium prices



Drivers:

- **Reduces Radio toxicity**

Leverages mature technology

Defers need for disposition

Burns toxic actinides
Ultimately no orphan wastes

Status of Deploying the Recycling Technology

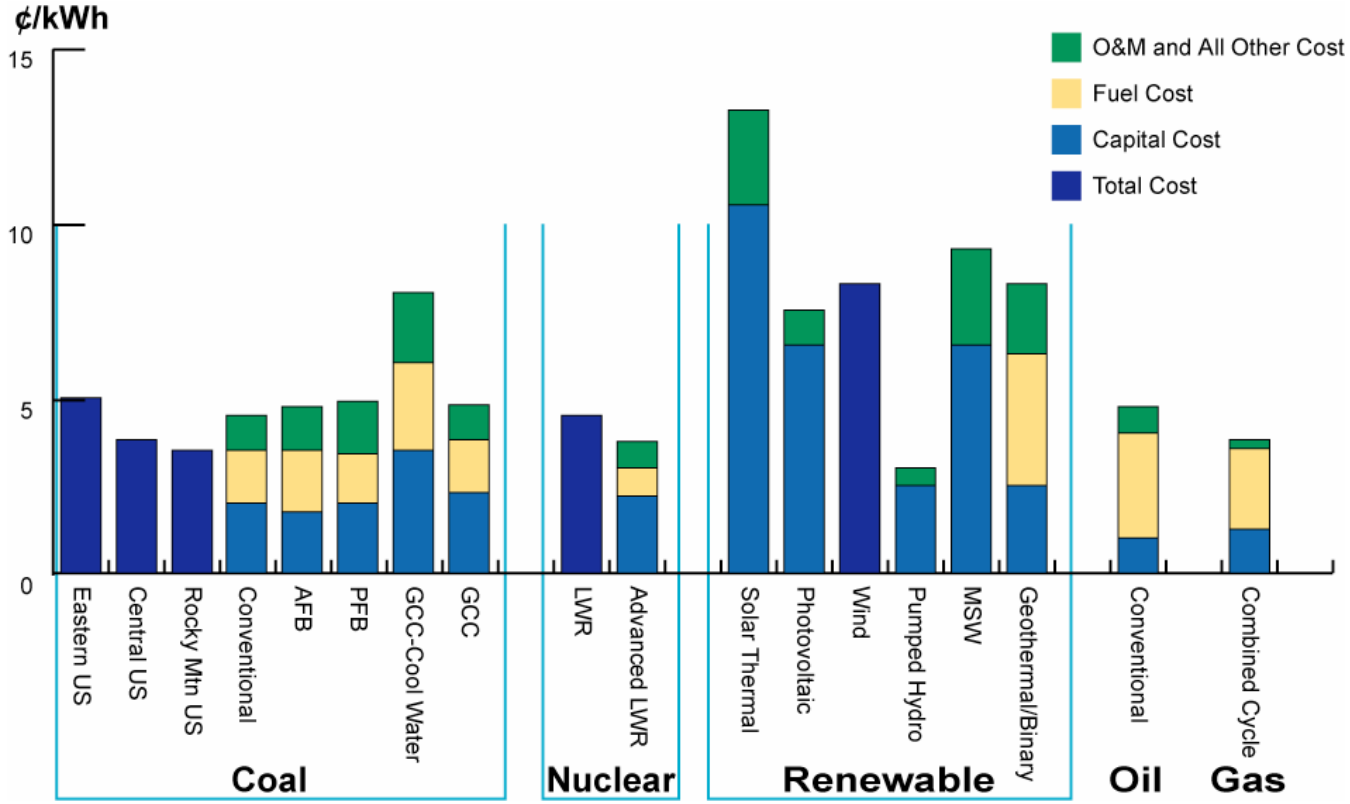
- **Commercially proven technology**
- **The technology is proliferation resistant and pure plutonium is never separated nor produced**
- **Facility design is available**
- **Recycling used LWR fuel makes economic sense now and reduces HLW volumes substantially**
- **The necessity of HLW disposal can be delayed**
- **Focused technology development for ARR fuel recycling should enable commercial deployment in 35-40 years**

Non Proliferation

- **Attractive fuel service package from US & other supplier nations would preclude the need for recycling in other nations**
- **No separation of pure plutonium**
- **Designs can prevent access or diversion**
- **Real time process & facility surveillance by IAEA**
- **No protracted storage or accumulation of ‘fissionable’ material**
- **A focus of fuel recycling capability and skills in stable economies and geographies**

Economics

- **Nuclear Energy is a mature technology**
- **Competitive with other electricity generation sources**



Economics (continued)

- Recycling LWR fuel is commercially viable now
- The first facility can be on line in 15 years
- Public-private partnership, no large appropriations
- Requires legislative & regulatory changes
- Can be funded via waste fees and fuel revenue
- Leverage international investment
- Single regulatory body

Fast vs. Thermal

- **Advantages of fast and breeder reactors**
  - **^{238}U converted to fissile material**
  - **^{238}U in enrichment fuels can be used as a blanket breeder**
  - **Up to 50 times more energy than a once through thermal**
  - **Effective spectrum for burning actinides**
  - **Demonstrated at scale**
  - **Decouple from fresh U supplies**

Experimental Breeder Reactor - INL

Monju - Japan

Photo courtesy of IAEA

Fast versus Thermal

- **The expansion of nuclear power needs LWR recycling now and ultimately fast reactor recycling**
- **Economics is the key, waste management drives the economics**
- **LWR recycling is ready for commercial deployment**
- **Fast Reactor (FR) technology is well understood but still requires development**
- **Fast Reactor is not yet ready for commercial deployment**
- **LWR recycling of U & MOX will continue into the next century using aqueous processes**
- **Full potential of fast reactors as breeders will not be realized until the second half of this century**

Government vs. Industry Public Acceptance Role

- **Play to strengths**
  - **Government – long term – high risk – technical uncertainties**
  - **Government legislative and regulatory change**
  - **Industry – shorter term – lower risk**
- **Public Acceptance**
  - **Close to waste issue**
  - **Reduce proliferation risk**
  - **Improves security of energy**
  - **Paid for by commercial sector**
  - **Reduces CO_2 emissions**
  - **Creates jobs**

Nuclear Fuel Recycling Center
Advanced Technology ready to deploy