

The Nuclear Energy Policies of the New U.S. Government and Opportunities for Japan-U.S. Cooperation

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Outline

- **The Nuclear Energy Policy of the new U.S. Government**
- **Implications to the U.S. and global nuclear power programs**
- **Opportunity for Japan-U.S. Cooperation**
- **Closing remarks**

Details of U. S. Nuclear Energy Policy are not yet set

Because:

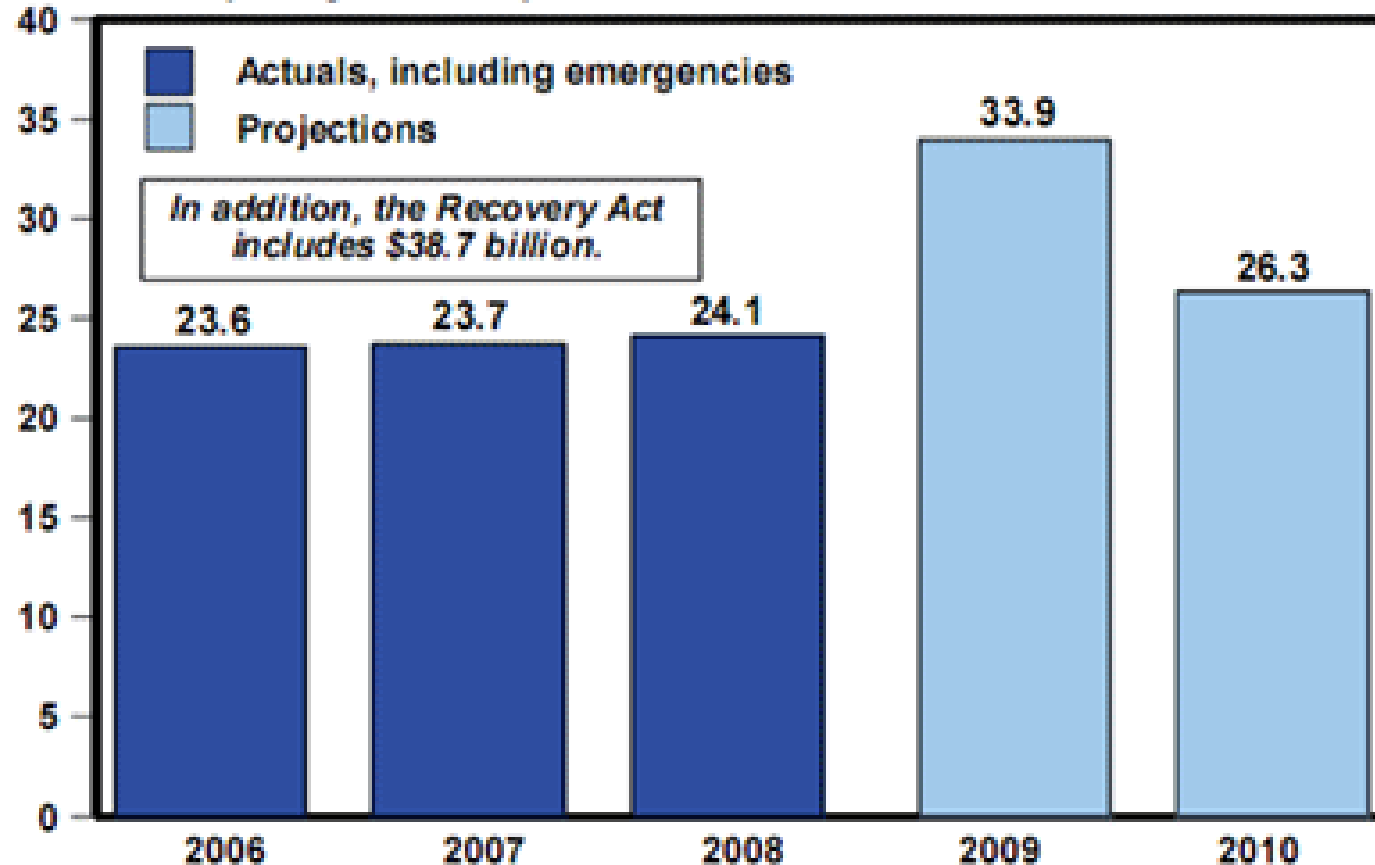
- The change of government (2+ months into the Obama Administration),
- Attention has been placed on economic issues, stimulus package, health cares, and Iran, etc.,
- Cabinet departments including DOE have not had a full team, prospective appointees require lengthy background check and Senate confirmation,

Although budget for FY2009 has still not finalized (on continuing resolution), the administration has to submit to Congress in February budget guidance for FY 2010

Improving safety of nuclear energy & waste disposal

Department of Energy

Discretionary budget authority in billions of dollars



Note: Included in 2009 is emergency funding for Advanced Technology Vehicles Manufacturing Loan Program, \$7.5 billion, and \$250 million for Weatherization.

Nuclear Policy Guidance for FY2010:

- Reduce Proliferation Risks,
- Ensure the Safety, Security, and Reliability of the nuclear weapons stockpile without nuclear testing,
- Secure and dispose of nuclear material,
- Invest in innovative science and technology to detect and deter nuclear smuggling and the development of weapons of mass destruction programs,
- Focus on the cleanup and management of radioactive waste and nuclear materials,
- Focus on improved performance and accountability for the environmental legacy of the nation's nuclear weapons program,
- Scale back Yucca Mountain program to those costs necessary to answer inquiries from the Nuclear Regulatory Commission,
- Devise a new strategy toward nuclear waste disposal.

Meeting two Obama goals

Lugar-Obama Nonproliferation Legislation

U.S. Senators Dick Lugar (R-IN) and Barack Obama (D-IL) introduced the Lugar-Obama Non-Proliferation legislation in November 2005, expanding the U.S. ability to destroy conventional weapons stockpiles and to **detect and interdict weapons and materials of mass destruction throughout the world**. Upon securing funding for its implementation in June 2007, Senator Obama called this "a major step forward in addressing critical security challenges faced by the United States and our allies." "This funding will further strengthen our ability to detect and intercept illegal shipments of weapons and materials of mass destruction, enhancing efforts to prevent nuclear terrorism."

Obama letter to Las Vegas Review Journal, May 20, 2007

After spending billion of dollars on the Yucca Mountain Project, there are still significant questions about whether nuclear waste can be safely stored there. I believe a better short-term solution is to **store nuclear waste on-site at the reactors where it is produced, or at a designated facility in the state where it is produced**, until we find a safe, long-term disposal solution that is based on sound science.

In the mean time, I believe **all spending on Yucca Mountain should be redirected to other uses**, such as improving the safety and security of spent fuel at plant sites around the country and exploring other long-term disposal option.

Implications to US and Global Nuclear Energy Programs

Questions:

- Would the new Democrat Administration and the Democrat-controlled Congress turn “negative” toward nuclear energy?
- Would the decision on Yucca Mountain dampen the utilities’ interest in building new nuclear power plants?
- Would the end of GNEP impact other countries’ fuel cycle policies, such as that in Japan?

New administration support for nuclear energy

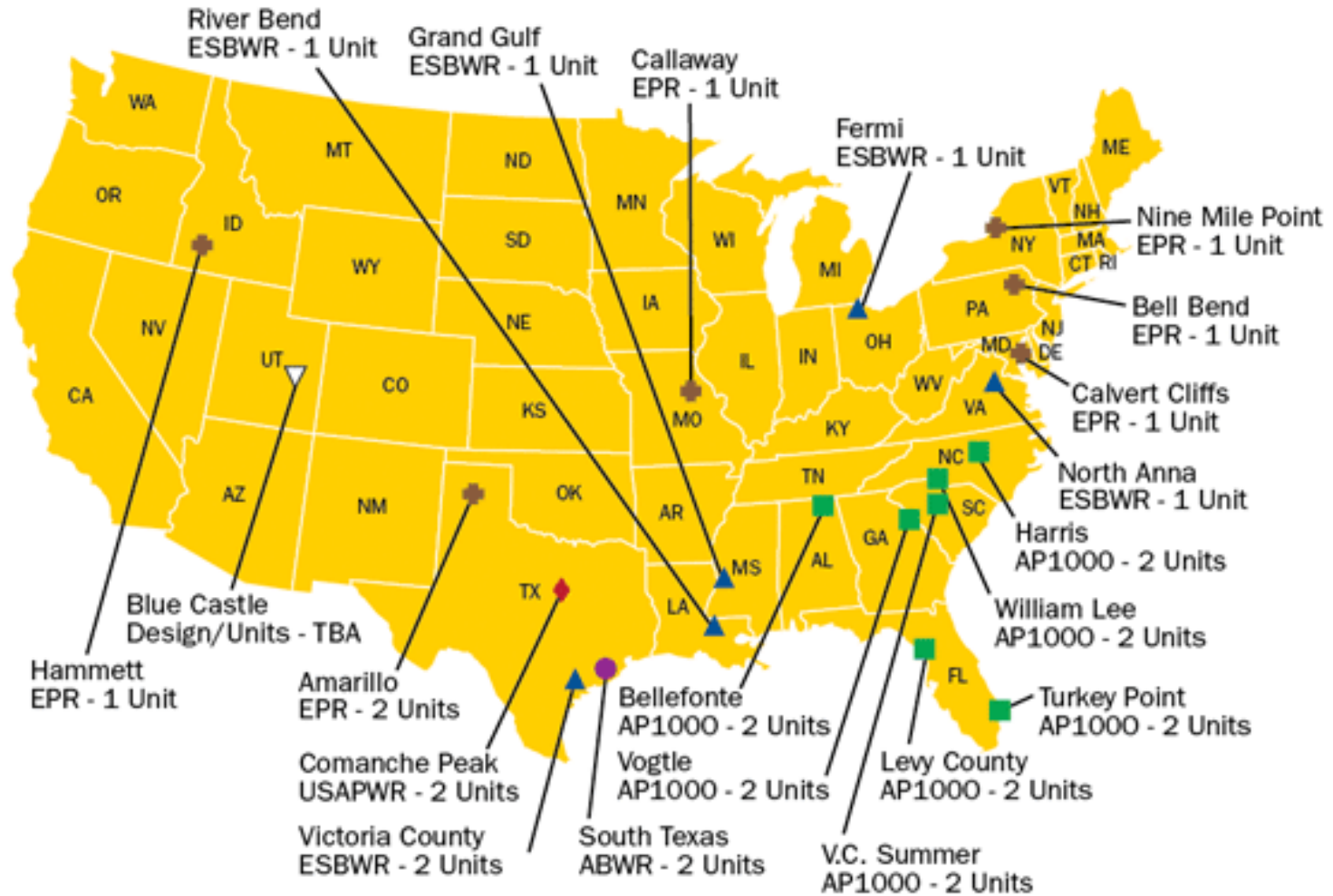
- May not be as much as the renewable,
- But Obama's strong support for US leadership on global climate changes **makes it difficult to dismiss the contributions that can be made by nuclear energy**,
- Renewable sources, such as solar, hydro and wind, combined comprise only about 10% of the total US energy,
- Excluding hydro, the contribution by solar and wind can't be used as base-load (due to their intermittent availability) and only account for a few percent of the total US electricity supply,
- **DOE Secretary Steven Chu is generally supportive of the use of nuclear energy**, he recognizes the role nuclear energy can and should play in dealing with climate change,
- **Secretary Chu is a strong supporter of the NP2010 loan guarantee program which would provide up to \$18.5 billion for new nuclear projects, sufficient for 2 to 3 new nuclear plants**,
- The nuclear industry has 26 COL applications in NRC review, requiring loan guarantee total \$122 billion. But it is unlikely that this level of authorization would be approved by the Democrat-controlled Congress.

COL Applications Received by USNRC (as of March 9, 2009)



Proposed New Reactor(s)	Design	Applicant
Bell Bend Nuclear Power Plant	U.S. EPR	PPL Bell Bend, LLC
Callaway Plant, Unit 2	U.S. EPR	AmerenUE
Calvert Cliffs, Unit 3	U.S. EPR	Calvert Cliffs 3 Nuclear Project, LLC. and UniStar Nuclear Operating Services, LLC.
Nine Mile Point, Unit 3	U.S. EPR	Nine Mile Point 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC (UniStar)
Comanche Peak, Units 3 and 4	US-APWR	Luminant Generation Company, LLC (Luminant)
Fermi, Unit 3	ESBWR	Detroit Edison Company
Grand Gulf, Unit 3	ESBWR	Entergy Operations, Inc. (EOI)
North Anna, Unit 3	ESBWR	Dominion Virginia Power (Dominion)
River Bend Station, Unit 3	ESBWR	Entergy Operations, Inc. (EOI)
Victoria County Station, Units 1 and 2	ESBWR	Exelon Nuclear Texas Holdings, LLC (Exelon)
South Texas Project, Units 3 and 4	ABWR	South Texas Project Nuclear Operating Company (STPNOC)
Shearon Harris, Units 2 and 3	AP1000	Progress Energy Carolinas, Inc. (PEC)
Levy County, Units 1 and 2	AP1000	Progress Energy Florida, Inc. (PEF)
Bellefonte Nuclear Station, Units 3 and 4	AP1000	Tennessee Valley Authority (TVA)
Virgil C. Summer, Units 2 and 3	AP1000	South Carolina Electric & Gas (SCE&G)
Vogtle, Units 3 and 4	AP1000	Southern Nuclear Operating Company (SNC)
William States Lee III, Units 1 and 2	AP1000	Duke Energy
Total Units = 26		

Location of Projected New Nuclear Power Reactors



You may click on a design name to view the NRC's Web site for the specific design.

● ABWR
 ■ AP1000
 ⊕ EPR
 ▲ ESBWR
 ◆ USAPWR
 ▽ Design/Units - TBA

Why US matter in global nuclear expansion?

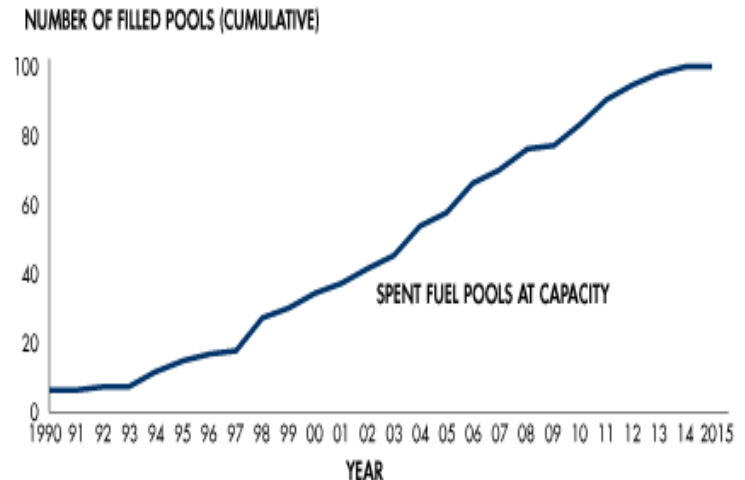
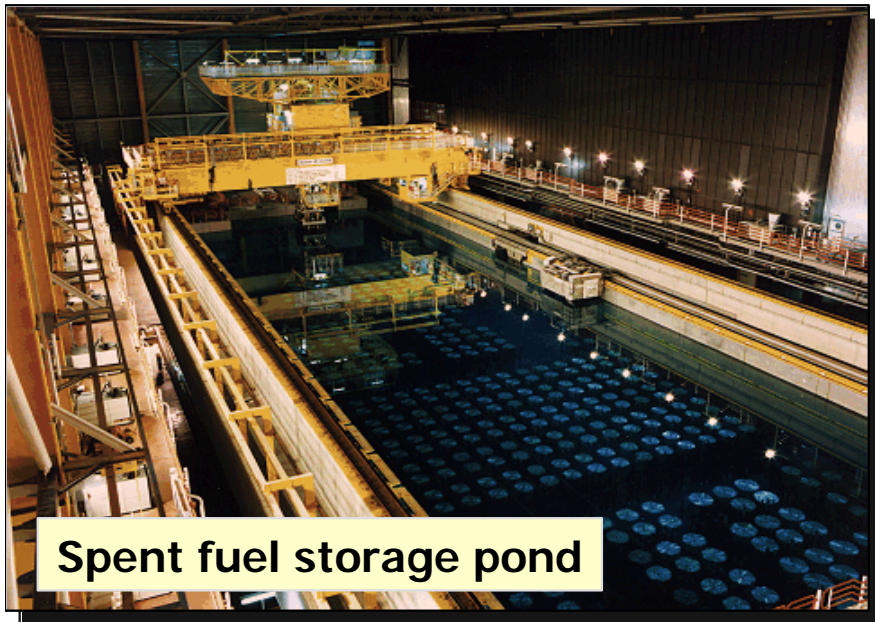
- The US is providing a market for the global nuclear suppliers:
 - In constructing LWRs (APWR, EPR, USPWR, ABWR, ESBWR, etc.),
 - In enrichment:
 - The “Megaton-to-Megawatt” agreement with Russia blended-down 500 tonnes of Russian weapons HEU and converted them to LEU for fuelling in US and western reactors,
 - The US-Russian HEU agreement will finish by 2013. 3 facilities are proposed to be built in the US to fill the annual demand of 11+ Million SWU (LES (Urenco), USEC, and Areva). GE is pending on a decision to build a laser-enrichment Silex plant .
- The US is influential in multinational approaches for nuclear fuel cycle:
 - Offered 17 tonne of HEU for a LEU fuel bank,
 - NAS-RAS joint committee study on “Internationalization of nuclear fuel cycle” to provide assurance of fuel supply.

Yucca Mountain Project (YMP)

- Declared as “not an option”,
- Secretary Chu commented, “the position is Yucca Mountain is not going forward, that’s the president’s position”,
- Budget for YMP has been decreasing over the years since the Democrats controlled the Congress, and Senator Harry Reid (D-NV) became the Senate Majority Leader,
- However, a decision not to pursue a repository at Yucca Mountain will require a change in law (NWPA of 1982, and NWPAA of 1987), which becomes a complex and contentious matter,
- DOE would likely to continue on the license application for YMP, it is up to NRC whether there would be enough budget from Congress to complete the review process (which is expected to last 4+ years),
- DOE would set up a “blue-ribbon” commission to study the nuclear waste issue and make recommendation by the end of 2009 (in time to inform the FY2011 budget request).

What is next?

- **Interim spent fuel storage**, at reactor, or at centralized storage facilities,
- Spent Nuclear Fuel Inventories:
 - Worldwide: >230,000 MT, grows by ~10,000 MT/yr
 - US: >58,000 MT, grows by ~2,000 MT/yr
 - Currently stored on-site or away-from-reactor, mostly in wet storage facilities



Note: All operating nuclear power reactors are storing used fuel under NRC license in spent fuel pools. Some operating nuclear reactors are using dry cask storage. Information is based on loss of full-core reserve in the spent fuel pools.

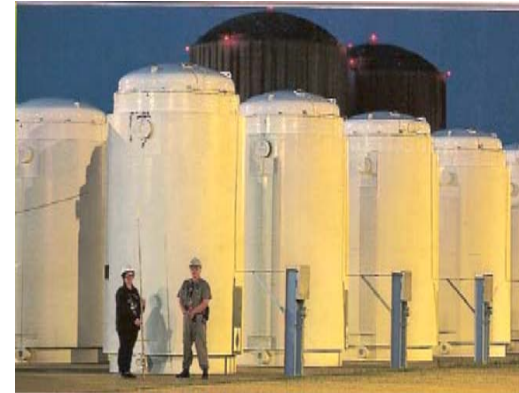
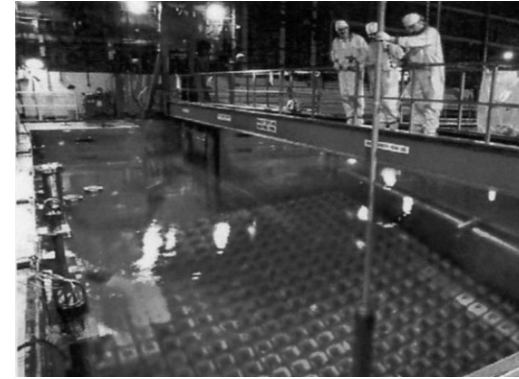
Source: Energy Resources International and DOE/RW-0431 – Revision 1

How Long Can Spent Fuel Be Stored

- Safely?
- In wet storage?
- In dry storage?
- Before final repository disposal?

The US experience:

- Longest wet storage: 40+ years
- Ave. wet storage period: 16-22 years
- Longest dry storage: 20+ years (Surry-2 PWR spent fuel in CASTOR V/21)
- Ave. dry storage period: 12-16 years
- The USDOE has opened and inspected dry storage casks at INL

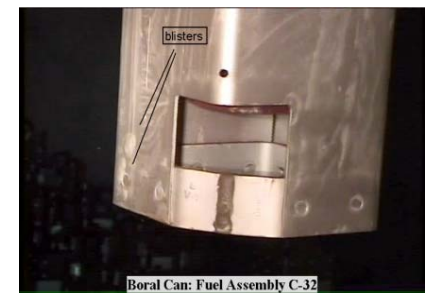


Experience with both wet and dry storage of SNF so far has been reassuring with no indication of fuel failure. However, neutron absorbing materials in wet storage have had some problems.

Challenges to Long-Term Spent Fuel Storage

Key technical issues during regulatory period

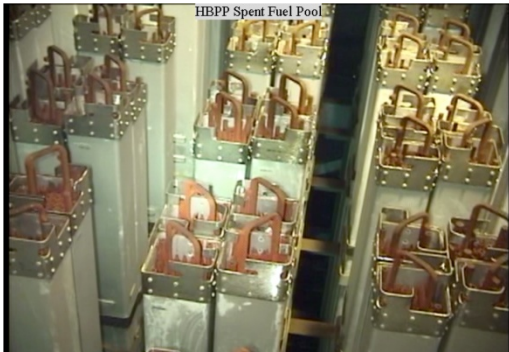
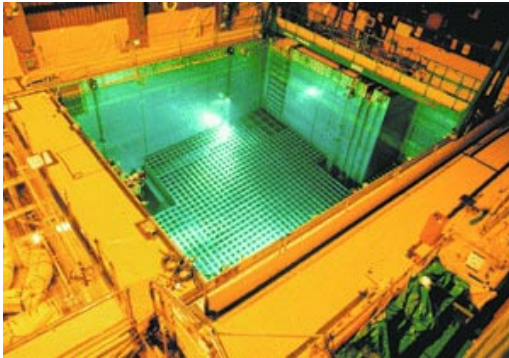
- **Loss of configuration control**
 - damaged spent fuel
 - spent fuel in prolonged storage (>20 years)
- **Higher burn-up spent fuel and burn-up credit**
 - from 35 GWD/t to 60 GWD/t
 - no burn-up credit for fission products allowed
 - confirm reactor records with burn-up measurements
- **Degradation of neutron absorbers in wet storage**
 - degraded Boraflex™ affects criticality control, dissolved silica affects operation of inter-connecting plant systems
 - boral blistering has been observed



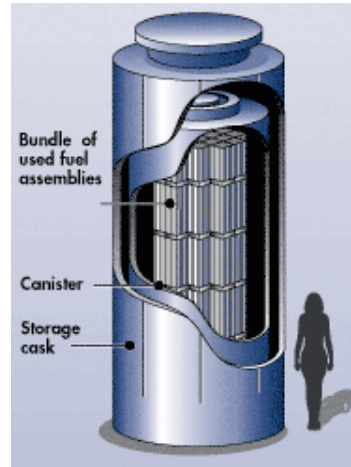
Humboldt Bay Spent
Fuel Storage Rack

Industrial Use of Criticality-Control Materials

- Boron based
- Aluminum matrix



A Wet Pool Storage:
Boraflex™, Boral, Metamic™



A Dry Cask Storage:
Boral™, Metamic™



TRANSNUCLEAR's
NUHOM™ 24P
Dry canister



A Rail Transportation Cask:
Boral, Metamic™

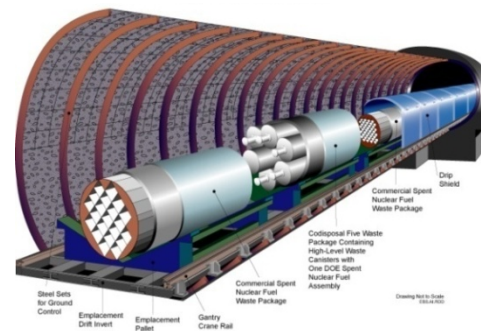
The Crucial Role of SNF & Waste Management

- Provide a safe and secure disposition for spent nuclear fuel (SNF) and radioactive wastes (HLW)
- Regional/multi-national approaches driven by non-proliferation, security, and environmental considerations

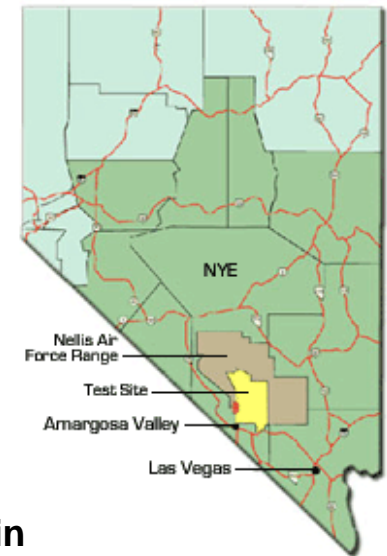
USDOE operated a WIPP for TRU waste in New Mexico, and submitted a license application to USNRC in June 2008 for Yucca Mountain (YM) as the US SNF and HLW repository



Waste Isolation Pilot Plant



Yucca Mountain



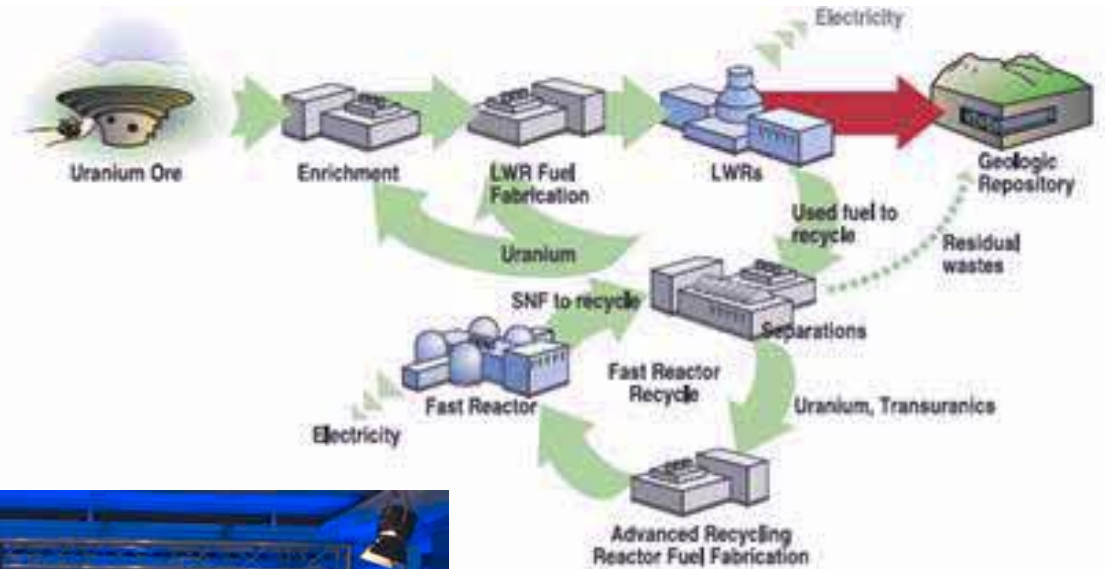
- The US decision that YM is no longer an option would have significant ramifications for other HLW repository efforts around the world. This issue may in long term impact the expansion of nuclear power world-wide

Global Nuclear Energy Partnership (GNEP)

- Never accepted by Congress,
- Office of Nuclear Energy has dismantled most of GNEP's organization structure and reassigned most GNEP staff,
- New effort to develop technology solutions to nuclear waste could emerge as part of DOE's AFCI portfolio, if so, the **international cooperation in this area may be limited to a very few key countries, primarily France and Japan,**
- Secretary Chu is concerned about separated plutonium, it is unlikely that aqueous separation process such as PUREX would be acceptable,
- **There is no support for a rapid deployment of reprocessing facilities, most efforts in this regard would be R&D,**
- Instead, the development of advanced, proliferation-resistant technologies seems most likely to be pursued,
- **DOE may continue on the international program activity, now consists of 25 member countries, however, such effort may be coordinated by DOS, if DOS is interested in its continuation,**

Global Nuclear Energy Partnership (GNEP)

International Focus:
Reliable Fuel Supply,
 but not yet on spent fuel
 take-back/take-away



Domestic Focus:
Advanced Fuel Cycle,
 cooperation with a few
 countries: France, Japan

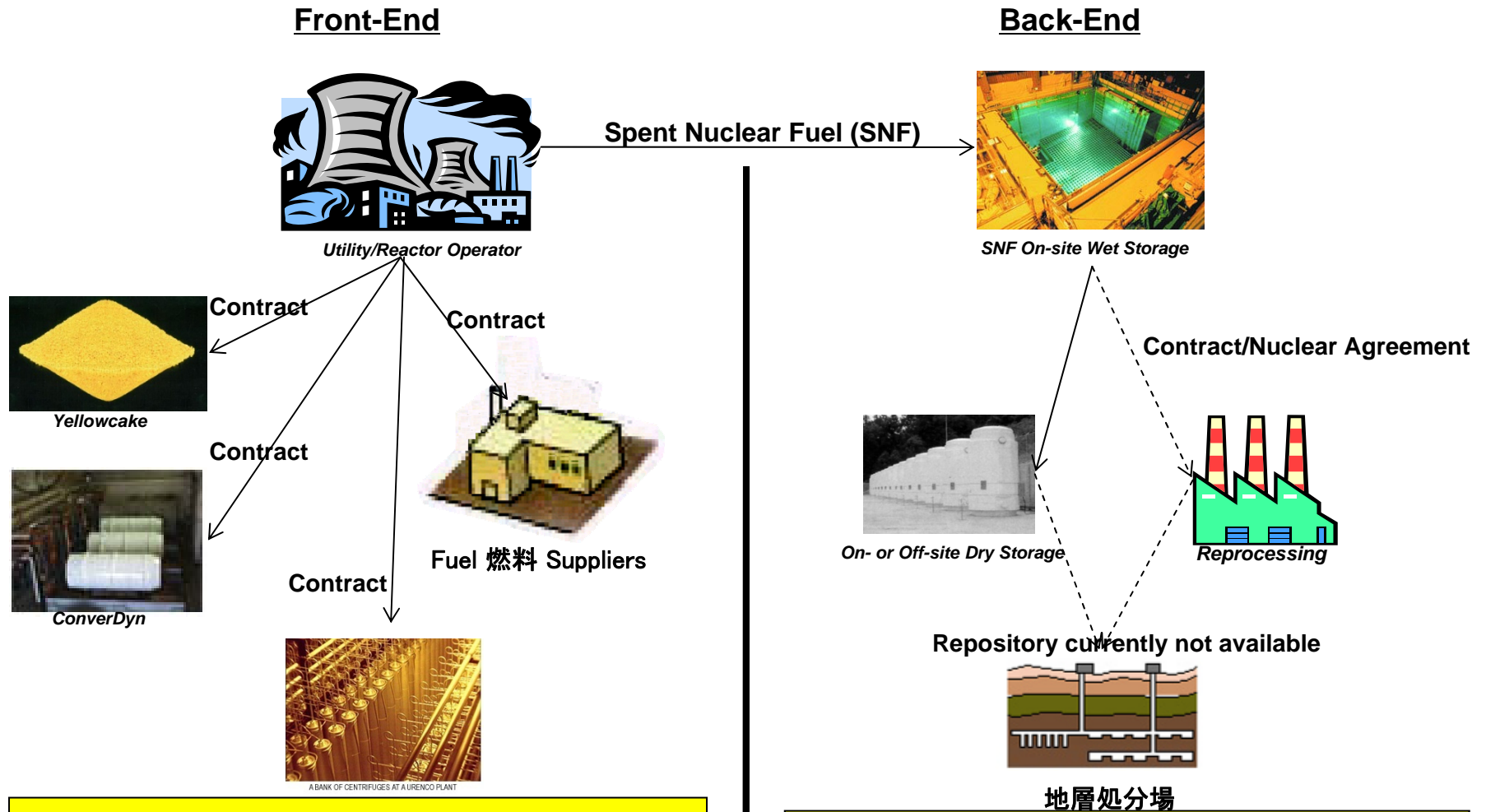
GNEP Executive Committee Ministerial-Level Meeting, Paris 2008

Nuclear Non-proliferation Challenges

- IAEA safeguards (Pre-NPT, CSA, AP),
- In recent years, more than a dozen states in the Middle East have expressed an interest in developing nuclear energy,
- It is difficult to see how the security threats raised by the spread of nuclear power to the Middle East can be controlled except by the strengthening of the Nuclear Non-Proliferation Treaty (NPT),
- Is it possible to minimize the spread of sensitive fuel-cycle technologies, while at the same time, allow for the expansion of nuclear energy applications?

“Business as usual” is no longer an acceptable option. A new model of nuclear fuel-cycle services is needed to offer to emerging nuclear countries for reducing the nonproliferation risks and environmental burden.

Current business practice for fuel-cycle services



**Separate contracts for fuel services,
Enrichment service could become
political and restrictive**

**Reprocessing service restrictive,
No repository available,
Utilities constipated with spent fuel**

Recent proposals :

Study on International Nuclear Fuel Cycle Regime/ Non-Proliferation Framework:

- El Baradei: Limit to E/R under multilateral controls
- Bush: Limit to existing full scale E/R facilities
- J. Choi & T. Isaacs: Global Network of Fuel Cycle
- IAEA Multinational Approach (MNA)
- Vic Reis: Fuel leasing, fuel-cycle states vs. Rx states
- MIT: Assured Fuel Service Initiative
- Putin: System of International Fuel Cycle Centers & IUEC
- WNA: Assured Fuel Supply/ International Fuel Cycle
- Intergovernmental WG: Multilateral mechanism
- Japan: IAEA standby arrangement system
- NTI: International LEU Fuel Bank
- GNEP: Reliable fresh fuel supply (& SNF take-back):
- **NAS/RAS: Internationalization of nuclear fuel cycles**
- Others

The NAS/RAS study was summarized by Micah Lowenthal, its study director at the Tokyo University workshop on regional network of nuclear fuel cycle facilities on 16 March 2009

FINDINGS

By 2020, many countries without a nuclear power plant are likely to initiate programs for the construction of one or more.

Uranium enrichment and spent fuel reprocessing have peaceful applications but also enable countries to produce direct-use materials for nuclear weapons.

Uranium enrichment programs are the main concern today, but spent nuclear fuel reprocessing could become the main concern again.

The more countries to which enrichment or reprocessing spread, the greater the risk of proliferation of nuclear weapons will be.

RECOMMENDATIONS

The governments of the United States and Russia should:

- Work with other countries and IAEA to make assured fuel supplies available before there is a major commitment to new nuclear power plants by countries that do not have them today.
- Continue to support a broad menu of approaches
- Seek to establish additional benefits and incentives for countries that choose not to enrich or reprocess.
- Work with the international community to help countries provide adequate capacity for safely storing spent fuel (on their own territory or elsewhere), or reliable reprocessing services from existing providers.

Plutonium (separated or new fuel) should not be sent to countries that have not previously received or made such material.

Countries should reduce and seek to minimize commerce in highly enriched uranium, except if sealed in a reactor core.

RECOMMENDATIONS

The United States, Russia, and other suppliers should increase their emphasis on establishing mechanisms for assured fuel-leasing or reactor-leasing services, including take-back of all irradiated fuel.

The United States and Russia should work together on cooperative approaches that would make it possible to enter into fuel-leasing arrangements in which they would guarantee to supply, and to take back, fuel for the lifetime of reactors built in “newcomer” states, with the fuel taken back to Russia for now, or to the United States too, if circumstances someday make that possible.

RECOMMENDATIONS

Multinational and international centers, need to be careful of the potential for leakage of sensitive technology and expertise.

Should work to ensure that all efforts to establish international centers for enrichment, reprocessing, or other sensitive activities include specific, stringent plans to prevent leakage of sensitive information and technology.

Those working to develop centers should have criteria for participation. Two major criteria for participation beyond the technology holders

- They should not have or be developing an enrichment facility
- They should be in compliance with IAEA safeguards and nonproliferation obligations.

Opportunity for Japan-U.S. Cooperation

A Proposal by the Nonproliferation Study Committee at Tokyo University for an Asia Pacific Cooperative Framework

- The committee consists of representatives from Japan's nuclear industrial companies, utilities, governmental agency, laboratories, NGOs, and staff and students from Tokyo University.
- The committee formed a working group to study the cooperative framework focusing on the Asia Pacific region.
- The goal of the regional network of nuclear fuel cycle facilities in Asia Pacific is to promote trust, confidence-building measures, and transparency of peaceful nuclear fuel-cycle programs in Asia Pacific.

The study committee aims to foster free-discussion on the future direction of nuclear energy from nuclear non-proliferation viewpoints among the members of G-COE-Tokyo University, nuclear industry utilities, and institutes on nuclear energy.

Therefore, the opinions given does not represent the individual companies /organizations, but the majority of the opinions shown during the discussions of the committee.

**A Nuclear Fuel-Cycle Network
for Asia Pacific#**
Board of Governors
 (Representatives of Member Parties)

**IAEA administers
safeguards to
fuel cycle
facilities**

**Possible
Member Parties:
Countries in Asia
Pacific Region**

**Office of Executive
Directors**

**Possible Uranium
Resource:** Market
mechanism

Possible Conversion
Market mechanism

**Possible Fuel
Fabrication:**
Market mechanism,
tied to specific
reactor vendors

**Possible MOX fuel
fabrication:** Limited
to countries which
have fuel cycle
needs and
capabilities

Possible Enrichment: Market
mechanism and Other
activities, e.g., Fuel Bank by
IAEA

Possible Reprocessing:
Limited to countries which
have fuel cycle needs and
capabilities

**Possible Spent Fuel
Storage Facilities:**
Provided by each member-
party country, and
possible regional facilities
for:
Interim (approx. 50 years)
Preferably by NWS
Multilateral Controls
Apply Safeguards

**Possible Geologic
Repositories:** Provided by
each member-party
country, and possible
regional repository

**Light Water Reactors
with U fuel**

Many countries

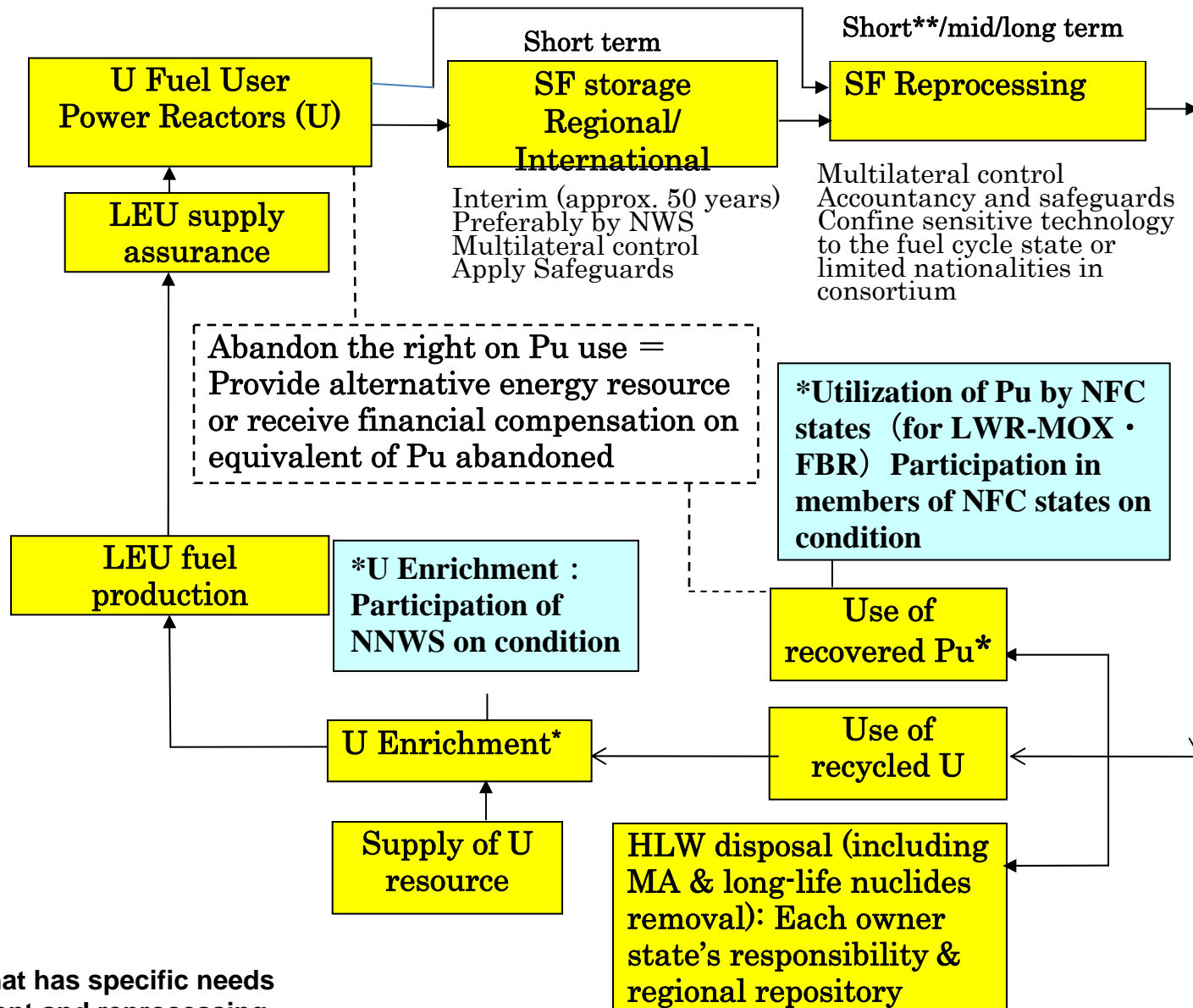
**Light Water Reactors with MOX fuel,
Fast reactors with Pu:**
Limited to countries with needs
and capabilities

Proposed by Nonproliferation Research Committee of Tokyo University

Objectives of the regional network

- Facilitate partnerships among Member Parties to provide fuel-cycle services,
- **Assure that reliable and economically-competitive fuel-cycle services will be provided** (including efficient use of resources),
- Increase in transparency among partners; prevent proliferation of SF and sensitive technologies, reduce diversion risk in nuclear fuel cycle states by multi-national control, employ proliferation resistant technologies.
- Efficiently coordinate international/regional safeguards inspection of fuel-cycle facilities in the network,
- **Effectively administer safety, security, and safeguards (3S) requirements on facilities of nuclear fuel cycle including spent fuel storage in the network,**
- Enhance the profile of peaceful use of nuclear power in Asia Pacific.

Activities in International/Regional Fuel-Cycle System

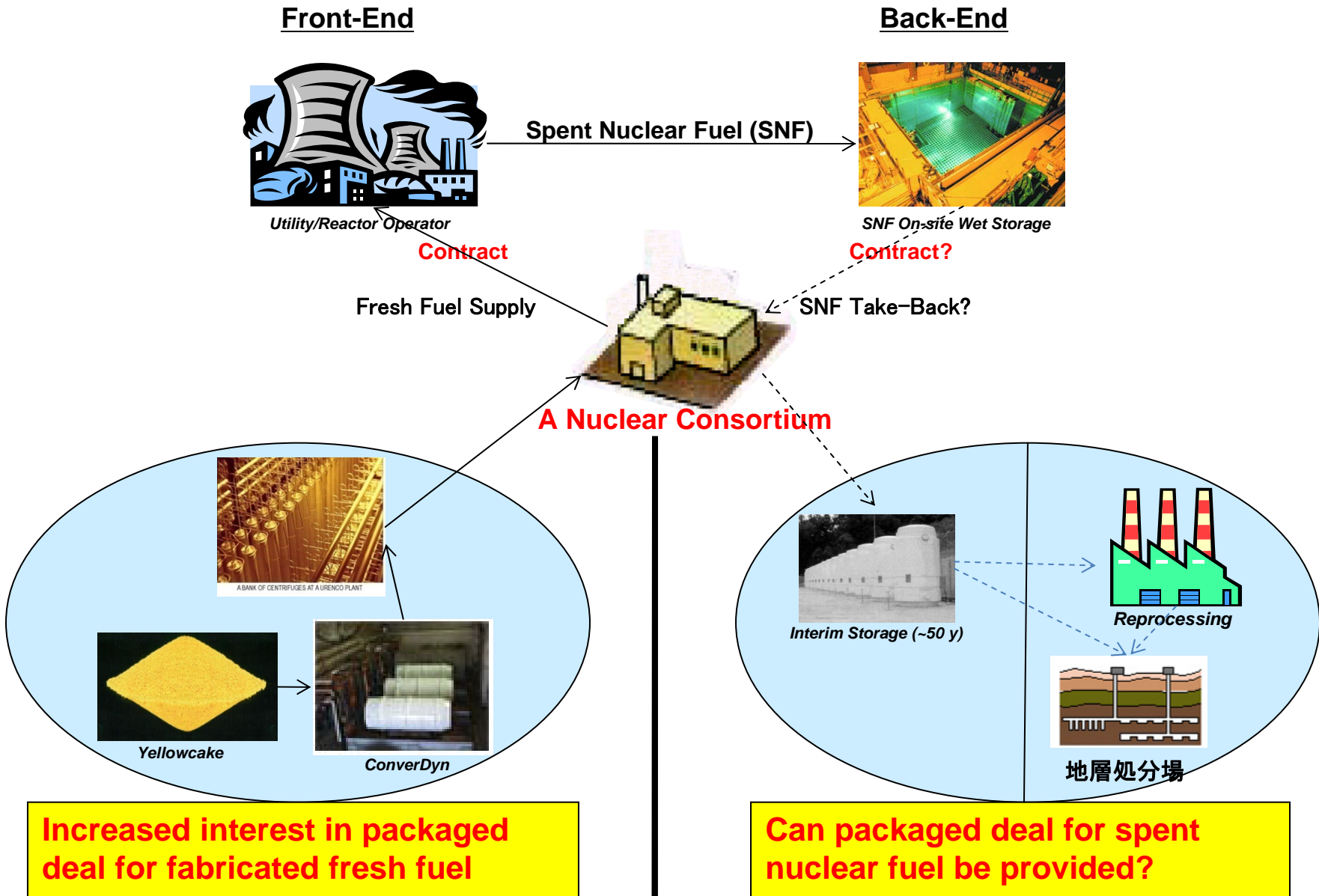


*Country that has specific needs of enrichment and reprocessing

Conditions to become a nuclear fuel cycle country

- **Has consistent need on plutonium (Pu) for peaceful utilization.** If there is an imbalance between the production and utilization of separated Pu in NNWS, the NWS should be willing to store / buy Pu from requests by NNWS when surplus Pu beyond its utilization strategy exists.
- The plan and activities on nuclear fuel cycle should be **transparent and be recognized by international communities.**
- The possession of fuel-cycle technology and the level of capability should be recognized by international communities.
- Should be **under international/institutional systems/norms including CSA, AP.**
- Should possess record of excellent performance of fuel cycle facilities in compliance with the international/institutional systems/norms.
- Time-proven adherence to international norms and cooperative performance in international activities on nuclear non-proliferation.
- Measures for **physical protection are at international level.** (Ratification of the Convention on Physical Protection of nuclear materials, and Treaty against Nuclear Terrorism, etc.)

A new model of fuel-cycle services for emerging nuclear countries



Benefits

- Emerging countries can have access to nuclear power at market prices.
- Fresh nuclear fuel supplies are assured at competitive prices.
- Spent nuclear fuel could be returned for management and disposal.
- Spread of sensitive fuel cycle technologies (enrichment/ reprocessing) reduced or eliminated – there is no need for emerging countries to develop these technologies.
- Increase business for nuclear consortia who provide “cradle-to-grave” nuclear fuel-cycle services.

- This is not a restriction to a country’s own fuel cycle development.
- It is an option aiming at improving nonproliferation and waste management.
- If a country decides to develop its own enrichment and reprocessing, it will have to deal with the nonproliferation and wastes issues conformed to international safeguards, safety, and security standards.

Challenges

- Key facilities in the back-end of the nuclear fuel cycle supporting the spent-fuel take-back, notably the regional spent fuel/HLW storage and waste repository are still needed.
- Cooperation is needed within the consortium that each partners has its roles and responsibilities in providing a “packaged deal for spent fuel”.
- Cooperation is needed within regions of emerging nuclear countries (e.g., ASEAN, Middle-East) to understand that a packaged deal for spent fuel is a “win-win” for nonproliferation and radioactive waste management.

Not all countries take others' spent fuel, a few examples are:

- The former USSR took spent fuel back from recipient countries
- Russia currently stores spent fuel for and from CIS countries
- The US takes research reactor spent fuel from recipient countries

- Can the Nuclear Weapons States do more?
- Can the Uranium Producing Countries help?

Closing Remarks

- Non-proliferation and waste management play an important role in the nuclear renaissance especially in the back-end of the nuclear fuel cycle. They also could have great impact to the entire nuclear enterprise.
- Technical cooperation on spent fuel storage among countries with existing nuclear power programs is needed to share operating experience on:
 - Industrial use of spent-fuel storage systems,
 - Challenges to long-term spent fuel storage/disposal.
- To reduce the proliferation risks and waste management burden for emerging nuclear countries, we may need:
 - A new model of fuel-cycle services,
 - Institutional cooperation, including regional/multi-national approaches for spent fuel/HLW storage and disposal.

**Thank You Very Much for
Your Attention**

Questions?