The Global Nuclear Energy Partnership

fact sheet 14

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Similar schemes have been developed in the past and they have all proved to be dangerous, polluting and to increase weapons proliferation risks.

Introduction

The Global Nuclear Energy Partnership (GNEP) is a set of proposals first advanced by United States' President George W. Bush in February 2006. It involves:

- the expansion of nuclear power in the US;
- changes to international civil nuclear arrangements such that a limited number of supplier nations would provide fuel services — supplying fresh fuel and recovering spent nuclear fuel for treatment and disposal — to 'user' nations; and

- a set of proposals with a domestic US focus, including reprocessing and the development of fast neutron reactors, aimed primarily at helping to resolve intractable waste management problems.

The domestic aspects of the GNEP have dominated the ongoing debate in the US and they are the focus of this paper.

The US Department of Energy (DOE) lists the following benefits of the GNEP:[1]

- Providing energy "without generating carbon emissions or greenhouse gases";
- Recycling used nuclear fuel to minimise waste and reduce proliferation concerns;
- Assuring maximum energy recovery from still valuable used nuclear fuel.
- Safely and securely allow developing nations to deploy nuclear power to meet energy needs; and
- Reducing the number of required US geologic waste repositories to one for the remainder of this century.

The US proposes to recommence commercial processing, and to develop and build fast neutron reactors that would produce electricity and also convert long-lived radioactive wastes into relatively short-lived wastes (a process called transmutation).

A May 2006 report by the US House Energy and Water Development Appropriations Committee points to the lack of detail in GNEP proposals: "[T]he Committee has serious reservations about GNEP as proposed by the Administration. The overriding concern is simply that the Department of Energy has failed to provide sufficient detailed information to enable Congress to understand fully all aspects of this initiative, including the cost, schedule, technology development plan, and waste streams from GNEP." (US House Committee, 2006.)

Radioactive Waste

Establishing interim storage and permanent disposal facilities for nuclear waste has been a protracted and controversial issue in the US and it is a long way from resolution.

The waste management problems could jeopardise plans to build new reactors. The US House Committee questions whether the Nuclear Regulatory Commission would licence new reactors in the absence of a clear disposal path for spent fuel, and notes that DOE's response is to seek legislation eliminating the availability of disposal space in a permanent repository as a consideration for the NRC in licensing new reactors.[2] The Committee argues that attempting to "legislate away" the waste problem is not a responsible course of action.

The estimated opening date for the Yucca Mountain repository in Nevada has been pushed back from 1998 to 2017. As the US House Committee notes, DOE's latest plan entails a seven-year delay from the schedule just two years ago. In other words, Yucca Mountain keeps receding into the future!

Even if the Yucca Mountain repository is eventually opened, the current legal limit for the repository is insufficient for the total projected output of reactors currently operating in the US, GNEP reprocessing and transmutation plans aim to partly address this problem As Steve Kidd from the World Nuclear Association states: "The difficulties encountered with establishing Yucca as an operating repository have undoubtedly influenced the move towards GNEP.[3] The likelihood of having to establish several Yuccas in the USA alone, if there is a significant boom in nuclear power in the 21st century, has obviously concentrated a lot of official thinking."

Reprocessing

The GNEP could partially and temporarily alleviate the waste management problems. In particular, the recommencement of commercial reprocessing in the US would reduce the volume of high-level nuclear waste to be disposed of. (Spent nuclear fuel from conventional reactors typically comprises, by mass, 3% high-level waste, 1% plutonium and 96% unused uranium.

Oelrich (2006), a member of the Federation of American Scientists, summarised the problem in the Nuclear Engineering International magazine: "Few are willing to argue that Yucca Mountain is the ideal long-term geologic waste repository. It was picked, in part – and there can be much debate about how large a part – because of political expediency. At the time of the decision, Nevada had a much smaller population and was politically weak. Since then, the population of Las Vegas has exploded and Senator Harry Reid of Nevada is the Minority Leader in Congress. Whatever the fate of Yucca Mountain, it continues to be an ugly political battle that no-one wants to repeat."[4]

The GNEP envisages the development of novel reprocessing technologies, with particular emphasis on 'UREX+'. The DOE says UREX+ would accomplish the following:

- Separate uranium from the spent fuel at a high level of purification that would allow it to be recycled for re-enrichment, stored in an unshielded facility or simply buried as low-level waste.
- Separate and immobilise long-lived fission products, technetium and iodine, for disposal in Yucca Mountain.
- Extract short-lived fission products, cesium and strontium, and prepare them for storage until they meet the requirements for disposal as low-level waste.
- Separate transuranic elements (plutonium, neptunium, americium and curium) from the remaining fission products so they can be fabricated into fuel for fast neutron reactors.[5]

The main potential advantages of UREX+ over conventional 'PUREX' reprocessing are as follows:

- Plutonium mixed with other transuranic elements is more difficult and dangerous to use in nuclear weapons compared to the plutonium extracted from spent fuel during conventional reprocessing (transuranic elements are atoms heavier than uranium that are produced in the process of nuclear fission).
- The transuranic elements can be irradiated in fast neutron reactors, converting them to nuclides with shorter half-lives, thus facilitating storage and disposal.

The development of new reprocessing technology promises to be protracted and expensive. The US House Committee (2006) states "advanced recycling on any significant scale is at least a decade or more in the future".[6]

Fast Neutron Reactors

Fast neutron reactors use plutonium as their basic fuel and have no moderator. The intention is to fission long-lived wastes to transmute them to nuclides with shorter half-lives, thus simplifying disposal. Fast neutron reacors would be required because complete destruction of transuranics is not feasible in conventional light-water power reactors.

As with the development of new reprocessing methods, the development of fast neutron reactors also promises to be expensive and protracted and to raise new safety issues (as has been the historical experience with fast breeder reactors). The US House Committee (2006) states that the plan to use fast reactors "adds significant cost, time, and risk" to previous, less ambitious plans to recommence commercial reprocessing in the US and to use the separated plutonium in mixed plutonium/uranium oxide (MOX) fuel.[7]

Transmutation — using neutrons from reactors or other sources, or charged particles from particle accelerators — has been studied for decades but progress has not been promising. There is no reason to believe that the use of fast neutron reactors will dramatically improve the balance of benefits to costs and risks.
A report from the UK government's Radioactive Waste Management Advisory Committee (2003) concluded that partitioning (separation of different nuclides) followed by transmutation could deal with only a small fraction of the UK's higher-activity wastes, it would be costly, and would require new nuclear reactors and reprocessing plants.[8]
The Massachusetts Institute of Technology Interdisciplinary Study concludes that: "Decisions about partitioning and transmutation must ... consider the incremental economic costs and safety, environmental, and proliferation risks of introducing the additional fuel cycle stages and facilities necessary for the task. These activities will be a source of additional risk to those working in the plants, as well as the general public, and will also generate considerable volumes of non-high-level waste contaminated with significant quantities of transuranics. Much of this waste, because of its long toxic lifetime, will ultimately need to be disposed of in high-level waste repositories. Moreover, even the most economical partitioning and transmutation schemes are likely to add significantly to the cost of the once-through fuel cycle."[9]

GNEP is at best a partial, temporary and problematic solution to the waste controversies. The US House Committee states: "Resolution of the spent fuel problem cannot wait for the many years required for the GNEP to proceed through comprehensive planning, engineering demonstration, NRC licensing of the recycling plant, any new reactor types such as fast reactors, and each new recycled fuel type, and ultimate operations. The credibility of the Administration's support for the future of the nuclear power industry rests on its resolution of the issues associated with taking custody of spent fuel and opening a permanent geologic repository for high-level nuclear waste (Yucca

Mountain), as required by the Nuclear Waste Policy Act. GNEP will not be ready to begin large-scale recycling of commercial spent fuel until the end of the next decade, and the Yucca Mountain repository will not open until roughly the same time. Such delays are acceptable only if accompanied by interim storage beginning this decade."[10]
Richard Lester, professor of nuclear science and engineering at the Massachusetts Institute of Technology, doubts whether the GNEP plans will lessen the controversy surrounding waste management issues: "Energy Secretary Sam Bodman recently suggested that GNEP has the potential to postpone a second U.S. waste repository indefinitely, even if nuclear power growth does resume. This appeals to politicians, who are almost desperately eager to avoid another politically painful repository-siting process. But offsetting this promise is the requirement, also implicit in GNEP, to find sites for new reprocessing plants, fuel and target fabrication facilities, and fast-spectrum burner reactors. Each of these may be easier to site than a second waste repository, though perhaps only marginally so. But GNEP is likely to increase the quantity of required nuclear sites, possibly by a large number."[11]

Lester concludes: "The Bush administration claims that this scheme could eliminate the need for repositories other than Yucca Mountain, cut the duration of the waste disposal problem from hundreds of thousands of years to something much shorter, and use almost all the energy in uranium fuel. This is an appealing vision, but the reality is that GNEP is unlikely to achieve these goals and will also make nuclear power less competitive."
According to Steve Kidd, the US nuclear power industry has greeted the GNEP "politely, but coolly".[12]
The GNEP envisages that reprocessing plants could double as interim storage sites. However, there are no commercial reprocessing plants in the US, and one can easily imagine heightened opposition to the development of reprocessing plants if they are also to serve as interim storage sites.

Oelrich states: "To an extent, reprocessing is an attempt to escape the political pain of finding a site for a second geologic repository. But this simply trades the well-know political problems of Yucca Mountain for the thus far hypothetical, but most likely equally intense, local political resistance that can be expected from trying to site more than a dozen fast neutron reactors, a couple of reprocessing centres, and the transportation of spent fuel."[13]
Given the problems with management of domestic wastes, it is almost inconceivable that the US would receive spent fuel or high-level waste from power reactors in other countries for disposal. (A program has been operating for many years under which the US accepts some spent fuel from research reactors, but a program dealing with wastes from power reactors would involve vastly greater amounts.)

Weapons Proliferation
UREX+ is preferable to conventional reprocessing for a variety of reasons including that it produces a mixture of plutonium and other, more radioactive isotopes. However, this might not create much of a radiation barrier to would-be proliferators.[14] Spent nuclear fuel provides a vastly greater radiation barrier — by as much as several orders of magnitude. Indeed from the mid-1970s until recently, US governments have implemented a policy of opposition to reprocessing because of proliferation concerns.

Lester questions the non-proliferation claims made in support of the UREX: "[A]doption of UREX+ reprocessing of light-water reactor fuel combined with reprocessing of advanced burner reactor fuel would introduce sizeable new flows and stocks of contaminated plutonium that might be only marginally better protected from would-be proliferators than pure plutonium, and much less protected than if the plutonium simply remained in the spent fuel. For countries that are not now reprocessing, including the United States, this would not be a positive development. In the case of GNEP, the goal of ensuring that no plutonium would be available to nuclear felons centuries from now is achieved at the price of an elevated proliferation risk during the several-decade period between waste generation and disposal, as well as the additional economic costs, plus health, safety, and environmental risks, incurred during that time."[15]

While the emphasis has been on the development of fast neutron reactors to 'burn' plutonium and other actinides, these reactors can also be used to 'breed' plutonium, which sits uncomfortably with the stated non-proliferation objective.

Fast neutron reactors could initially be fuelled with existing plutonium stockpiles but in the longer term the system relies on the ongoing production of plutonium and on reprocessing.

The history of conventional reprocessing is not reassuring. For many years plutonium has been separated from spent fuel at considerably greater rates than its use in MOX or breeder reactors, such that the global stockpile of separated plutonium has been steadily increasing. The stockpile of 'unirradiated' plutonium (separated or contained in MOX) has grown to over 270 tonnes, with about 15-20 tonnes of plutonium separated from spent fuel each year but only 10-15 tonnes fabricated into MOX fuel (and a very small amount into fuel for the few existing fast neutron reactors).[16]

The GNEP's vision of regional reprocessing centres could come into conflict with the fundamental GNEP goal of limiting the spread of reprocessing. It is argued that existing plants could be used, but in the longer term new reprocessing plants would be required. Moreover, since a new reprocessing method is envisaged, the argument about the potential use of existing plants does not hold.

It is difficult to see how the non-proliferation goals of the complex GNEP concept could be realised when the vastly simpler problem of reducing existing stockpiles of unirradiated plutonium — by slowing or suspending reprocessing — remains unresolved.

Further reading:

US Department of Energy's GNEP website: www.gnep.energy.gov

Nuclear Age Peace Foundation:
www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/proliferation/fuel-cycle/index.htm

International Atomic Energy: www.iaea.org/NewsCenter/Focus/FuelCycle/index.shtml

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About the author:

Jim Green is the national nuclear campaigner with Friends of the Earth. He has an honours degree in public health and a PhD in science and technology studies for his doctoral thesis on the Lucas Heights research reactor debates. He is the author of the September 2005 report, 'Nuclear Power: No Solution to Climate Change', available at: www. melbourne.foe.org.au/documents.htm.

About our organisation:

energyscience.org.au is a co-operative production by a group of concerned scientists, engineers and policy experts that seek to promote a balanced and informed discussion on the future energy options for Australia.
With increasing concern over the looming impact of global climate change the community needs to be aware of the issues involved. energyscience aims to provide reliable and evidence based information to our whole community

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