

Dual Use: Dealing with Uranium Enrichment

Plans are afoot to limit access to uranium enrichment in order to exclude the misuse of civilian nuclear projects for military purposes. These discussions are focusing on projects for an international uranium bank and on new US approaches to technology exports for the purpose of preventing the proliferation of nuclear weapons.

By Jonas Schneider and
Oliver Thränert

The Nuclear Non-Proliferation Treaty (NPT) is the core pillar of all efforts to keep the number of nuclear weapons states low. While the US, Russia, the UK, France, and China are permitted to own nuclear weapons at least for the time being, all other state parties – which currently include nearly all members of the UN, including Switzerland – have permanently foregone nuclear weapons. At the same time, the non-nuclear weapons states still have the right to use nuclear energy for peaceful purposes. According to Article IV of the NPT, the parties to the treaty even subscribe to the greatest possible degree of cooperation in the use and advancement of peaceful nuclear energy.

Since the very beginnings of the NPT, there have been recurrent debates over the danger of military misuse of peaceful nuclear projects. There are essentially two different ways of acquiring fissile material for construction of nuclear weapons: The first is to highly enrich uranium; the second is to extract plutonium from fuel rods. For this reason, uranium enrichment and nuclear reprocessing are seen as the main proliferation-critical elements of a nuclear program.

The problem of military misuse of civilian nuclear programs is also reflected in the controversy over Iran's nuclear program.



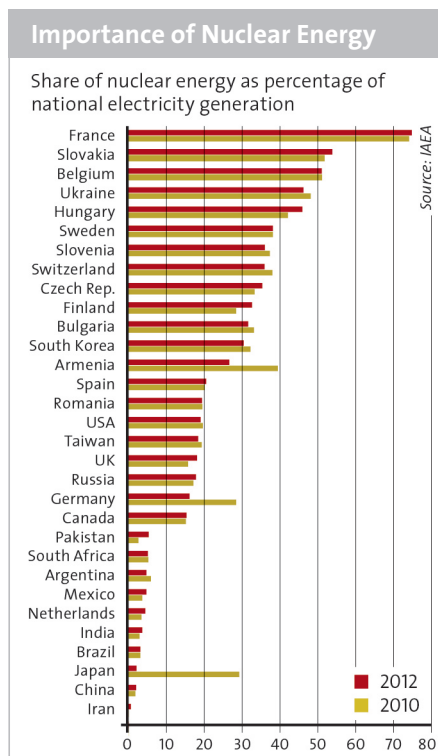
Gas centrifuges are typical dual use goods: they may be used to enrich uranium for civilian as well as military purposes. *USEC*

Tehran asserts that its intentions are entirely peaceful. However, Iran has jeopardized the necessary international trust by failing to report its uranium enrichment plants as well as a heavy-water reactor still under construction to the International Atomic Energy Agency (IAEA), as required under the NPT rules. In the interim agreement with the E3/EU+3 (France, the UK, Germany, the US, Russia, China) of November 2013, Iran stated its willingness largely to freeze these projects for the time being. However, at the same time, it asserts what it regards as its right to enrich uranium.

Two Types of Reactors

There are essentially two types of nuclear reactors: Heavy- and light-water reactors. The first type uses heavy water as a moderator and for cooling. Natural uranium serves as fuel. Thus, the uranium does not need to be enriched. With regard to proliferation, heavy water reactors are problematic, as weapons-grade plutonium can be made from their fuel rods.

Most of the nuclear power plants used for power generation are light-water reactors, though. They use ordinary water for mod-



The statistics published in the “World Nuclear Industry Status Report 2013” show that the share of nuclear energy as a percentage of global power generation is on the wane, as is the number of operational reactors, since more old power plants are being switched off than new ones are going online. At the same time, however, some countries are expanding their nuclear energy use, especially China, where 29 nuclear plants are currently under construction. Additionally, a number of countries are building commercial reactors for the first time, or planning to do so; among these are the United Arab Emirates (UAE), Egypt, Jordan, Turkey, Indonesia, Bangladesh, and Vietnam.

Against the background of the dispute over Iran’s nuclear program, but also because an increasing number of states is planning to begin using atomic energy for peaceful purposes, the international debate over the “multilateralization of the fuel cycle” has intensified over the past years. Former US senator Sam Nunn has summarized the problem in a nutshell, saying that if every country that planned to build light-water reactors were also to consider operating uranium enrichment plants, the proliferation of dangerous nuclear material would increase at a reckless pace.

Uranium Banks Secure Fuel Supply

The current international efforts essentially hinge on the fact that operators of light-water reactors must, on the one hand, have access to the necessary fuel, i.e., sufficiently enriched uranium, while on the other hand voluntarily forgoing the construction of uranium enrichment plants of their own. Since December 2010, the Russian government in cooperation with the IAEA has been operating a uranium bank near the city of Angarsk in Siberia comprising 120 tons of low enriched uranium. While this bank is fully under the authority and control of the Russian government, there are also plans for establishing a uranium reserve under the authority and control of the IAEA in Kazakhstan. This USD 150 million facility is to be financed by the privately operated US “Nuclear Threat Initiative” as well as the US, the EU, Kuwait, the UAE, and Norway. While the IAEA board of governors agreed to this proposal at the end of 2010, the details of how the IAEA and Kazakhstan will cooperate on this matter have not yet been finalized, which is why the uranium bank has not yet begun to operate.

If IAEA member states that put their peaceful nuclear programs under IAEA safeguards, and operate in accordance with its regulations, should experience a disruption of their fuel supply, they are to be given access to enriched uranium at market prices from one of the two uranium banks. This would not require the countries explicitly to renounce uranium enrichment activities of their own. Nevertheless, several countries have reservations regarding the uranium bank scheme. They note that the market for enriched uranium for civilian purposes is currently functioning smoothly. Should a country be excluded from purchasing enriched uranium for political reasons, it would certainly also not be given access to one of the uranium banks. Therefore, critics suspect that the uranium bank advocates are motivated by purely economic considerations: If the number of urani-

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um enrichers remains restricted, they will be better able to control the supply and thus the market prices for uranium.

On 27 November 2009, Switzerland voted in favor of the Angarsk uranium bank in the IAEA board of governors. At the time of the vote on the second bank in Kazakhstan, Berne was no longer a member of that forum. Despite the vote in favor, many of the critics’ arguments against these projects are shared in Switzerland. In particular, there is skepticism regarding the dominance of the permanent UN Security Council members (P5) in connection with the uranium bank scheme.

The View from Washington

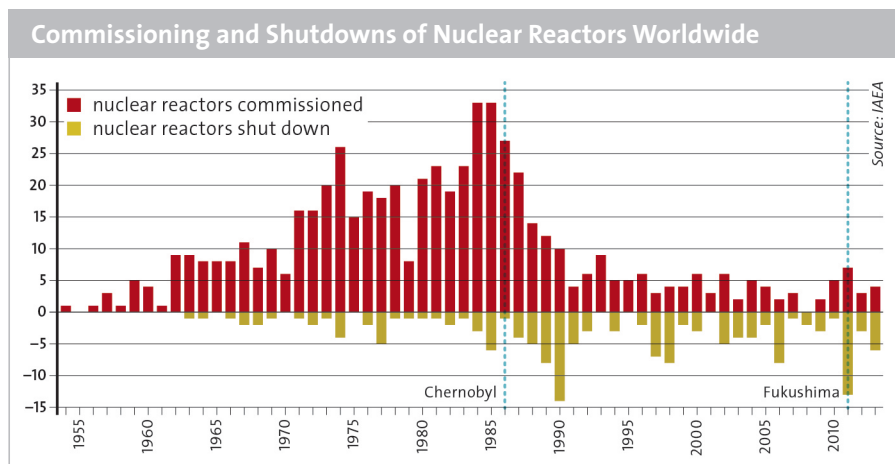
US policy on limiting access to sensitive technologies such as uranium enrichment is an important factor. In order for US companies to be able to export nuclear technology or nuclear material, a “123 cooperation agreement” must be in place between the US government and the recipient country’s government. Such agreements stipulate that nuclear material will not be enriched or reprocessed without previous programmatic consent by the US government if the material was supplied by the US or was produced using nuclear material or installations imported from the US under a 123 agreement. Notably, this requirement for US consent also applies if only

eration and cooling. Their advantage, from the proliferation perspective, is that it is difficult to divert plutonium for military purposes from this reactor type.

However, in order to be used in light-water reactors, uranium must first be enriched. The technology is demanding and elaborate, and only 14 states have mastered it – most of them already nuclear weapons states. Indeed, uranium enrichment is a textbook example of a dual-use technology, since it can be used both for civilian and for military purposes. Uranium enrichment plants can be used, without major structural modifications, to produce both low enriched uranium (3–5 per cent) for use in light-water reactors and highly enriched uranium (80–90 per cent) for use in nuclear weapons.

More Countries Using Nuclear Energy

In some European countries, the reactor disaster at Fukushima in March 2011 caused a rethink. Germany has decided to abandon nuclear energy. In Switzerland, too, the Federal Council and the parliament have resolved to shut down the country’s five nuclear power stations after the end of their safe operational lifetime, which will probably be fixed at 50 years; at the same time, no construction of new reactors will be permitted.



certain elements of an installation are sourced from US companies.

The US currently maintains 123 agreements with 21 states including Switzerland as well as with the European Atomic Energy Community (Euratom) and Taiwan. Only three partners were given programmatic consent for enrichment and reprocessing: Euratom, Japan, and India. The other 19 states and Taiwan have given assurances to the US that they will not themselves enrich or reprocess any of the nuclear material they have received from the US or created with US technology over the years. Since for many of these countries, the US is the main source of nuclear material and technology, the 123 agreements considerably limit the legal options of these partners concerning nuclear technology. However, they are allowed to enrich and reprocess the nuclear material that they have neither received from the US nor created using US-nuclear technology. Since the George W. Bush administration, there have been discussions in Washington over how to close this gap. In January 2009, the US successfully concluded a legally binding agreement with the UAE in which the Emirates renounced future enrichment and reprocessing projects of their own. This agreement was significant because the UAE had commissioned the construction of four light-water reactors by a South Korean consortium using US technology. Among some US observers, this strict agreement was subsequently cast as the desirable “gold standard” for all new 123 agreements.

The advocates of this gold standard are to be found mainly in the US State Department. Officials of the State Department argue that in crisis regions such as the Mid-

dle East, the sweeping introduction of this standard is the only way of dealing with the danger that increased civilian use of nuclear energy may be accompanied by the proliferation of nuclear weapons. In the US Department of Energy (DoE), on the other hand, skepticism prevails. While the State Department emphasizes nuclear non-proliferation, the DoE is guided by business interests. The fear is that potential partners might refuse a US offer based on a 123 agreement that incorporates the gold standard and strictly excludes uranium enrichment and reprocessing. Instead, such states might do business with other provider countries that do not require such a legal renunciation.

This is indeed a justified concern, as the US is competing with a broad range of other nuclear provider countries, none of which has so far subscribed to the notion of a gold standard. These include France, Russia, China, South Korea, and Japan. The following example shows that the concerns of US gold standard sceptics are not devoid of substance. Japan has a great deal of interest in an international consortium, which includes the Japanese Mitsubishi Corporation, being able to construct four reactor blocks on the Turkish Black Sea coast. This

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deal is favored by the fact that Japan and Turkey have concluded a nuclear cooperation agreement that explicitly permits Ankara to enrich and reprocess uranium.

Decisions of the US Administration

After several years of inter-ministerial discussions, the administration of US President Barack Obama decided in December 2013 against fixing the gold standard as the norm for all future 123 agreements. Instead, it wants to be able to decide flexibly which conditions a given cooperation partner must meet for a 123 agreement to be concluded. This may include the legally binding renouncement of any uranium enrichment and reprocessing as defined by the gold standard. However, in other cases, the US government may be satisfied with a mere political statement of intent by the partner not to enrich or reprocess nuclear material. It is also conceivable, however, that a 123 agreement may only stipulate the usual limitations on enrichment and reprocessing of nuclear material imported by the US or produced with US technology. Even agreements expressing the fundamental US programmatic consent to other uranium enrichment and reprocessing by additional states are not inconceivable.

The Obama administration has so far stated that it aims to make the requirement for a legally binding renunciation as defined by the gold standard dependent on three criteria: The first is the region where the state in question is located. In the Middle East, where an acquisition of nuclear arms by Iran might trigger a new arms race, Washington may be expected to be particularly insistent in demanding restraint in terms of uranium enrichment and reprocessing. The same is likely to apply, secondly, to states like South Korea that have in the past considered options for building nuclear weapons. Third, Washington will have to take into consideration whether the potential partner might prefer to forgo a 123 agreement with the US altogether rather than entering into one based on the gold standard.

US Nuclear Partnerships

The flexible negotiation strategy of the Obama administration has already been revealed in the recently concluded 123 agreements. For instance, the 123 agreement signed with Vietnam in October 2013 only includes a political undertaking in its preamble not to aim for own uranium enrichment or reprocessing. A gold-standard agreement, observers say, would have been refused by Hanoi. Conversely, the 123 agreement with Taiwan announced in January 2014 stipulates a gold-standard 123 agreement. This is most likely due to Taip-

ch's weaker negotiating leverage: For Taiwan, which is not recognized internationally as a state and can therefore not join the IAEA, the US constitutes the only link to the international nuclear market. Therefore, Taiwan could not refuse the US demand to observe the gold standard.

In the coming years, Washington aims to sign three more 123 agreements with Jordan, Saudi Arabia, and South Korea. Jordan and Saudi Arabia have already signed political statements of intent with the US on foregoing uranium enrichment and reprocessing. Nevertheless, in both cases, the Obama administration – with the backing of Congress – will insist additionally on the legally binding gold standard, arguing that the risks of proliferation in the region are too high. Neither state, however, is willing to agree to the gold standard so far.

South Korea not only wants to skirt the gold standard in renewing its expiring 123 agreement, but also is aiming at getting US programmatic consent for enriching uranium of its own and operating a certain type of reprocessing known as pyroprocessing. The wish for reprocessing in particular is based on a reasonable requirement: As one of the world's most prolific users of nuclear energy (21 power plants), South Korea has accumulated huge amounts of spent fuel rods. Its storage capabilities for this

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nuclear waste are almost completely exhausted. Pyroprocessing would be a possible solution to this problem. Also, South Korea aims to increase its exports of nu-

The 123 Agreement between the US and Switzerland

Since Switzerland is not a member of the European Atomic Energy Community, it is the only Western European country apart from Norway to maintain a separate 123 agreement with the US. It is based on the US-Swiss agreement on the civilian use of nuclear power of 1965 and was **signed in 1997**. Under the terms of the treaty, both parties undertake not to use nuclear material and equipment exchanged between them for research, construction, and development of nuclear warheads or other military purposes. All of the transferred nuclear material must have appropriate physical safeguards. Nuclear material used in Switzerland must be made accessible to the IAEA (as stipulated by its bilateral agreement with Switzerland). Uranium transferred as part of the treaty **may not be enriched to beyond 20 per cent**; nor may it be reprocessed unless both parties have given their permission. An annex lists the **Swiss nuclear institutions** allowed to use plutonium (the light-water reactors Beznau I and II; Paul Scherrer Institute, Villigen) and highly enriched uranium (the University of Basel's research reactor and the Paul Scherrer Institute) under the 123 agreement. Any disputes are to be resolved by a joint arbitration commission. The agreement is valid for 30 years.

clear reactors in the future. In order to be able to compete with countries like France or Russia, Seoul would like to be able to supply the uranium for its reactors as well. While the Obama administration acknowledges these issues that South Korea has, it still wishes to withhold uranium enrichment and reprocessing capabilities from Seoul.

Future Implications of an Iran Deal

The future modalities of access to uranium enrichment depend to a considerable degree on the outcome of the current negotiations on the Iranian nuclear program. Should these talks confirm the outlines of a deal as foreshadowed in the interim agreement of November 2013 – allowing Iran to continue its uranium enrichment – it would be difficult to withhold the technology from other states that also have an interest in acquiring it. They will point out that they themselves have been faithful to their obligations under the NPT and the IAEA and argue that they cannot be denied what is being conceded to Iran after it defaulted on the treaty.

While uranium banks are unlikely to stop these countries from pursuing their own enrichment capabilities, the US would find it even more difficult to deny to countries that are mostly its allies a technology that it is allowing Tehran to possess.

Jonas Schneider is a PhD student and researcher at the Institute of Social Sciences at the Christian Albrechts University, Kiel, Germany.

Dr. Oliver Thränert is the head of the think-tank at the Center for Security Studies (CSS) at ETH Zurich, Switzerland.

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Feedback and comments: analysen@sipo.gess.ethz.ch
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