New multilateral approaches solving the nuclear energy dispute with Iran

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Summary

The focus of this report is on possible multilateral approaches for cooperation with Iran on the nuclear fuel cycle. The aim is to contribute in finding diplomatic solutions to the Iranian nuclear dispute. The proposals challenge the traditional views of Iran's role in the nuclear negotiations in particular, and in the international community in general. The report investigates the possibility of accepting Iran's enrichment of uranium, under an enhanced safeguards regime, and through a multilateral cooperation on the production of nuclear fuel. In relation to this, the report also explores the benefits of including new actors in the proposed solutions.

Two different models for multilateral nuclear fuel cycle cooperation with Iran will be presented. The aim of these models is to ensure greater transparency in Iran's nuclear activities, in order to minimize the risk of proliferation of nuclear weapons, while simultaneously presenting a solution that will be acceptable to Iran. The first model is a tripartite consortium model that consists of a cooperation between Kazakhstan, Iran and South Africa, in which these countries additionally cooperate with an IAEA-supervised international nuclear fuel bank. The second model is a nuclear fuel cycle cooperation between Iran and six of the countries bordering the Persian Gulf. In both models, the countries in question will be responsible for different parts of the nuclear fuel cycle. Iran will be responsible for the uranium enrichment activities, but will have to give up all other fuel cycle activities. Another prerequisite is that Iran accepts not to store enriched uranium on Iranian soil.

The report shows that the international community should consider accepting enrichment of uranium on Iranian soil in the long-term. In addition, it is concluded that cooperation with Iran on the nuclear fuel cycle, where Iran is a reliable nuclear supplier state of enriched uranium and other states are responsible for the remaining parts of the fuel cycle, can potentially be realized. It will require a large amount of political will, however; both from the international community and from Iran. Fuel cycle cooperation with Iran is also a solution in a long-term perspective. Certain conditions must be fulfilled for the solution to feasible, and of particular significance is an Iranian implementation of confidence-building measures, in order to increase the world's confidence in Iran's intentions in the nuclear field. Regardless of which actors are best suited to participate in a nuclear fuel cycle cooperation with Iran, the Iranian government will have to play with open cards and implement transparency measures already in an early phase.

Norwegian Summary

Fokuset for denne rapporten er rettet mot mulige multilaterale tilnærminger for samarbeid med Iran om den kjernefysiske brenselssyklusen. Tilnærmingene er ment som et verktøy i bestrebelsen etter å finne diplomatiske løsninger på atomkonflikten med Iran. Forslagene som presenteres utfordrer til nytenkning om Irans rolle i det internasjonale samfunnet generelt, og i atomforhandlingene spesielt. Rapporten undersøker muligheten for at Iran kan få aksept for å anrike uran på egen jord, gjennom et multilateralt samarbeid om produksjon av kjernebrensel under bestemte rammer. Rapporten ser i den sammenhengen på muligheten for inkludering av nye aktører i forhandlingene.

Det blir presentert to modeller for multilateralt samarbeid med Iran om den kjernefysiske brenselssyklusen. Formålet med begge modellene er å presentere forslag til løsninger som skaper større grad av innsyn i og kontroll av Irans kjernefysiske aktiviteter, som kan bidra til å minimere risikoen for spredning av kjernefysiske våpen, og som samtidig vil kunne aksepteres av Iran. Den første modellen som presenteres dreier seg om et trilateralt konsortium mellom Kasakhstan, Iran og Sør-Afrika, hvor disse aktørene samarbeider med en brenselbank. Den andre modellen dreier seg om et brenselssyklussamarbeid mellom Iran og golfstatene. I begge modellene vil de nevnte aktørene ha ansvar for forskjellige deler av den kjernefysiske brenselssyklusen. Et vilkår er at Iran ikke lagrer anriket uran på egen jord.

Rapportens funn viser at tiden er moden for å vurdere å akseptere anrikning av uran på iransk jord på sikt. I tillegg er det konkludert at et samarbeid med Iran om den kjernefysiske brenselssyklusen, hvor Iran står for anrikningen og andre stater står for resten av syklusen, potensielt kan realiseres. Dette krever likevel stor grad av politisk vilje, både fra det internasjonale samfunnet og fra Iran. Et brenselssyklussamarbeid med Iran er et løsningsforslag i et langsiktig tidsperspektiv. En rekke brikker må falle på plass før forslaget kan realiseres, og av størst viktighet er det at Iran iverksetter tillitskapende tiltak, for å øke tilliten til at de har fredelige hensikter med sitt kjernefysiske program. Uavhengig av hvilke aktører som eventuelt egner seg best i et brenselssyklussamarbeid med Iran, vil det være en forutsetning at Iran legger flere kort på bordet allerede i første fase av et samarbeid.

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Preface

This work has been performed by two students in cooperation with, and under guidance by, Halvor Kippe. We are obliged to many colleagues, in particular, to Steinar Høibråten for fertile discussions and always constructive feedbacks. We thank Sverre Lodgaard for his thoughtful remarks on an early version of this report. We also thank Elin Enger who gave us valuable technical information. Additional thanks to Andreas Persbo, Marius Bjørningstad and Morten Bremer Mærli for helpful discussions and enlightening remarks along the way.

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Hege Schultz Heireng, Maryam Moezzi and Halvor Kippe

1 Introduction

The five permanent members of the United Nations Security Council plus Germany (P5+1) and the International Atomic Energy Agency (IAEA) are using an inefficient strategy when confronting Iran regarding its nuclear programme. This has been clearly demonstrated through Iran's continued unwillingness to suspend its uranium enrichment activities. Given the different opinions in the Security Council, the confrontational stance of the Iranian government, and the lack of new thinking and progress in the negotiations, it is assumed that no solution can be negotiated in the foreseeable future, unless the P5+1, Iran or both change their course.

Our aim with this report is to present possible long-term solutions to the nuclear dispute. The report proposes two models for a multilateral agreement with Iran, in which the most important elements are to achieve greater transparency in Iran's nuclear programme while improving the relations between Iran, the P5+1 and the IAEA. The following conditions are considered necessary in order to realize the proposals:

In the short term:

- Negotiations should involve an expanded group of states beyond the P5+1 and Iran
- Iran should cooperate fully with the IAEA to resolve all outstanding issues with respect to past and present activities relevant to its non-proliferation commitments.
- Iran should accept a temporary freeze of its enrichment and heavy-water related activities pending an IAEA "clear bill of health" and the conclusion of negotiations of a long-term solution for its fuel cycle activities

In the long term:

- The international community should prepare to accept Iran's enrichment of uranium under an enhanced safeguards regime, and with a cap on the enriched uranium stockpile
- The international community should consider accepting Iran as a reliable nuclear supplier state in a multilateral nuclear fuel cycle cooperation

These conditions at first glance may seem controversial and impractical. It would be incorrect to suggest that there are no difficulties in implementing the ideas presented, but the proposals are well-considered, and the report will give guidelines for implementation while elaborating on the challenges and benefits of each of them.

The report will present two different models for how to achieve multilateral nuclear fuel cycle cooperation (MNFCC) with Iran. The first model is a tripartite consortium model that consists of a cooperation between Kazakhstan, Iran and South Africa. The second model is MNFCC between Iran and six of the countries bordering the Persian Gulf. We believe the P5+1 and the IAEA will benefit from the models presented, because it secures greater transparency in Iran's nuclear

activities. Iran will also benefit because the country will be recognized as an important regional actor in the Middle East.

Any agreement will have to comprise some real confidence-building measures from Iran, in order to gain confidence in the truly peaceful nature of Iran's nuclear efforts. Iran's leaders will have to ratify the Additional Protocol to its safeguards agreement, which is a verification standard designed to give assurances that no undeclared activities are going on, and they will have to act in accordance with the Nuclear Non-Proliferation Treaty (NPT). The NPT is an international treaty designed to prevent the spread of nuclear weapons, stimulate the development of nuclear technology for peaceful uses, and promote global nuclear disarmament. It is vital that an agreement with Iran strengthens rather than weakens the nuclear non-proliferation regime in general, including export control and verification norms. To convince Iran to act in accordance with these demands, an agreement will have to contain some face-saving elements for Iran, but also some real benefits in terms of assurance of nuclear fuel supply and the roll-back of certain United Nations Security Council (UNSC) resolutions. Accepting Iran's uranium enrichment programme, and thereby contributing to Iran's emerging as an important regional actor in the Middle East, is a benefit any negotiating parties should be willing to consider offering Iran in order to achieve a solution that deters Iran from developing nuclear weapons overtly or covertly.

2 Background: the controversy concerning Iran's nuclear development

2.1 Overview

In August 2002, the Iranian opposition coalition National Council of Resistance of Iran (NCRI) revealed information about two secret nuclear sites in Iran that turned out to be a heavy-water production plant (HWPP) in Arak and a uranium enrichment plant in Natanz. In the months that followed, several other revelations amassed, adding to a picture of a comprehensive, clandestine nuclear programme previously unknown to the outside world. As a signatory of the NPT, Iran was obligated to report to the IAEA on its nuclear activities. The disclosures therefore resulted in a comprehensive struggle between Iran and the international community. The Western powers have since been on the forefront of accusing Iran of developing nuclear weapons, while Iran has constantly claimed that their nuclear activities are completely peaceful, complaining that the West merely seeks to deprive it from its right to develop nuclear energy technology. Caught in the middle of the struggle, the IAEA has assumed the role of a mediator, striving to prevent the proliferation of nuclear weapons while securing all member states' inalienable right, according to Article IV of the NPT, to develop research, production and use of nuclear energy for peaceful purposes. A state's breach of any NPT commitments would by standard international law nullify its Article IV rights. Iran's failure to declare substantial nuclear fuel cycle activities undoubtedly constituted a breach of its NPT Article III commitment to implement efficient IAEA safeguards to all nuclear materials and activities relevant to the purpose of the NPT, although the non-declaration of specific facilities such as in Natanz and Arak was not literally a breach in itself, since Iran's Comprehensive Safeguards Agreement with the IAEA states that countries that have

signed the NPT are obligated to declare their nuclear facilities within 180 days prior to nuclear material being introduced (Kippe 2009:15). There have been disagreements, however, on whether or not Iran has violated the actual non-proliferation provisions stipulated in NPT Article II, since no assembled nuclear weapons have been found in Iran, and because evidence of such intent is hard to vet and usually of circumstantial nature.

2.2 Nuclear development in Iran

Iran has had nuclear ambitions since the 1950s. Its nuclear development began in an alliance with the United States (NTI 2005a) in 1957, when Iran and the United States signed a civil nuclear cooperation agreement as part of the United States' Atoms for Peace programme (NTI 2005a). According to the agreement, the United States was going to provide Iran with technical assistance and the lease of several kilograms of enriched uranium, and cooperate with Iran on the research on peaceful uses of nuclear energy. The United States supplied the Tehran Nuclear Research Center with a small research reactor (Tehran Research Reactor, TRR) in 1967 (NTI 2010c). The Iranian government signed the NPT in 1968, on the day it opened for signature (NTI 2005a). During a trip to Iran in 1974, the United States Atomic Energy Commission's chairman Dr. Dixy Lee Ray suggested that Iran should establish enrichment and reprocessing facilities (NTI 2005a). At that time Iran was viewed, by the West, as the best candidate for establishing enrichment and reprocessing facilities for the Middle East region, since Iran by then had developed an impressive baseline capability in nuclear technologies (NTI 2005a). Since the Iranian revolution in 1979, however, the United States has been the most critical actor towards Iran's nuclear development (NTI 2005a).

The Iranian revolution stalled Iran's nuclear programme, as the new leader, Ayatollah Ruhollah Khomeini, largely abandoned the former Shah's agenda, cancelling almost all of the Islamic Republic's nuclear contracts with foreign companies (NTI 2010c). Work on two nuclear power reactors in the city of Bushehr was suspended by the German contractor, but nuclear research at the TRR continued (NTI 2010c). However, in 1984 Khomeini expressed a renewed Iranian interest in nuclear power, seeking the assistance of international partners to complete construction at Bushehr (NTI 2010c).

In the aftermath of the Iranian Revolution in 1979, there was a clear shift in the West's will to cooperate with Iran in the nuclear field. The United States, France and Germany did not fulfill their promised assistance to the Iranian nuclear programme. The development of Iran's nuclear programme met even more barriers during the eight-year long war with Iraq in the 1980s. During the war, the reactors in Bushehr were bombed by Iraq, while most Iranian research scientists and nuclear experts emigrated from Iran (Melman and Javedanfar 2007:99-100). This loss, compounded by Ayatollah Ruhollah Khomeini's previous opposition to nuclear technology, resulted in the near disintegration of Iran's nuclear programme after 1979 (NTI 2010c).

However, Iran began investing more heavily in nuclear technology again following the Iran-Iraq War. Iran had to rebuild parts of its nuclear programme from scratch, and the development progressed slowly because Iran received very limited, if any, assistance from the Western powers.

Tehran had to look for new parties offering assistance in the nuclear field. During the 1980s and 1990s, the Iranian government received nuclear know-how and assistance from China, Russia and Pakistan. While China provided Iran with a research reactor in Isfahan, the Russian government committed to complete one of the two damaged reactors in Bushehr (Melman and Javedanfar 2007:100-103). At the same time, Iranian students received education on nuclear technology abroad.

Iran's nuclear programme is long rooted in its history, but the current nuclear dispute did not arise until August 2002. The disclosure of the undeclared nuclear facilities in Natanz and Arak created apprehension about an acute proliferation risk. In the aftermath of the August 2002 disclosures, a new undeclared facility was revealed at a research center in Lavizan-Shian in Tehran in 2003, but the facility was demolished a few months after the discovery (Kippe 2009:54). Suspicions concerning nuclear activities in a military site in Parchin outside Tehran were also reported, but the IAEA was unable to detect any nuclear activities after being granted physical access and allowed environmental sampling (IAEA Board of Governors 2005). However, in October 2009, the existence of a second uranium enrichment plant, near the city of Qom, approximately 100 km south of Tehran, was revealed. Iran had again failed to inform the IAEA about its intention to build a nuclear facility. As of today, there is no "smoking gun" evidence that Tehran is developing nuclear weapons. Still, the continued secrecy by the Iranian government, and the unclarified aspects of the Iranian nuclear programme, creates uncertainty about Iran's nuclear ambitions.

2.3 The non-proliferation regime

The IAEA was originally set up as the world's "Atoms for Peace" organization in 1957 within the United Nations. The Agency works with its member states and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies. On the one hand, the IAEA seeks to inhibit nuclear development for military purposes, while on the other hand it seeks to assist the peaceful development of nuclear energy. The international community has entrusted the IAEA with the authority to safeguard nuclear facilities and to verify the declarations made by States on their nuclear material and activities (IAEA 2001:7).

Even though the IAEA is established independently of the United Nations, under its own international treaty, the Agency reports to both the UN General Assembly and the UN Security Council. The 1997 Model Additional Protocol to Safeguards Agreements extends the IAEA safeguards authority and allows access to locations not previously subject to IAEA inspections, including undeclared facilities (IAEA 2001:7). The purpose of the safeguards system of the IAEA is to provide credible assurance to the international community that nuclear material and other specified items are not diverted from peaceful nuclear uses. The IAEA's responsibility is to safeguard nuclear technology and to verify member states' compliance with the NPT, a treaty to prevent the spread of nuclear weapons. The NPT was signed in 1968, entered into force on 5 March 1970, and was extended indefinitely in 1995. At the moment, 187 states have signed the NPT, consisting of 182 states that do not possess nuclear weapons, and five states that had tested

nuclear weapons before January 1967. The NPT focuses on preventing the weapons use of nuclear materials (NPT Treaty Text 1968).

Because the NPT's provisions are formulated rather generically, its interpretation and implementation are reviewed and evaluated every five years during a formal NPT Review Conference involving all its states parties.

2.4 The nuclear dispute

There is legitimate concern surrounding Iran's nuclear programme, especially after the unveiling of their secret nuclear enrichment facilities in 2002. Uranium enrichment is one of the many processes natural uranium has to go through to become nuclear reactor fuel (NEA 2008:60). Enriched uranium provides the fuel for most of the world's nuclear power reactors, and the enrichment process is a vital process in a multi-step nuclear fuel cycle (IAEA 2009). The technology is viewed as sensitive and strategic, because the enriched uranium may be used to produce nuclear weapons as well as to generate nuclear power (Cassedy 1998:173).

Nuclear power utilizes nuclear fission, a reaction in which the fissile element's nuclei is splitting into lighter nuclei and a few neutrons, releasing kinetic and radiation energy in the process. The significance of nuclear fission lies in its ability to form a chain reaction, where the neutrons emitted by the fission of one nucleus move on to create other fission reaction (Cassedy 1998:173).

The successive collisions and fission reactions can create a self-sustaining chain reaction on the condition that there is a large enough amount of the fissile material, a so-called critical mass. In other terms, the critical mass is achieved when the density and total mass of the fissile fuel is large enough to sustain the chain reaction (Cassedy 1998:173). This chain reaction is the phenomenon behind both the nuclear bomb and the nuclear reactor, with the most important distinguishing characteristic being that in a reactor the rate of fission reactions is controlled (Cassedy 1998:173).

The most common fissionable element is uranium, which has several isotopes. The most abundant isotope ^{238}U cannot sustain a nuclear chain reaction on its own. The only nuclide found in nature that can support a nuclear chain reaction is ^{235}U. In natural uranium, for every 140 atoms of ^{238}U there is only one atom of ^{235}U (Medvedev 1992:4).

Plutonium is the most important fissile material apart from uranium. More specifically, the fissile isotope is ^{239}Pu, which is made through conversion of ^{238}U (Cassedy 1998:171, 217). When neutrons collide with the nuclei of ^{238}U, some of the ^{238}U nuclei transform into ^{239}Pu (Medvedev 1992:5).

It is customary to denote isotopes which can sustain a chain reaction as *fissile*. In practice, fissile isotopes – such as ^{235}U and ^{239}Pu – can be fissioned by neutrons of all energies. Other fissionable,

but not fissile, isotopes – such as ^{238}U and ^{240}Pu – can only be fissioned by fast neutrons (i.e. with energies in the MeV range), and can thus not sustain a chain reaction.

Natural uranium may be used to fuel nuclear reactors, as long as the reactors are moderated by (i.e. the neutrons are slowed by) heavy water or graphite (Kippe 2009). However, natural uranium cannot be used to fuel a nuclear bomb, because the ^{235}U content is too low. The ^{235}U concentration can be raised by several techniques, the most common being enrichment through gaseous diffusion and gas centrifugation (NEA 2008:60). Both nuclear weapons and nuclear power production depend on having fissile isotopes in sufficient concentration to sustain a chain reaction (Cassedy 1998:173). Nuclear weapons must use highly enriched uranium (HEU) or plutonium, in order to obtain an explosive chain reaction (Cassedy 1998:173). The fuel for nuclear power reactors usually consists of low-enriched uranium (LEU) in oxide form (UO_2) (Cassedy 1998:173). LEU has lower than 20 % concentration of ^{235}U, and HEU has 20 % or higher concentration of ^{235}U (Kippe 2009).

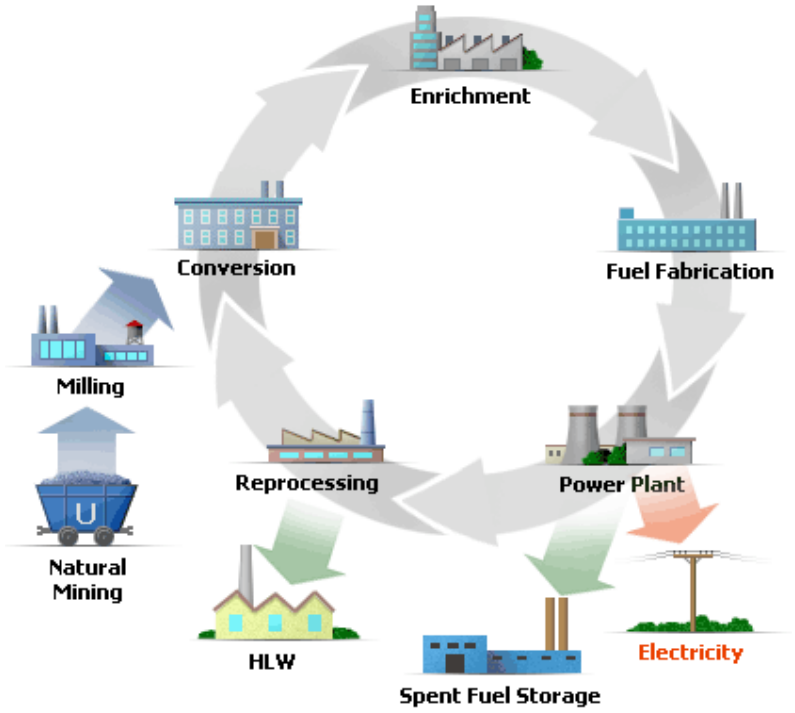

Figure 2.1 The nuclear fuel cycle. The figure is found and adapted from A.C. Nuclear Opportunities Fund.

Although Iran has constructed facilities through the whole front-end of the uranium fuel cycle, the country will still need to import yellowcake (uranium oxide, U_3O_8 on average), since it does not have enough usable uranium ore for a self-sustained large-scale nuclear power programme (Kippe 2009; Forden and Thomson 2007:6). Yellowcake is converted into UF_6 through a series of chemical processes in a conversion facility, such as in Isfahan in Iran. UF_6 is then fed into an

enrichment facility, in which it is enriched in the isotope ^{235}U. Iran has not yet put into operation a production line to re-convert the low-enriched uranium hexafluoride ($LEUF_6$) to UO_2 at its uranium conversion facility in Isfahan. Instead, it stores its entire stock of $LEUF_6$ (3 – 4 % ^{235}U) at the enrichment plant in Natanz, which means that it may readily reintroduce the material into the gas-centrifuge cascades to rapidly produce weapons-grade uranium. In that case, a reconfiguration of the centrifuge cascades would be expected in order to optimize the production (Kippe 2009:).

Modern nuclear power reactors usually use LEU fuel (IAEA 2007b). The most common reactor fuel is LEU enriched to 3 – 5 % (Kippe 2009:37). If the proportion of ^{235}U is increased to above 90 %, it is considered weapons-grade uranium (WGU) (Kippe 2009:37). Iran has already experience with higher enrichment levels at Natanz Pilot Fuel Enrichment Plant (PFEP), where they have enriched up to 19.75 %, which is, however, still considered low-enriched.

In international politics there has been skepticism and serious concern regarding the nuclear development in Iran. Iran has overcome the technological barrier of uranium enrichment, and thereby actually achieved an option of producing uranium for nuclear weapons (Kippe 2009:15).

There is significant historical material pointing back to countries Iran has cooperated with in the nuclear field, such as the United States, France and Germany, who all have to some degree failed to fulfill their promises (NTI 2005a). In a March 2003 interview with Iran's ambassador to the United Nations, Javad Zarif, Zarif said to the United Nations that the West cannot expect Iran to sit still when the Iranian government has neither any confidence nor any insurance that in coming years, pressure from the United States will not affect their suppliers (NTI 2005b). The message was clear; Iran's aim was to create a source of self-sufficiency, including a nuclear fuel cycle programme. The head of the Atomic Energy Organization of Iran soon after announced on Iranian state television that Iran plans to resume research of nuclear fuel production (NTI 2005b). The goal of the Iranian government is to achieve a completely independent, full-scale nuclear power programme, meaning that the state wants to master every process that is necessary for the production of nuclear power (NTI 2005b).

In spite of the West's demands to suspend all enrichment-related activities in Iran, Iran has continued its development. The controversy over the Iranian nuclear programme is mostly concerned with the enrichment of uranium, and the Fuel Enrichment Plant (FEP) in Natanz is therefore under heavy observation from the outside world. In October 2006, then Russian Deputy Prime Minister Sergey Ivanov tried to reassure the world that there was no reason to worry about Iran acquiring WGU. He further stated that Iran had launched a second cascade of centrifuges, and that the process was fully monitored by the IAEA (NTI 2006). The Iranian nuclear enrichment efforts are generally not recognized by other states as just a scientific accomplishment, but more as a threat to global security. Although the risk of nuclear weapons proliferation is a valid concern, it is still important to highlight the fact that it is not at this point proven beyond doubt that Iran's nuclear development is aimed at the pursuit of nuclear weapons.

2.5 Attempted negotiations

The first nuclear discussions between Iran and the IAEA took place in September 2002, in the aftermath of the disclosure of the nuclear facilities in Natanz and Arak. Then Director General of the IAEA, Mohamed Elbaradei, was allowed by the Iranian government to visit the uranium enrichment facility in Natanz in February 2003, in order to verify the status of the Iranian nuclear programme. A few months after his visit, the IAEA announced that Iran was in non-compliance with its Safeguards Agreement on a number of instances (IAEA 2003a:7). The non-compliance concerned reporting of nuclear material, processing and use of such material, as well as the declaration of facilities where the materials had been stored and processed (IAEA 2003a:7). Forcing Iran to comply with its Safeguards Agreement has been of immense significance for the IAEA, to ensuring that Iran is enriching uranium for nuclear power plants, and not for a nuclear bomb.

In August 2003, Iran announced that they had engaged in talks with Britain, France and Germany (EU-3) regarding their nuclear programme. The EU-3 aimed at making Iran halt its enrichment activities at least until all outstanding issues regarding its previously undeclared activities were resolved. The nuclear talks transpired simultaneously as Iran negotiated with the IAEA on verification issues, and through the discussions with the EU-3 Iran accepted to voluntarily suspend all enrichment-related activities. The Iranian government also signed the Additional Protocol to its Comprehensive Safeguards Agreement, and implemented it despite absent ratification (IAEA 2004). The implementation of the Additional Protocol in Iran allowed the IAEA to obtain additional access rights to Iran's declared and suspected undeclared nuclear facilities. This is considered a prerequisite for IAEA's being able to provide assurances regarding the absence of undeclared nuclear activities on Iranian soil. Overall, the IAEA, Iran and the EU-3 accomplished significant transparency concessions in their nuclear discussions between September 2002 and July 2005.

However, the improvements were not maintained, as there was a considerable change in the Iranian foreign policy strategy after August 2005. [1] Iran announced it would restart uranium enrichment, which resulted in a break-down of the negotiations with EU-3 (IAEA 2005a). The Iranian government also informed the IAEA that Iran would no longer implement the Additional Protocol. The IAEA expressed great concerns by the lack of confidence that Tehran's nuclear activities were solely for peaceful purposes (IAEA 2005b:2). The IAEA also emphasized the need for better understanding of the proliferation-sensitive aspects of Iran's nuclear activities.

In an attempt to encourage Iran to comply with the demands of the IAEA, the EU-3 presented elements of a Long-Term Agreement to Iran, on behalf of the EU, in August 2005 (UNSC 2007). The framework included some very profitable incentives to Tehran, which were supposed to be developed more specifically over time and covered in a comprehensive agreement between Iran

[1] The rapid change of strategy in Iran can be explained by the new hard-line Iranian government led by President Mahmoud Ahmadinejad (Blair 2009). A second explanatory factor can be Iran's relatively high degree of bargaining power vis-à-vis the United States during Ahmadinejad's presidential period, as a result of the costly and unsuccessful foreign wars in Iraq and Afghanistan (Heireng 2010:44).

and the EU (UNSC 2007). The incentives Iran was offered mainly included fuel assurances, membership in the World Trade Organization, assistance in building new light-water power reactors and energy partnership between Iran and the EU (UNSC 2007). In return, Iran had to comply with three criteria: Firstly, Iran had to commit to addressing all outstanding concerns with the IAEA. Secondly, Iran was obligated to suspend all enrichment-related activities. Thirdly, Iran had to implement the Additional Protocol (UNSC 2007). Tehran's chief nuclear negotiator, Ali Larijani, proclaimed that "These proposals include positive steps and they also include some ambiguities that should be removed" (O'Rourke 2006). In the end, Iran decided to turn down the offer from the EU.

In February 2006, the IAEA voted to refer the Iran-issue to the UNSC, seeing that the IAEA was not capable of resolving the nuclear dispute with Iran by itself. The IAEA received a letter from Iran requesting the Agency to reconsider the idea of transferring Iran's nuclear file to the UNSC (IAEA 2006). Iran argued that the IAEA had no legitimate right to relocate the case, and Iran threatened the Agency with boycott in case the transfer took place. Despite Iran's stipulation, the IAEA decided to transfer the Iran-case to the UNSC. The statutes of the IAEA stipulate in Article XII, paragraph C, that member states found in non-compliance with its safeguards commitments shall be reported to the UNSC, after the IAEA Board of Governors has called upon the member state in question to remedy the situation. Iran has made the case that it was not given sufficient time and opportunity to come clear before its dossier was transferred to the UNSC.

An immediate consequence of the transfer was the implementation of UNSC resolutions containing sanctions against Iran. Up to now, the UNSC has implemented four rounds of sanctions against Iran in an attempt to coerce Iran to be more cooperative. However, the sanctions have had very little effect on Iran's position in the nuclear talks.[2] Iran has neither ratified nor implemented the Additional Protocol, and there is still lack of confidence that Iran's nuclear programme is exclusively for peaceful purposes. The divergent positions among the permanent members of the Security Council concerning sanctions against Iran is making matters worse, as stronger sanctions depend on consensus among the permanent members of the UNSC. Given that China and Russia are not endorsing or ensuring the passing of stronger sanctions against Iran, it is assumed that few achievements will be attained in the nuclear negotiations in the nearest future.

Iran's nuclear programme has become a prestige project for the Iranian elite. The nuclear programme has not only put Iran on the world map as a significant power in the Middle East, but has also become a symbol of Iran's national pride and sovereignty (Perthes and Wegner). Interestingly enough, this is not only the standpoint of the Iranian elite. The overall attitude towards Iran's nuclear development has been positive within the country, where both the majority of the regime and the majority of the people in general view Iran's nuclear development as Iran's right as a country. The UNSC's ineffective sanctions and the EU's vague incentives have not

[2] The UNSC sanctions have been modest. Effective sanctions require multilateral support and collaboration (Cortright and Lopez 2005:21). Unless major powers such as China and Russia support harsher sanctions against Iran, the sanctions will not become very effective. Also, although sanctions have been adopted, their effective implementation has not always been evident in key states.

been sufficient to convince Iran to act in accordance with the IAEA's requirements and the P5+1's demands. The nuclear programme is so valuable to Iran that any solution to the nuclear dispute will have to include some very profitable incentives that, from an Iranian point of view, surpass the value of the Iranian nuclear programme in its current shape. Such incentives will be extremely difficult to agree upon.

Assuming that the Security Council will not be able to agree on sanctions that will alter Iran's strategic position in this matter in the near future, there is a need to look for new ways to influence Iran. This point leads us to the next chapter, where we will present a proposal we believe can be seen as profitable to all negotiating parties.

3 Uranium enrichment on Iranian soil

The previous chapter has shown the need for new ways of dealing with Iran's nuclear programme. In this chapter we will discuss the possibility and benefits of accepting long-term uranium enrichment on Iranian soil. Previous suggestions concerning possible solutions have been either Iran stopping enrichment on Iranian soil, or enrichment on Iranian soil being controlled by international actors without Iranian access to the technology. Although accepting enrichment in the hands of the Iranian regime may seem risky, it is really just acknowledging the actual situation. The highest goal in the nuclear dispute concerning Iran should be reassuring the international community that Iran's development is not geared towards nuclear weapons. If Iran accepts increased transparency in its nuclear affairs, and thereby contributes in creating an environment for confidence and verification, could the Western powers then acknowledge uranium enrichment on Iranian soil?

3.1 International acceptance

Iran has enriched uranium on a large scale since august 2005 and will probably not halt these activities any time soon. The country has invested a considerable amount of money, time, energy and pride in building its nuclear infrastructure, including especially its uranium enrichment facilities. Dismantling the enrichment facilities in Iran would not be sufficient to alleviate all proliferation concerns, because thousands of employers are working in these facilities on a daily basis, and these scientist and engineers would still retain key enrichment know-how. If their jobs were taken from them, they may turn to other options like selling their knowledge on the black market and contributing to clandestine uranium enrichment activities. This "brain drain" challenge obviously makes it very difficult to abandon Iran's enrichment related activities completely.

Some have suggested a compromise implying the establishment of a multilateral enrichment plant on Iranian soil utilizing more efficient gas centrifuges. In this framework, Iran would be deprived of the actual enrichment technology, by "black boxing" all critical components supplied by other parties. It is understandable that black boxing of sensitive enrichment technology is viewed as a solution to avoid transfer of enrichment technology, given the unique nature of enrichment that

involves a great proliferation risk. However, in the Iranian case the enrichment capability is already established, and so we would face the "brain drain" problem outlined above. The current situation, with Iran continuing enrichment at its own pace, is also not preferable, as long as the IAEA sees itself unable to guarantee the exclusively peaceful nature of Iran's nuclear efforts due to the country's lack of transparency and cooperation in resolving past and present outstanding issues relevant to its NPT commitments. Iran is in particular stonewalling on the weaponization allegations, which makes it impossible for the IAEA to give Iran a "clear bill of health." It is in that respect of great importance that Iran implements the Additional Protocol, which will give the IAEA mandate to ask for access to undeclared facilities suspected to be relevant to its nuclear activities.

It may be time to start discussing the possibility of accepting enrichment of uranium on Iranian soil. It will not be easy for the UNSC, and especially not the United States, to accept this, since Iran has been in defiance of the UNSC's demands in this regard for several years. However, if Iran would be willing to accede to some vital concessions, which will be elaborated on in the next section, then continued enrichment in Iran may be viewed as acceptable by the international community. Sanctioning Iran has not been an efficient strategy, and the P5+1 could potentially achieve a lot more from Iran if they acknowledge the limitations of its current strategy. An immediate acceptance of the enrichment activities in Iran, however, is not realistic in today's political context with binding UNSC resolutions demanding a halt. A starting point may be to discuss the positive and negative consequences of accepting uranium enrichment on Iranian soil. Being caught up in a diplomatic tug of war with Iran, without any prospect of enhanced transparency, may in fact increase the risk that Iran may covertly develop a nuclear weapons capability. Instead, suggesting the possibility of long-term acceptance of the most valued part of Iran's fuel cycle activities may in fact turn out to be a necessary prerequisite for substantial progress in the negotiations.

3.2 Necessary concessions by Iran

The international community cannot accept enrichment on Iranian soil unless the UNSC decides to roll-back or revise the sanctions resolutions previously implemented. Such a roll-back will not be feasible unless Iran makes some necessary, short-term concessions. These concessions must include some real transparency measures in order to reduce the uncertainty and convince the world that Iran is not pursuing a nuclear weapons programme. The first necessary concession is Iran accepting a temporary freeze of its enrichment and heavy-water related activities. The P5+1 and the IAEA may have to accept that Iran operates their centrifuges under vacuum without UF_6 in order to prevent the centrifuges from breaking down during the shutdown. The second necessary concession is an Iranian implementation of the Additional Protocol. The Additional Protocol must be implemented, and also ratified, in order to strengthen the effectiveness of the safeguards system. The protocol must be implemented in advance of any withdrawal of the UNSC's sanctions.

One of the most significant transparency deficits in Iran's nuclear efforts today, is its insisting on a long-outdated version of the provision of its safeguards agreement regarding the timing of

declarations of planned nuclear facilities. Specifically, Iran has reverted to a 1976 version of the so-called Code 3.1 of the subsidiary arrangements of its Comprehensive Safeguards Agreement, which in Iran's eyes allows it to wait until 180 days before introducing nuclear materials into a newly constructed facility before declaring the facilities to the IAEA (IAEA 2007a). This provides Iran with a pretext to continue constructing undeclared fuel cycle facilities, possibly hoping to evade detection at all. In the revised version, the Modified Code 3.1, a state has to declare a planned facility, i.e. provide the IAEA with design information, from the moment a decision to construct the facility has been taken. All IAEA member states with significant nuclear infrastructure, except Iran, adhere to this modern version of Code 3.1. The Additional Protocol also includes requirements of early provision of design information for planned facilities. Implementation of the Additional Protocol therefore would render the implementation of the Modified Code 3.1 superfluous. But pending an Iranian ratification of the Additional Protocol, adhering to the Modified Code 3.1 would constitute a valuable confidence-building measure. An even more valuable confidence-building measure would of course be to implement the Additional Protocol before its ratification.

For a solution to be feasible, it is vital that it strengthens rather than threatens the Nuclear Non-Proliferation Regime. Some observers argue that the credibility of the Non-Proliferation Regime already has been threatened by the absence of consequences when Iran was found in non-compliance with its Safeguards Agreement (Goldschmidt 2006). It is therefore particularly significant for the position of the Non-Proliferation Regime that a diplomatic solution is securing the credibility of the regime.

In addition to these concessions, Iran must cooperate substantially with the IAEA to resolve questions related to possible military dimensions of its nuclear programme. This would involve, at a minimum, bringing forward key personnel like Dr. Mohsen Fakrizadeh and some of his collaborators to shed light on alleged activities pertaining to, *inter alia*, the casting of uranium metal hemispheres, studies of multipoint-initiation of high explosive lenses,[3] adaptation of Shahab-3 ballistic missile re-entry vehicles to accommodate a nuclear payload, and the production of uranium tetrafluoride (UF_4 or "green salt"),[4] all of which have clear military applications. These pending issues, as well as the insufficient transparency in Iran's known, current activities, makes it difficult for the IAEA to provide credible assurance of the non-existence of undeclared nuclear facilities and activities, as well as the truly peaceful nature of Iran's past and current nuclear efforts as such.

Iran needs to accept the necessary concessions presented, but it would be helpful to also introduce a cap on the storage of enriched uranium on Iranian soil both in the short and long term. The international community must be reassured that significant quantities of enriched material will not

[3] Metal hemispheres of uranium or plutonium, as well as multipoint-initiated high explosive lenses, are key to nuclear implosion weapons similar to the bomb dropped over Nagasaki in 1945.
[4] Green salt is an intermediary product in the production of uranium hexafluoride, which is used in uranium enrichment, as well as in the reduction of enriched uranium hexafluoride into uranium metal or uranium oxide.

be diverted at a later point, providing Iran with a so-called “rapid breakout capability.” Even if Iran implements the Additional Protocol, Iran will have to accept limits to UF_6 storage because the material may easily be further enriched into HEU, either in declared facilities or in previously undeclared facilities, but either way not without the IAEA detecting the diversion of the safeguarded LEU. Accepting uranium enrichment in Iran must therefore include better control of uranium in the front-end of the fuel cycle, preferably with Additional Protocol safeguards already from yellowcake production and imports, and that Iran does not at any time store tons of LEU in UF_6 form as they do today. Iran will have to either convert the enriched UF_6 directly to UO_2 or export the UF_6 straight after the enrichment process. If Iran does not want the enriched UF_6 to leave the country, it will have to agree to expand its nuclear fuel conversion facilities, so that the UF_6 is not kept in this form for a long time before converted into nuclear oxide. Converting UF_6 into UO_2 will decrease the security concerns considerably, because it will be time consuming to reconvert UO_2 back to UF_6 (Kippe 2009).

Withdrawing the sanctions may be seen as giving Iran the opportunity to be a part of the international community on equal terms with other countries. This may be an incentive Iran will find beneficial, and thus agree to the terms prescribed above. There must be guaranteed, severe consequences if Iran violates the NPT or its safeguards obligations after it is allowed to continue its enrichment activities. The international community should then be committed to reinvigorate the sanctions, again leaving it up to the UNSC to decide proper action.

3.2.1 Overcoming a possible show-stopper

What if Iran, while fully cooperating with the IAEA on the issues related to possible military dimensions of its nuclear programme, admits to having conducted a set of activities that in the eyes of the world would amount to a clandestine effort to develop a nuclear weapons option? In that case, discussions between Iran, IAEA and P5+1 should be candid and focused on how to provide a face-saving response in the IAEA Board of Governors and the UNSC. The discussions should preferably be conducted by properly mandated officials from Iran, the P5+1, and the IAEA in a discrete manner, as all preliminary talk would be highly delicate. The outcome of such talks should be a common wording of what these activities actually amounted to. An explicit breach of Article II of the NPT, which stipulates, *inter alia*, that Non-Nuclear Weapons States (NNWS) should not “manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices,” would in fact require the assembling of complete nuclear weapons. Few believe Iran has even had the opportunity of achieving that as of yet. A common wording should therefore seek to focus on the alleged studies as a sort of feasibility study of a nuclear weapons option, presumably without a final decision to go all the way.

It is vital that an Iranian admission along these lines is not taken lightly, but at the same time it is important to stimulate Iran to pursue a constructive role and avoid further trenching in the future. Perhaps a Presidential Statement from the UNSC, followed by a report on the findings to the IAEA Board of Governors, along with Iran voluntary accepting the concessions described here, could represent a measured response, given the prospects of a constructive long-term solution?

In any way, if there is substance behind the weaponization allegations, this may very well turn out to be an extremely delicate issue to overcome in order to make the IAEA close Iran's nuclear dossier.

4 Dealing with Iran in a new multinational way

The previous chapters have highlighted the need for new thinking, and discussed how uranium enrichment on Iranian soil may, in a long-term perspective, become acceptable to the international community. The focus of this chapter will be on the feasibility of creating multilateral cooperation with Iran in the nuclear field. This chapter will also discuss the necessity for new actors to be included when dealing with Iran's nuclear development.

4.1 Multilateral cooperation with Iran on the nuclear fuel cycle

Multilateralism within the nuclear field traditionally includes the idea of cooperation among states on issues related to uranium enrichment, plutonium separation and storage, and the disposal of spent nuclear fuel (Rauf and Simpson 2004). The alternative to such multilateralism is traditional national state control, where single countries are in charge of all these sensitive aspects separately. If the sensitive parts of the nuclear fuel cycle are placed under some form of multilateral or multinational control, it could strengthen the non-proliferation regime considerably by lowering the risk of diversion to military use (Rauf and Simpson 2004). Multilateralism may build confidence between states, and can provide enhanced assurance to the international community that the sensitive portions of the civilian nuclear fuel cycle are less vulnerable to weapons proliferation (Rauf and Simpson 2004).

Having more than one country involved in Iran's nuclear activities could reduce the proliferation risks. Multinational cooperation with Iran may also strengthen non-proliferation norms by requiring nuclear verification, security and safety measures that go beyond existing international agreements. Previously suggested solutions to the Iranian nuclear dispute have called for black boxing of Iran's enrichment technology or enrichment on Iranian soil being controlled by international actors. We propose to pursue an idea of multinational cooperation with Iran, but without black boxing the enrichment technology in Iran, since Iran already to some degree has developed and implemented this technology. A better idea is entering into a multinational cooperation on the nuclear fuel cycle with Iran, where Iran is permitted to enrich uranium under international monitoring by the IAEA, under the presence of representatives from the cooperating partner states, and where the general scope of safeguards is enhanced through the Additional Protocol. If Iran is cooperating on the nuclear fuel cycle through a multinational agreement, the collaboration may be fruitful in achieving a codependent relationship between Iran and other countries. This interdependence between the parties involved will generate increased confidence and transparency in Iran's nuclear activities. The participating partners in such activities ought to conceivably allow the IAEA inspectors "anytime, anywhere" access rights, as well as other confidence-building measures (Rauf and Simpson 2004), in order to create more transparency, and thus gain and maintain confidence, in Iran's nuclear programme. Iran will benefit by entering

into a multinational cooperation on the fuel cycle, because the financial burden will be shared between the cooperating countries, instead of Iran standing alone with all the expenses. Iran will also benefit from cooperating with nations that may have experience in the nuclear field. However, Iran must accept renouncing parts of its front-end nuclear fuel cycle, as new actors will be responsible for parts of the fuel cycle other than enrichment.

Giving Iran an actual role in a multinational nuclear fuel cycle cooperation will have positive outcomes both for Iran and the international community. Russia has had great success in achieving a multilateral nuclear fuel cycle cooperation (MNFCC). Russia's idea to internationalize their enrichment services was at first an attempt to engage Iran in a multilateral cooperation that would secure all parties nuclear fuel, however all parties involved would have to eschew from enrichment technology. In November 2005, Russia proposed joint ownership with Iran of a uranium enrichment venture as a deal to make Tehran halt their enrichment activities (Loukianova 2008). Their offer would have allowed Iran to use facilities located in Russia to convert Iranian-made uranium tetrafluoride (UF_4) into uranium hexafluoride UF_6, and enrich it to LEU in order to produce nuclear fuel to power Iran's nuclear power plants (Loukianova 2008). The offer, however, was met with dismissal (Loukianova 2008). Moscow's assured fuel supply proposal was initially envisioned as a bilateral cooperation with Iran; however, it gradually evolved into a multilateral nuclear fuel cycle enterprise. In September 2007, International Uranium Enrichment Center (IUEC) at the Angarsk Electrolytic Chemical Combine (AEKhK) was incorporated as a joint venture between two nuclear fuel cycle service providers, Russia's Tekhsnabexport and Kazakhstan's Kazatomprom (Loukianova 2008).

Russia has been able to internationalize their Angarsk enrichment services and assure fuel supply to its partners, which has strengthened the Russian nuclear industry as well as reinforced Russia's position and status in the non-proliferation regime. Through realizing international enrichment cooperation centers, Russia contributes in the effort to solve the global nuclear security problems (Loukianova 2008). Although Russia has not been able to persuade Iran to cooperate with them on the nuclear fuel cycle, we will use the success Russia has had in the internationalization of enrichment services and apply a similar plan in incorporating Iran in a MNFCC. We propose to handle the nuclear dispute with Iran in a new way; rather than demanding a halt in Iran's uranium enrichment activities, including Iran's enrichment services in a MNFCC. Incorporating Iran as a responsible actor, who contributes in the multilateral cooperation through enrichment services, will strengthen the Iranian nuclear industry as well as reinforce Iran's position and status in the non-proliferation regime and the international community, as it did for Russia. For international actors to consider such a cooperation, however, the Iranian enrichment capability needs to reach a commercially viable level.

4.2 Commercializing nuclear enrichment services in Iran

The idea of Iran's nuclear enrichment capability growing to commercial levels may seem a great proliferation risk; however, stagnation in the nuclear talks with Iran leaves Iran's progress in mastering enrichment technology even more closed off to the rest of the world. Iran having codependent relationships in the nuclear field could hinder a potential covert enrichment effort,

due channeling its resources into an internationally accepted, and commercially viable, enrichment development programme. Through a MNFCC, Iran will depend on importing source material and exporting the enriched product for conversion and fuel fabrication. This situation does not make Iran self-sufficient, but leaves Iran with the most prestigious part of the fuel cycle, a technology Iran already has developed to a certain level. To make sure Iran is taking the multinational collaboration effort seriously; Iran must accept the short-term concessions described in Section 3.2.

Research and development (R&D) in the nuclear field is extremely costly and highly time consuming. Iran attaining a role as a supplier of enriched uranium would therefore require great financial investment in enrichment R&D to further enhance the existing uranium enrichment technology to a commercial level. Whether or not Iran may succeed in commercializing their uranium enrichment services depend on the capability of making extensive technological progress in their already existing enrichment technology and being able to expand their enrichment facilities. There are three factors that have to be in place to achieve commercial uranium enrichment in Iran:

- Financial ability
- Technological ability
- Uranium reserves

The enrichment facilities in Iran are not presently on a competitive commercial basis. The Iranian enrichment facilities have up and running a few thousand IR-1 centrifuges and plans to develop and produce more advanced and efficient models (Kippe 2009). Developing more efficient centrifuges is an absolute prerequisite for achieving commercial viability in a global market perspective. Iran does not, however, have any reactors that produce electricity, even though they have ambitions of large-scale nuclear power production in the future (Forden and Thomson 2007:11). Although Iran wants to develop the whole nuclear fuel cycle independently, in an effort to be as self-sufficient as possible, the country does not currently have enough known uranium reserves to be completely self-sufficient in the long run (Forden and Thomson 2007:6). It is, however, more convenient to rely only on foreign sources of uranium ore, rather than having to import completely manufactured fuel.

Iran’s enrichment capacity is not comparable to commercial enrichment services globally. Four companies, represented by six states, dominate the commercial enrichment services in the world today. Four of these six countries are Nuclear Weapon States (NWS). Clearly, the NWS dominate the commercial enrichment market.

4.3 Competitive uranium enrichment

As mentioned above, only a few companies in a small number of countries possess commercial uranium enrichment technology. Almost all of these companies are either state-owned or have their origins in government programmes, and the availability of the technology is carefully controlled, for reasons of national security and non-proliferation (NEA 2008:59). As a result,

state involvement in the commercial enrichment sector is high, and the number of competitors is rather small (NEA 2008:59). There are in effect just four major companies worldwide which presently supply enrichment services to the international market (NEA 2008:59):

- AREVA, controlled by the French government.
- Atomenergoprom, owned by the Russian government, which controls the four enrichment plants in Russia.
- Urenco, a British-Dutch-German consortium with mixed state-private ownership with plants operating in each of these three countries.
- The US Enrichment Corporation, USEC, a private-sector corporation formed by privatizing the enrichment operations of the US Department of Energy

In addition, there are smaller scale producers serving domestic markets in China, operated by the state-owned China National Nuclear Corporation, CNNC, and in Japan, operated by Japan Nuclear Fuel Ltd, JNFL. There are also a small number of government agencies in other countries, such as Brazil and South Africa, which have developed enrichment technology, mainly for strategic or self-sufficiency reasons. However, the scales of enrichment in these countries have little or no impact on the commercial market (NEA 2008:60), similar to the Iranian enrichment production (Forden and Thomson 2007:ii).

As highlighted, commercial enrichment services are limited to a few companies who represent a small fraction of the world's countries. Is it legitimate that a few actors reserve the right to nuclear enrichment activities? The IAEA conveys the necessity of cooperation between governments, industry and financial institutions in developing nuclear power, and the Agency emphasizes that the technology-transfer process is an important element for the diffusion of nuclear power technology (IAEA 2001:9). Uranium enrichment technology, however, contradicts with the positive objective to technology transfer within the nuclear field. Nuclear Suppliers Group (NSG) guidelines restrict NPT article IV rights with reference to proliferation concerns, that is, restricting the actual technology and knowledge transfer in the nuclear field, when actual proliferation concerns exist.

4.4 New actors

In order for a MNFCC to be possible, where Iran is responsible for the uranium enrichment, there is a need to find suitable actors who can be responsible for the remaining parts of the nuclear fuel cycle. Which countries would be able to cooperate with Iran, which countries would Iran be able to cooperate with, and which countries would the P5+1 accept cooperating with Iran? The political aspect has to be considered in the pursuit of finding cooperation partners for Iran on the nuclear fuel cycle. However, there are also other limitations to finding cooperation partners for Iran, such as finding countries with the necessary technical know-how and countries with actual uranium reserves, which narrows the search considerably. Iran also needs to cooperate on a financial level regarding expansion of its enrichment facilities, which presents opportunities for

countries without already existing nuclear technological development as cooperation partners. Since Iran has been the weaker party in previous negotiations and cooperation, it is especially important to find partners that do not present this imbalance.

As much as the world powers have doubts about the actual purpose behind Iranian nuclear development, Iran has as many reservations to cooperating with the major nuclear supplier states, questioning whether or not their promises will be kept. Iran's nuclear development has been based on the highest degree of self-reliance possible, and their enrichment effort is the strongest symbol in this regard. As pointed out in Section 4.3, there are few countries who offer enrichment services, and these are to a large degree responsible for the sanctions enacted on Iran. Several of these states have also failed to fulfill promises and contracts with Iran in the nuclear sector in the past. Iran therefore clearly has legitimate concerns about trusting any cooperation with these actors. An obvious solution is to seek other possible actors. However, this may be viewed as challenging the traditional political power balance, which the P5 may not find acceptable. Including other actors in the quest to resolve the current nuclear dispute, however, would be a positive shift that may actually stop the present diplomatic halt on this topic with Iran.

Regarding new actors in the nuclear negotiations, Iranian President Mahmoud Ahmadinejad has argued that "Talks must involve an expanded group of nations beyond global powers China, France, Germany, Russia, the United Kingdom and the United States" (NTI 2010a). The statement came subsequent to Iran, Turkey and Brazil reaching an agreement on uranium exchange.[5] In this report, we have chosen to focus on two possible multinational collaboration models:[6]

- Fuel cycle cooperation between Iran, Kazakhstan and South Africa, where these states are cooperating with a fuel bank.

- Fuel cycle cooperation between Iran and the Persian Gulf Countries.

Several of these states have already entered into nuclear cooperation deals with the major supplier states, which underscores their position as trustworthy actors in the global nuclear energy market. Until now, Iran has mainly been negotiating with P5+1 when it comes to addressing the wider scope of its nuclear efforts, not to pursue concrete cooperation with these states in the nuclear fuel cycle. By including NNWS, preferably non-aligned states, in the nuclear talks, Iran will negotiate on a more equal level, and presumably be more willing to compromise, provided with the prospect of realizing a role as a nuclear supplier state. Iran values good relations with leading countries in the Non-Aligned Movement (NAM). NAM countries, in particular Egypt, South

[5] Under this agreement, Iran was to ship out of the country most of its LEU in exchange for a corresponding amount of uranium fuel plates enriched to just below 20 % for TRR. The rationale behind such an agreement, from other states' perspective, was to deprive Iran of the so-called rapid breakout capability represented by amounts of LEU sufficient for at least one nuclear weapon if further enriched. This rationale is in line with our proposal to put a cap on stored LEU in Iran.

[6] These countries are only meant as suggestions. Many states can potentially assume a constructive role in fuel cycle cooperation with Iran, and we therefore encourage others to investigate other possible multinational collaborations.

Africa, Indonesia and Malaysia, often criticize the major supplier states for their reluctance to sharing nuclear technology as granted by Article IV of the NPT. A MNFCC including some NAM countries will for that reason probably enjoy broad support from most of the other NAM countries.

4.5 Status concerns

> "Iran assumes it is by right the preeminent power in the Persian Gulf and the greater Middle East region. It has the largest population, largest land mass, largest military and oldest culture and civilization. It believes it is the economic engine of the region and the most innovative in application of science and technology." (Yaphe 2008).

Complications seen in the nuclear diplomacy with Iran are not only a consequence of Iran defending its nuclear activities, but is also an effect of Iran not being satisfied with the negotiation situation (Heireng 2010). Iran is generally an opponent of the P5+1 having a role in the nuclear negotiations, because it creates an asymmetric power balance in the negotiations. While the Western powers prefer to discuss exclusively Iran's nuclear programme, Iran wants to be a part of a wider discussion on power balance in general, and power distribution in the nuclear negotiations in particular. Iran wants a negotiation situation in which power is symmetrically distributed between the parties involved. In particular, Iran has expressed a desire to address a whole range of regional questions in any future dialogue with the US. These questions include the fight against Taliban in Afghanistan, refugee and drug trafficking issues related to the war in Afghanistan, the political situation in Iraq, and not least the Palestinian situation. Iran could undoubtedly play a key role in tackling all these challenges, if it were allowed a seat at the table.

Iran is seeking worldwide recognition as an important regional power in the Middle East. Tehran expects to be treated as a major power, and the lack of progress in the nuclear negotiations probably reflect Tehran's pursuit for that recognition. Iran's rising influence in the Persian Gulf is indisputable, but the main question is how to deal with a rising Iran. Washington has been striving to contain Iran, as a way of reducing Iran's influential power. Beijing and Moscow have, on the other hand, advanced their relations with Tehran considerably during the same period of time (Gundzik 2005). Proposals on how to deal with Iran are many. Within the UNSC, the main procedure to deal with the Iranian nuclear programme has been to force Iran to close down all enrichment-related activities, in response to Iran's failing to fulfill its obligation to ensure the IAEA and the rest of the world of its peaceful intentions.

Even though the United States and other Western countries are not willing to give Iran the recognition the Iranian government is seeking, any solution to the nuclear dispute must include some real benefits to Iran. The benefits should preferably confirm Iran's position in the Middle East and in the international hierarchy.

4.6 Two models for multilateral cooperation with Iran on the nuclear fuel cycle

We have presented the idea that multilateral cooperation with Iran in the nuclear field could stimulate progress in the nuclear negotiations with Iran. In addition, we have emphasized the importance of bringing new actors into the nuclear negotiations, as possible cooperation partners in Iran's nuclear development. The purpose of including new actors is to achieve equal terms for all actors in an effort to reach codependent relationships between Iran and other actors in the nuclear field. Incorporating new actors will also create greater transparency in Iran's nuclear activities. This is far from adequate at the moment. If MNFCC is established with Iran, where Tehran is allowed to enrich uranium, the enrichment activities in Iran will have to be profitable for all cooperation partners.

Multilateral cooperation on the nuclear fuel cycle may seem a good idea; however, the idea is hard to realize because of the trust issues between countries, as well as the strive for power and control. Still, despite the disappointments of past initiatives of this kind, such ideas merit serious consideration. It may be that new thinking on old ideas is the answer we are seeking in being able to cope with Iran's nuclear goals.

In the following chapters we will propose two different MNFCC models. First, we present a tripartite consortium model that consists of cooperation between Iran, Kazakhstan, and South Africa. In this model, we also suggest that an international fuel bank is created under IAEA's supervision, with nuclear fuel in storage, as a guarantee for all partners involved. The second model is a MNFCC with Iran and the countries bordering the Persian Gulf. In both models, Iran will be responsible for uranium enrichment, but will have to export the $LEUF_6$ immediately to its cooperation partners who will convert the $LEUF_6$ to uranium dioxide, thus preventing that $LEUF_6$ is stored on Iranian soil. The countries that receive the $LEUF_6$ will further convert it to uranium dioxide and eventually produce the actual reactor fuel at their fuel fabrication facilities for all the partners' reactors. The ideas we present do not constitute a threat to the non-proliferation regime. It will rather strengthen the regime through increased transparency and control of the nuclear activities in Iran and in the partner countries. All participating countries will have to implement the Additional Protocol to be part of the MNFCC, and the international community will have to be reassured, through IAEA inspections, that all activities are in conformity with the non-proliferation regime.

5 Tripartite consortium and fuel bank cooperation

One possible element of a long-term solution to the nuclear dispute is to construct a cooperation framework based on already existing capabilities, in which Iran, Kazakhstan and South Africa will be cooperating in the nuclear energy field. Both Kazakhstan and South Africa are non-aligned countries, with good standing in the Non-Aligned Movement (NAM) and in Tehran. In addition, South Africa is the only country to have developed nuclear weapons and voluntarily given them up (Boureston 2007).

The idea behind a tripartite consortium between Iran, Kazakhstan and South Africa is to incorporate Iran as a serious participant in a nuclear fuel production partnership. Kazakhstan and South Africa already have considerable knowledge and experience with most stages of the nuclear fuel cycle, including uranium production and conversion processes as well as fuel fabrication. South Africa has additional experience with enrichment of uranium. In the proposed MNFCC, however, Kazakhstan, Iran and South Africa will be responsible for different parts of the nuclear fuel cycle. This does not in any way imply that Kazakhstan and South Africa must give up its other nuclear activities. Kazakhstan could under this scheme be responsible for the production of uranium ore, as Kazakhstan has one of the largest known shares of uranium in the world (NEA and IAEA 2010). The state-owned Kazatomprom is already able to produce all relevant uranium compounds. Kazakhstan should therefore produce yellowcake from its indigenously mined uranium ore, convert it to UF_6, and export this to Iran for enrichment. South Africa also has considerable experience with uranium conversion, as well as with fuel fabrication (Enger 2008:28). In the MNFCC, South Africa could therefore be responsible for uranium reconversion and fuel manufacturing, as illustrated by Figure 6.2. Iran's contribution to the MNFCC will then be its enrichment services. Iran must, however, give up all other fuel cycle activities.

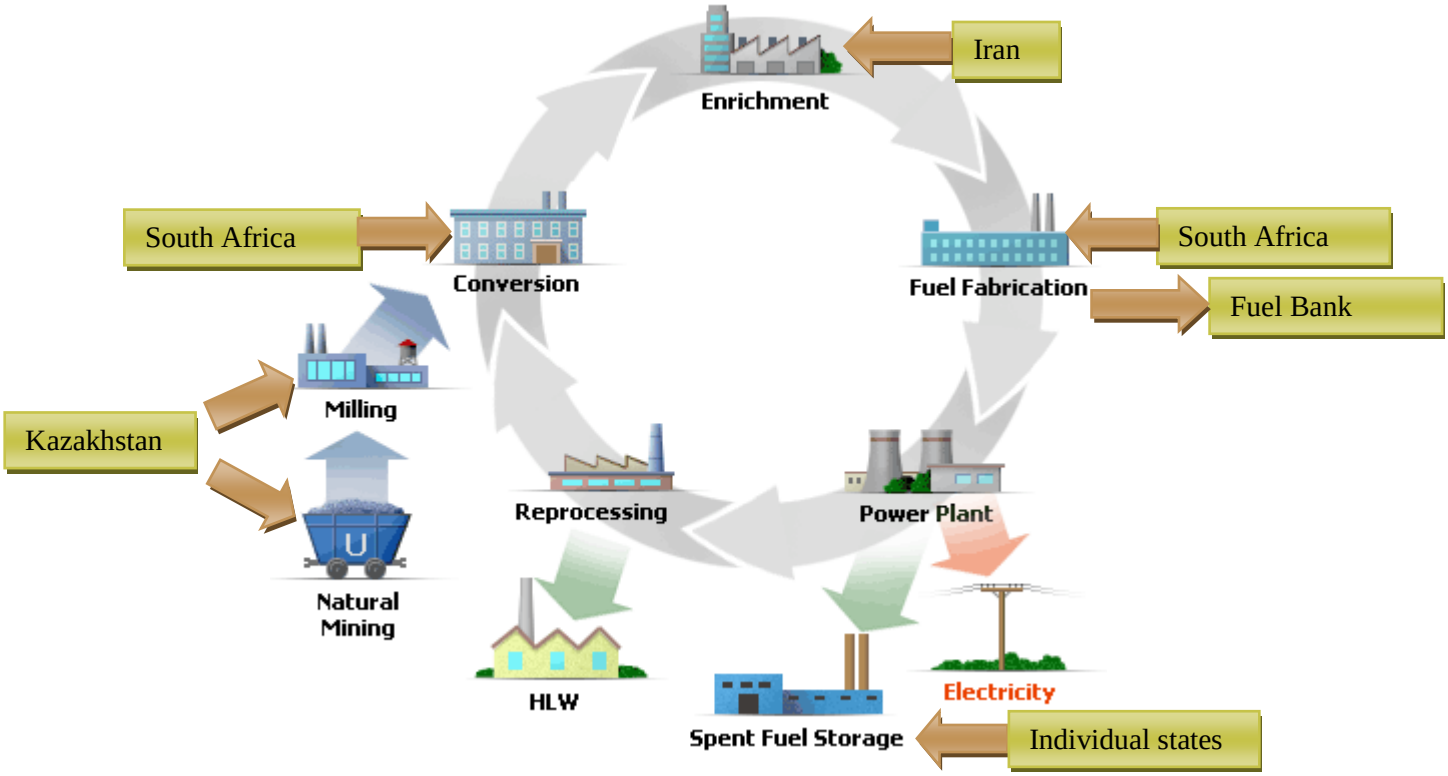

Figure 5.1 Multinational fuel cycle cooperation between Iran, Kazakhstan and South Africa. The figure is found and adapted from A.C. Nuclear Opportunities Fund, whereas all the suggested participating actors are added by the writers.

The consortium will make Iran, Kazakhstan and South Africa balanced partners. At the same time, these states will become codependent on each other in those parts of the nuclear fuel cycle

which they are not managing themselves. This will be particularly relevant for Iran, as Iran will have to give up its strive to develop the entire fuel cycle.

All members at the MNFCC will be assured nuclear fuel supply at all times. The consortium will offer excessive nuclear fuel to other actors in the open market to market price. This will be possible through the establishment of an international fuel bank under IAEA supervision. The bank will have nuclear fuel (in practice a mixture of uranium oxide powder enriched to various degrees, to meet different fuel characteristics criteria) in storage, as a guarantee for all IAEA member states in good standing. The fuel bank will have a significant role in the MNFCC, being a predictable customer in the first years of reserve supply build-up, and later by stepping in when fuel demand surmounts production in the three states. The coupling to such an international fuel bank will also symbolize a leadership role for the three states in securing access to nuclear fuel to all states on equal terms.

It would be beneficial to have additional partners offering financial support for the establishment of the international fuel bank, and perhaps also taking part in the ownership of the nuclear facilities of the consortium actors.

5.1 Kazakhstan as a uranium producer and exporter

Kazakhstan could potentially become a uranium producer and exporter within a MNFCC with Iran. Kazakhstan has become a significant player in the global uranium trade, and since 2006 its production has grown faster than that of any other country (NEA and IAEA 2010:44). In 2008, Kazakhstan became the world's second largest producer of uranium, and this makes Kazakhstan a prospective producer and exporter within a MNFCC.

Iran's demand for uranium increases with the expansion of its enrichment activities. Iran's stockpile of yellowcake, acquired from South Africa in the 1970s, is close to running out, and to meet its increased uranium demand Iran started small-scale production of uranium ore in 2005. It produced 6 tonnes of uranium metal (tU) by open-pit mining of the Gachin (also denoted "Gchine")deposit in 2009 (NEA and IAEA 2010:49). Iran is currently working towards an opening of a second facility at Ardakan, which will produce approximately 50 tU each year (NEA and IAEA 2010:49). Despite Iran's exploration of new uranium production routes, the country's uranium demand, to sustain its long-term nuclear power ambitions, surpasses its production. Tehran is looking for new domestic sources, as well as external suppliers of uranium, but the international society is concerned about Iran's nuclear ambitions, and is therefore striving to limit Iran's uranium supply.

In our proposal, Kazakhstan's supplying of uranium will alleviate Iran's strive for source materials. Through a MNFCC, Iran will be guaranteed natural UF_6 from Kazakhstan, as well as low-enriched fuel from South Africa. If these countries are not able to deliver their products, the fuel bank will contribute in order to satisfy the needs of all member states.

Many countries could in principle be prospective suppliers of uranium ore to Iran. In 2008, uranium was produced in 20 countries (NEA and IAEA 2010:44). Australia and Canada accounted for 40 % of the world's production, while Kazakhstan produced 20 % of the world's uranium from its mines. Other countries with uranium mine production include Namibia (19 %), the Russian Federation (8 %), Niger (7 %), Uzbekistan (5 %) and the United States (3 %) (NEA and IAEA 2010:44). One of the main ideas of this report is bringing new actors into the nuclear negotiations with Iran in order to achieve a positive outcome of the long-lasting negotiations. Kazakhstan has already decided to desist from enriching uranium, and has instead expanded its relations with Russia through increased integration of these two country's nuclear industries. Since Kazakhstan is participating in an international uranium enrichment center in Russia, Kazakhstan can potentially also become a possible contributor to a MNFCC with Iran.

Kazakhstan has a good standing in the non-proliferation regime. Kazakhstan showed goodwill in May 1992, when the Soviet legacy nuclear weapons in Belarus, Kazakhstan and Ukraine were moved to Russia. The three former Soviet Republics signed major international non-proliferation treaties, including a protocol to the Strategic Arms Reduction Treaty (START I) and the Cooperative Threat Reduction Programme (CTR). The latter was initiated by the United States Congress and was designed to provide the three countries with assistance in the destruction, transportation and secure storage of their nuclear weapons. Kazakhstan has also committed itself to being a NNWS under the NPT, as well as being a party to the Comprehensive Test Ban Treaty (CTBT) and a signatory of the Additional Protocol (NTI 2010b). In addition, Kazakhstan is a member of the Nuclear Supplier Group, as well as having ratified the treaty establishing a Central Asian Nuclear Weapons Free Zone (CANWFZ) (NTI 2010b). Kazakhstan is evidently not seeking nuclear weapons, and could potentially become a participant in a MNFCC with Iran and South Africa by, for instance, producing and exporting source material.

5.2 South Africa converting and producing fuel

In addition to Kazakhstan as a participant in the tripartite consortium, we propose South Africa as the third partner to conduct conversion of $LEUF_6$, transferred from Iran, to uranium oxide, and further to fresh, low-enriched fuel in a fuel manufacturing plant. South Africa would be a credible partner and guarantor within the MNFCC, because of its high credentials in the nuclear non-proliferation field.

Iran has been skeptical to previously suggested cooperations involving other actors, because most of these actors have been NWS. South Africa, however, is the only country to have developed nuclear weapons and voluntarily given them up. It started a nuclear weapons programme around 1970, and had a nuclear weapon ready by the end of the decade. The weapons programme was terminated by President de Klerk in 1990, and, in 1991, the country signed the Nuclear Non-Proliferation Treaty. In 1993, six nuclear weapons and a seventh incomplete one had been dismantled, and the IAEA declared in 1995 that all materials were accounted for, and that the weapons programme had been terminated and dismantled. In 1996, South Africa signed the African Nuclear Weapons Free Zone Treaty, also called the Pelindaba Treaty. In 2002, the country signed the Additional Protocol (WNA 2010).

South Africa has ambitions to expand its nuclear energy sector, because their electricity consumption has been growing rapidly since 1980. The country is part of the Southern African Power Pool, with Eskom as the main electricity supplier. Eskom is a South African state-owned company that supplies about 95 % of South Africa's electricity and approximately 45 % of Africa's. The electricity generation in South Africa is mostly from coal-fired stations, with just 5.3 % of total generation in 2008 from the Koeberg nuclear power plant. The Koeberg plant was built by Framatome, now Areva, in the mid-1970s. It is owned and operated by Eskom and has two 900 MW(e)[7] pressurized water reactors (PWR), the same as those providing most of France's electricity. South Africa announced early in 2006 that it was considering building an additional nuclear power plant, possibly at Koeberg, to boost supplies in the Cape Province (WNA 2010).

Early in 2007, the Eskom board approved a plan to double generating capacity by 2025, including construction of 20 GW(e) of new nuclear capacity, so that the nuclear contribution to the total power generation would rise from 5 % to more than 25 % and the coal contribution would fall from 87 % to below 70 %. The new programme would start with up to 4 GW(e) of PWR capacity to be built from about 2010, with the first unit finished in 2016. Areva and Westinghouse (an American company that recently was bought by Toshiba) offered to build the full 20 GW(e). However, in December 2008, Eskom announced that it would not proceed with the nuclear expansion due to lack of financing, and the government confirmed a delay of several years (WNA 2010).

The 2007 draft nuclear energy policy outlined an extensive programme to develop all aspects of the nuclear fuel cycle, including a return to conversion, enrichment, fuel fabrication, and also reprocessing of spent fuel, as strategic priorities related to energy security. A new 5 to 10 million SWU[8] centrifuge enrichment plant built in partnership with Areva, Urenco or Tenex is envisaged, the larger version allowing for exports (WNA 2010).

South Africa has clear ambitions to expand their nuclear energy production and develop the nuclear fuel cycle. Their plans to develop additional energy reactors and fuel cycle infrastructure were delayed because of lack of finance. If South Africa where to take part in a MNFCC, the financial load would be spread out on several actors. South Africa as a cooperation partner with Iran in an MNFCC is achievable because they already have had successful nuclear cooperation in the past, where South Africa exported uranium to Iran, although that was under the Shah's regime.

In order for South Africa to be a part of the MNFCC, they would have to expand their conversion and fuel fabrication infrastructure. South Africa would have to receive $LEUF_6$ straight away from Iran after the enrichment process, and then convert the $LEUF_6$ to uranium oxide and further to

[7] The "e" denotes electrical effect, in contrast to thermal effect, which is denoted by a "t".
[8] Separative Work Units, or SWU, denotes enrichment capacity of either one enrichment unit (such as a single centrifuge or a cascade of centrifuges) or an entire enrichment plant. An annual capacity of 100 000 SWU is required to enrich fuel for a 1 GW(e) light-water nuclear power reactor (for instance a PWR). On a smaller scale, only 5000 SWU is needed to produce 25 kg of 90 % (i.e. weapons-grade) enriched uranium, sufficient for at least one implosion-type nuclear weapon.

reactor fuel. In addition to energy security benefits, and thus potential economic incentives, South Africa would further enhance their non-proliferation credentials by contributing to the defusing of the Iranian nuclear dispute. South Africa will also emerge as a vital champion for the realization of NNWS' rights to develop peaceful nuclear energy technology.

5.3 International nuclear fuel bank

"The proposed fuel bank is a bold agenda and it is clearly not going to happen overnight. But bold measures, including assurances of nuclear fuel supply and multi-nationalizing sensitive parts of the nuclear fuel cycle, are vital if we are to enlarge the contribution of atomic energy to peace, health and prosperity throughout the world while curbing the proliferation of nuclear weapons and eliminating them altogether," (IAEA 2009)

A proposed international fuel bank under IAEA control is another approach in dealing with the expansion of enrichment technology. By providing a secure and reliable supply of the fuel needed for nuclear power generation, a nuclear fuel bank would strengthen the nuclear non-proliferation regime through assurance of supply and reliance on the nuclear fuel market (IAEA 2009). The idea of an international fuel bank in the nuclear field is bold, and the practicality of realizing the idea is complex and difficult. The core of the international fuel bank proposal has been that when a state actor is denied fuel from the commercial uranium f uel market, it should be allowed to purchase the fuel at market value from the international fuel bank. The criteria in past international fuel bank proposals put forward by the West have been that for states to benefit from the assurances of the international fuel bank, they would have to be in good standing in the non-proliferation regime, as well as being willing to forgo their right to develop enrichment and reprocessing technology. The reoccurring idea behind international fuel bank proposals has been that NWS should set an example by using their enrichment and reprocessing plants to provide nuclear fuel to other states that have eschewed these technologies (Rauf and Simpson 2004).

To meet the twin objectives of non-proliferation and "multilateralization," nuclear facilities can be provided to partners in a "black box" mode. In this way, the technology holders construct and operate facilities that are managed and operated multilaterally, without technical know-how being spread. A suggested fuel bank is an attempt to assure fuel supply to countries that are willing to forgo their right to develop enrichment technology. The fuel bank agenda is to avoid monopolistic fuel supply situations and to secure future development of uranium enrichment technology by restricting and controlling the technology, in an attempt to prevent the spread of the technology to those who may wish to use it for non-peaceful purposes (Rauf and Simpson 2004).

Opponents of multilateral approaches point to loss or limitation of state sovereignty and independence of ownership or control over a key technology sector (Rauf and Simpson 2004). Within a multilateral context, however, this can be done at a larger stage than unilateral denial policies, allowing countries greater access to truly peaceful nuclear technology while discouraging them from developing independent national programmes either overtly or covertly that can lead to weapons development.

The former Director General of the IAEA, Mohamed ElBaradei, spoke warmly of multilateralizing the nuclear fuel cycle through the establishment of an international fuel bank. Although at first met with skepticism from leading members of NAM, not least South Africa, a proposed model international fuel bank was approved by the IAEA Board of Governors through a resolution adopted in December 2010. The initial skepticism was rooted in a concern that the assurance of fuel supply would be conditioned on NNWS's binding renouncement of fuel cycle technology. In our proposal, Iran would be incited to keeping the most sensitive and prestigious part of the fuel cycle, namely the enrichment, but voluntarily giving up the less-sensitive parts of the fuel cycle.

Kazakhstan has been positive in its attitude towards multilateralization of the fuel cycle in general, and the establishment of international fuel banks in particular. It has even offered to host such a fuel bank on its own soil. South Africa was initially skeptical, as previously noted, to the concept of an international fuel bank, but has finally supported the idea as it was presented to the IAEA Board of Governors for its endorsement.

Iran's answer to the previous proposals of an international fuel bank has been somewhat positive as well as negative. The argument, however, is not straightforward. Iran views itself as the location in which such a future fuel bank should be localized. Since the Iranian government does not trust any other countries, it does not accept the idea of being part of a multilateralization group with its technology kept in a black box. The idea has been that Iran should give up its enrichment technology and leave the fuel cycle all together. This proposition may be attractive to countries that have not fully developed enrichment capabilities, but in Iran's case this is not an acceptable option.

We, however, propose that Iran internationalizes its enrichment services, and incorporates its enrichment facilities at Natanz in an international uranium enrichment center. Further, an international fuel bank should be created under IAEA supervision, with uranium oxide enriched to various degrees in storage, as a guarantee for all partners involved. Its location is not of paramount importance. The multilateral cooperation then generally secures nuclear fuel supply to all the involved actors, while the fuel bank only steps in as a supplier if the production through the MNFCC is lower than the demand. The bank would constitute a guaranteed customer for Iran and its partners in the medium term, and a guarantor for fuel supply in the longer term, when Iranian fuel demand has become a reality.

6 Iran and the Persian Gulf: Nuclear energy cooperation

In December 2009, the Foreign Minister of Bahrain announced that the nuclear negotiations with Iran had failed simply because the Gulf States were not involved in the talks (Stracke 2009). The countries bordering the Persian Gulf have tried to cooperate with Iran in the nuclear energy field, mainly through a joint initiative in November 2007. This was done in an attempt to assure that the Persian Gulf area remained free from weapons of mass destruction, while ensuring the Gulf States' inalienable right to use nuclear energy for peaceful purposes. The collaborative effort was

developed under the auspices of the Gulf Cooperation Council (GCC), consisting of six countries bordering the Persian Gulf; Bahrain, Kuwait, Oman, Qatar, Saudi-Arabia and the United Arab Emirates (UAE). The proposal would imply a halt in Iran's enrichment of uranium as well as greater Iranian dependence on the Gulf States. The government in Tehran did not accept the nuclear energy proposal put forward by the GCC.

In this chapter, we will examine the possibility of an agreement for nuclear fuel cycle cooperation between Iran and the GCC, in which Iran is permitted to enrich uranium. The model for multilateral cooperation between Iran and the GCC will be investigated in an attempt to achieve more proliferation resistance and transparency in Iran's nuclear efforts through partitioning and outsourcing of the less sensitive parts of the fuel cycle, and multinational presence in the enrichment-related assets. If Iran is allowed to enrich uranium under a MNFCC with the GCC, the activities will be extensively monitored by the IAEA. In addition, the UNSC will still have the authority to re-implement sanctions against Iran in case of Iranian non-compliance with the terms set out in the MNFCC agreement.

6.1 The Gulf Cooperation Council

The GCC was founded in Riyadh in the spring of 1981. The GCC was established to develop and strengthen ties between the member states and their people (GCC 2010a), and to meet the challenges imposed by surrounding circumstances, including the Iran Iraq War. To reach these goals, the member states expanded their cooperation in fields such as economy, trade, tourism, legislation, science and technology as well as other areas (GCC 2010a).

Even though Iran and Iraq are bordering the Persian Gulf, they are excluded from the GCC. The elimination arises from the fact that the GCC primarily was established to counter the influence of the Iranian revolution and the Iran Iraq War (Hooglund 1992, Kechichan 2001:281). Despite this, the GCC acknowledges the importance of having good relations with both nations. For example, at the 19th Session of the GCC, the Council emphasized the importance of having tangible relations with Iran, in order to solve conflicts peacefully and secure good neighborliness (GCC 1998). However, some challenges hinder further expansion of the Iran-GCC relations, whereby the most important concern is the dispute concerning three islands near the strategically important Strait of Hormuz, which since November 1971 allegedly belonged to the United Arab Emirates (UAE), but which Iran now claims the ownership of. Border and territorial disputes also exist among the GCC members,[9] and the island dispute is therefore not considered to have a sufficient destructive effect to prevent a nuclear agreement between Iran and the GCC.

[9] See for example Richard Schofield in "Iran, Iraq and the Arab Gulf States" edited by Joseph A. Kechichan (2001:213-220).

Figure 6.1 The Persian Gulf Area. The map shows the eight countries bordering the Persian Gulf and the six member states of the GCC (Bahrain, Kuwait, Oman, Qatar, Saudi-Arabia and the United Arab Emirates). The map is found and adapted from CIA World Factbook.

6.2 The GCC's joint nuclear programme

It was after GCC's 27th Summit, in December 2006, the GCC Secretary-General, Abdul Rahman bin Hamad al-Attiyah from Qatar, announced the intention of the six GCC states to develop a joint civil nuclear research programme (NTI 2006). The GCC has offered a number of official rationales for their interests in nuclear power (Huber 2007). Firstly, the states in the Persian Gulf are looking for nuclear energy as a result of growing electricity demands and a desire to replace high-priced oil products for cheaper nuclear energy. The electricity demand among the GCC countries is expected to increase by 10 % every year to 2015, and today's energy sources will therefore be insufficient to meet future demands (IISS 2010). Secondly, the GCC states are faced with a lack of sufficient knowledge of nuclear technology, with a desire to gain technical understanding and experience. Thirdly, Iran's nuclear ambitions have caused unease among the states in the Persian Gulf. Some researchers argue that the GCC is launching their nuclear programme merely as a response to Iran's increased influence in the Persian Gulf.[10] Developing a nuclear fuel cycle infrastructure is in many cases (including Iran's) seen as 'nuclear hedging', or creating an option for future nuclear weapons production.

[10] See for example Sverre Lodgaard (2010).

Many observers were surprised by the GCC's initiative to establish a joint nuclear programme, given their long-standing work towards a nuclear weapons free Middle East and the inherent proliferation risk associated with nuclear fuel cycle development (Stracke 2007). In their announcement, the GCC highlighted the necessity of all nuclear collaborations to be developed under the supervision of the IAEA, and exclusively in full compliance with the NPT. All the GCC states are signatories of the NPT. Bahrain is, however, the only GCC state that has signed the Additional Protocol. The others have signed the so-called Small Quantities Protocol (SQP) with the IAEA, which is considered the safeguards standard for states without any significant nuclear activities or facilities. In the event of a MNFCC involving some or all GCC states, all states holding fuel cycle assets should be strongly encouraged to sign and ratify the Additional Protocol.

In February 2007, the idea of a nuclear collaboration was again pursued when GCC leaders met with representatives from the IAEA to discuss the possibility of a joint nuclear programme in the Gulf region (Kaye and Wehrey 2007:113). Since then, the GCC has taken some steps towards an intense in-depth study of nuclear power possibilities, although their project has moved slowly (IISS 2010).

6.3 GCC - Iran collaboration in the nuclear field

As part of the GCC's pursuit of nuclear energy, and their shared interest in preventing Iran from becoming a nuclear power, Iran was invited by the GCC to join an agreement on nuclear energy in November 2007. The nuclear proposal to Iran stipulated that the GCC would provide $LEUF_6$ to Iran, from an enrichment facility set up in a neutral country in Europe. Switzerland was considered as a possible contributor, as Switzerland enjoys a positive image in Iran. The nuclear facility would not only provide Iran with LEU fuel to future power plants, but the Gulf States would also receive LEU (MEED 2007). The proposal allowed Iran to develop its nuclear energy programme except for the enrichment effort, while reducing the risk of Iran developing nuclear weapons. In December 2007, Iranian President Mahmoud Ahmadinejad was invited by the GCC leaders to participate as a guest at the GCC's 28th Summit. The Summit was conducted in Qatar, and was the first meeting in which an Iranian president was ever invited. During his stay, Ahmadinejad emphasized the importance of strong ties between Iran and the GCC, which "would promote security, peace and friendship in the region and the world" (Iranian Government 2007a).

The GCC's proposal to set up an enrichment facility in a neutral country was not realized. Information on Iran's response to the November 2007 GCC proposal is hard to find, but some observers believe the proposal was not taken seriously by the government in Tehran (Stracke 2009). There has been little discussion around the issue in the aftermath of the 28th summit, and little indicates that the proposal will be further debated. A common assumption among researchers in the field is that lack of success in nuclear negotiations with Iran reflects Tehran's pursuit of recognition as a powerful regional actor in the Middle East, something in which the Persian Gulf countries and the Western countries are reluctant to provide.[11] Another postulation is based on the hypothesis that the Iranian government seeks economical, political and military

[11] See for example Sverre Lodgaard (2010).

independence and self-sufficiency, and therefore prefers to develop its nuclear programme with minimal reliance upon foreign suppliers, even though this may not seem commercially viable.[12] An Iranian acceptance of the GCC proposal will in that perspective merely undermine Iran's pursuit of independence.

6.4 Iran as a credible nuclear supplier state in the Persian Gulf

The offer from the GCC was evidently met with dismissal in Iran. However, this does not in any way imply that cooperation on nuclear energy between the GCC and Iran is impossible. The GCC and Iran could potentially cooperate within a MNFCC, in which all participants are responsible for a specific part of the nuclear fuel cycle, and in which fuel supply is assured for all state parties involved. Iran can become a credible supplier of $LEUF_6$ in the region; however, Iran will only manage the enrichment technology in the nuclear fuel cycle, and will therefore have to end its activities in other parts of the fuel cycle, i.e. uranium mining, milling, chemical conversion and fuel fabrication.

Due to the rapid break-out capability that stored $LEUF_6$ represents, as explained in Section 2.4, we suggest that Iran exports its $LEUF_6$ across the border to a recipient Gulf state immediately after the enrichment process for conversion to UO_2. IAEA material accountancy measures will of course be in place to ensure there is no diversion of nuclear material during the transfer. The GCC will thus be responsible for the import of uranium, the conversion process and the fuel manufacturing, as illustrated by Figure 6.2. Uranium conversion facilities and fuel manufacturing plants will have to be set up in one or more of the GCC countries. The conversion facilities will convert imported yellowcake to natural UF_6, and $LEUF_6$ to UO_2. Stand-alone conversion or fuel manufacturing facilities represent much less of a proliferation risk than an enrichment plant, because none of the GCC states possess enrichment technology, and will therefore not be able to enrich the $LEUF_6$ to weapons grade. In addition, the conversion process which the GCC will be responsible for is not a sensitive part of the nuclear fuel cycleas conversion without enriched uranium will not bring a state closer to a nuclear weapons capability. Generally speaking, a segmented nuclear fuel cycle, where the assets are shared between several countries, is less proliferation-prone than a complete (or in this case: front-end) fuel cycle established in a single country.

The handling of spent nuclear fuel must also be dealt with. To avoid further proliferation concerns, an open fuel cycle is highly preferable, in which no reprocessing, and thus plutonium separation, takes place. Each fuel consuming state would be responsible for handling its own spent nuclear fuel under this scheme. However, a regional long-term repository could be envisioned, but this beyond the scope of this report, because it is a matter of practical safety rather than a proliferation concern.

A ground rule for a MNFCC to be developed between the GCC and Iran will be the implementation of the Additional Protocol among all those participant states hosting fuel cycle

[12] See for example Judith S. Yaphe (2008).

assets. This must be fulfilled prior to the UNSC accepting enrichment on Iranian soil and rolling back its sanctions. Iran must also, as a prerequisite, commit to fully cooperate with the IAEA on all outstanding issues relevant to its NPT commitments, as detailed in Section 3.2. All nuclear activities in Iran and the GCC must be strictly monitored by the IAEA. In addition, the UNSC will retain the authority to impose sanctions against Iran in case of non-compliance.

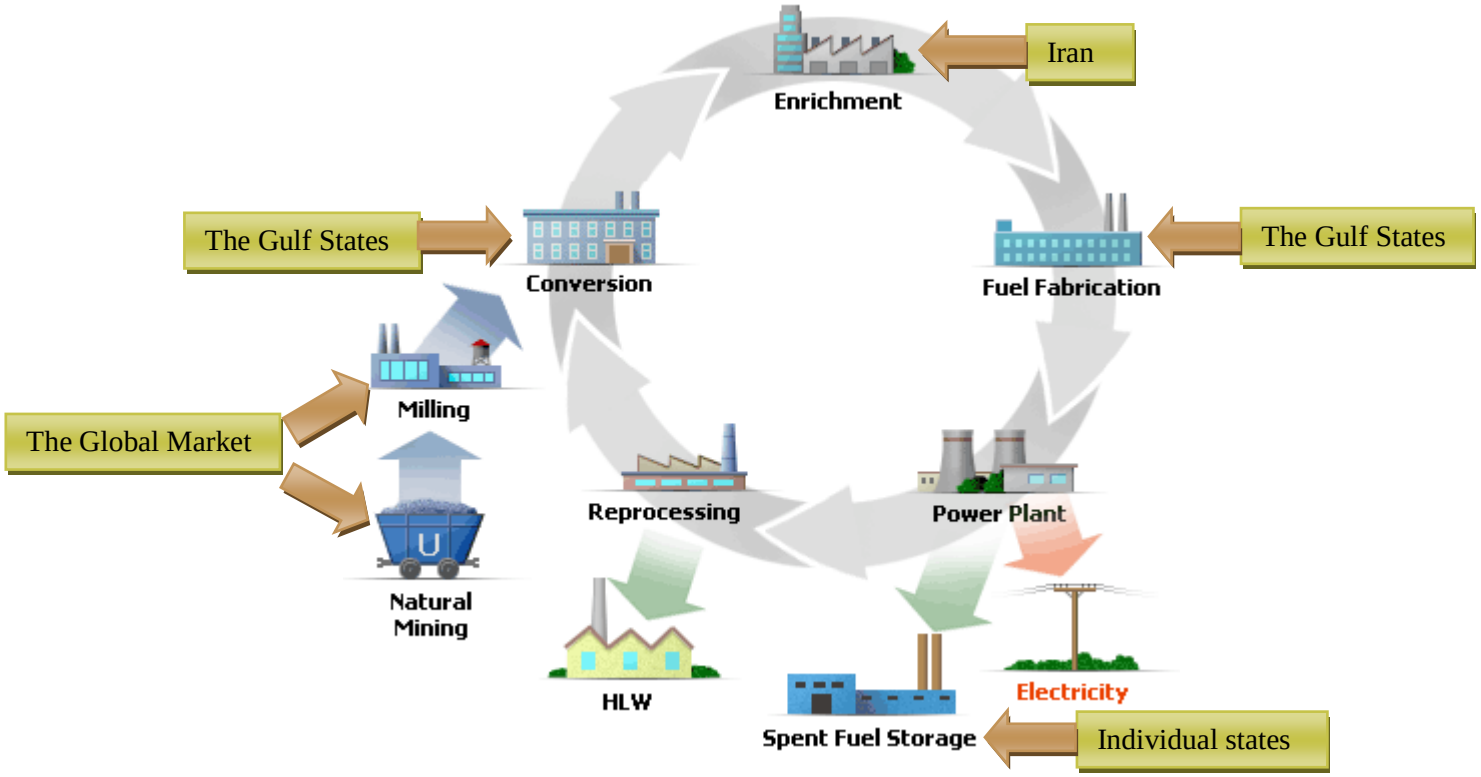

Figure 6.3 Distribution of responsibility in a multilateral fuel cycle cooperation between Iran and the Gulf Cooperation Council. The figure is found and adapted from A.C. Nuclear Opportunities Fund, whereas all the suggested participating actors are added by the writers.

To carry out an agreement for nuclear fuel cycle cooperation, Iran and the GCC will have to buy yellowcake on the open market, since none of these states possess significant, commercially viable uranium deposits. Iran buying source material on the open market in today's political context is not feasible. In addition to restrictions imposed by the UNSC, some Western countries have actually dissuaded uranium producers from selling such material to Iran (NTI 2009b). Letting a Gulf state import source material for conversion to UF_6 will probably be easier to achieve.

Through a MNFCC, Iran will be obliged to selling $LEUF_6$ to the Gulf States, as the Gulf States would be committed to transferring natural UF_6 to Iran. This interdependence may create assurances that Iran will comply with the agreement for nuclear fuel cycle cooperation.

We are not suggesting that increased enrichment on Iranian soil is a favorable outcome. The most desirable outcome is zero enrichment on Iranian soil. However, Iran letting go of its enrichment

technology is very unlikely, and today's situation is not preferable taking into consideration that Iran might be able to develop nuclear weapons covertly. Even though the proposal allows Iran to expand its enrichment activities, Iran will not be in possession of the complete fuel cycle needed to produce weapons-grade uranium. On the other hand, Iran will have to improve and develop their uranium enrichment technology, and will therefore have to share the financial burden with the GCC to enable a commercially viable expansion of their enrichment facilities. In this way, new actors will become shared owners of the project and its associated facilities. To make the proposal even more feasible, a possible solution could also include a broader involvement of the GCC, where the GCC and Iran are operating the enrichment plants collectively. In this case, however, one would have to consider ways of avoiding a further dissemination of enrichment know-how outside Iran's borders.

Given the lack of experience in nuclear technology among the Gulf states, contractors from the established supplier states will probably have to be involved in the construction and early operation phases of the conversion and fuel manufacturing plants, as well as the nuclear power reactors to be set up. Such assistance is usually accompanied by conditions of strict safeguards measures. Most states, however, will be much more reassured by having fuel cycle assets in the Gulf states rather than in Iran.

We believe the framework will be feasible and may produce positive outcomes in the long-lasting dispute between Iran and the international community. Nevertheless, since the idea is still in an early phase, we do not attempt to cover all aspects of the subject. Thus, we encourage others to further study and explore ideas on MNFCC with Iran. Some constraints and prerequisites are discussed in the following sections.

6.4.1 Challenges to the implementation

Making Iran a credible supplier of enriched uranium in the Gulf region will require strict regulations under the supervision of the IAEA. In addition, we foresee a regional arrangement in which representatives of the GCC Secretariat General are allowed on-site access to oversee that the GCC's commercial interests are ensured. The GCC Secretariat General is currently supervising the GCC nuclear power feasibility study in cooperation with the IAEA (Stracke 2007:4), and a possible solution might be to expand the administrative structure within the Secretariat General, with a new sector, called, for instance, Nuclear Affairs. However, the GCC Supreme Council needs to have the final say in all questions concerning a nuclear cooperation with Iran, as the Supreme Council holds the main authority in most GCC activities. The GCC Supreme Council also has the power to approve the budget of the Secretariat General, and thus must approve any financial contribution from the GCC. In addition to regulations by the IAEA, the GCC Secretariat General and the GCC Supreme Council, Iran will have to accede to the necessary concessions set out in Section 3.2.

The administrative structure of the Gulf Cooperation Council (GCC 2010b):
The Gulf Cooperation Council's administrative structure consists of three main institutions: The Supreme Council, the Ministerial Council and the Secretariat General. **The Supreme Council** is the highest authority of the GCC, formed of the Heads of member states. The Supreme Council shall aim to realize the objectives of the GCC, which includes approval of the GCC's main policy, approval of the rules for dealing with other states and intergovernmental organizations, and approval of the internal rules and budgets. **The Ministerial Council** is formed by the Foreign Ministers of the member states. The Ministerial Council shall propose policies and prepare recommendation in order to develop cooperation between the GCC states. The Ministerial Council shall also approve periodic reports, internal rules and regulations regarding administrative and financial affairs, and put forward recommendations to the Supreme Council for approval of the budget of the Secretariat General. **The Secretariat General** consists of a Secretary General appointed by the Supreme Council, five Assistant Secretaries General and a number of other staff members. The Secretariat General shall prepare the budgets of the GCC, prepare studies related to cooperation, and set up periodic reports on the work of the GCC. The Secretariat General shall also follow up the implementation by the member states of the GCC's resolutions and recommendations. The administrative structure within the Secretariat General consists of several sectors, including Political Affairs, Economic Affairs, Security Affairs, Military Affairs, Human and Environment Affairs among others.

At present, there are no operational nuclear power plants in the Gulf region (IISS 2010). This makes it essential to underline that the goal is to provide a long-term solution to the nuclear dispute, as there is currently no market for nuclear fuel among the states involved. The UAE plans to become the first country in the GCC to operate a nuclear power plant, and the UAE signed an agreement with Korea Electric Power Cooperation (KEPCO) to build four nuclear power reactors in December 2009 (IISS 2010). The aim is for the first reactor to produce electricity in 2017. The fact that the UAE has launched its separate national nuclear programme, despite their participation in the GCC's joint project (NTI 2009a), has created concerns regarding the possibility of developing a joint nuclear programme within the GCC. In July 2009, a common electricity grid was established in the Persian Gulf area, in an attempt to distribute electricity generated by nuclear power plants and to enable a cross-border electricity market (IISS 2010). The project was completed by the GCC, which tells us that some concrete steps towards broader cooperation in the nuclear field have been taken.

With the UAE possessing nuclear power reactors, and the GCC countries having access to an electricity grid, we envision that Iran potentially could be the single country in the region with enrichment technology. UAE has promised not to enrich uranium or reprocess spent nuclear fuel, and is committed to full transparency through accession to a so-called 123-agreement under the auspices of the US Global Nuclear Energy Partnership (NTI 2009a). In a similar way, Bahrain and Saudi Arabia has indicated willingness to abstain from enrichment technology. Enrichment technology represents the most sensitive part of the nuclear fuel cycle, but will in our proposal be subjected to even stricter multinational control and ownership compared to today's situation in Iran.

6.4.2 Will the Gulf States cooperate with Iran in the nuclear field?

In order to evaluate if the Gulf States would be willing to accept Iran as a credible nuclear supplier state, it is necessary to consider the relations between Iran and the individual Gulf states. Overall, Qatar and Oman have close contact and good relations with Iran, and they are certainly interested in maintaining these ties. Oman has tried to pursue a foreign policy agenda which is reasonable and non-confrontational, and this strategy has also characterized Oman's policy towards Iran (Stracke 2009). Qatar has also been moderate towards the government in Tehran. This can be explained by, *inter alia*, the large South Pars Gas field which is shared by Iran and Qatar. The South Pars Gas field is the biggest independent gas reserve in the world, and is shaping the political context and the relations between the two countries (Stracke 2009). During the 28th Summit of the GCC, the Qatari Emir Sheikh Hamad bin Khalifa al-Thani announced that existing ties between Iran and the GCC are "very good and consolidated" (Iranian Government 2007b).

Saudi Arabia and the UAE have comparatively poor relations with Iran. The UAE has made it clear that a nuclear Iran is unacceptable, as it will bring no benefits, and will increase the proliferation risk in the Gulf region. In a similar way, Saudi Arabia considers Iran's nuclear programme to be a threat to the non-proliferation and security in the Middle East, and has therefore been on the forefront of opposing Iran's nuclear programme (Khaitous 2007). The relations between Riyadh and Tehran have been strained since the onset of the Islamic revolution, and were additionally strained when Saudi Arabia supported sunni muslim governed Iraq during the Iran Iraq war from 1980 to 1988 (Khaitous 2007). Both Saudi Arabia and Iran have vast land areas and are rich on resources, and the two countries are competing both economically and politically. Saudi Arabia and Iran both have ambitions of regional hegemony. This indicates that the government in Riyadh is concerned about a growing influence of Iran in the Persian Gulf. On the other hand, Saudi Arabia has been working towards the ultimate goal of a nuclear weapons free zone in the Middle East. Lack of progress in the nuclear negotiations with Iran represents a threat to the regional security of the Middle East. If increased enrichment on Iranian soil includes reliable guarantees of strict control and regulations, the solution might be a more favorable alternative in the eyes of the government in Riyadh, compared to the current situation.

Kuwait has been more positive towards Iran, probably as a result of the Iraqi invasion of Kuwait in August 1990, and the continued apprehension of an ever-present Iraqi threat. A powerful Iran can potentially create a balance in the Gulf region and protect Kuwait from further attacks from Iraqi troops. Bahrain has, on the other hand, been more reserved towards Iran. This can be explained by Iranian claims on Bahrain's territory, as well as the majority of shias in Iran (Stracke 2009).

There are, as we can see, significant differences among the GCC states. They possess divergent viewpoints on Iran, and deviating strategies in their attempt to contribute to the development and stability in the Gulf region. Still, the GCC states have expanded their cooperation in many fields, including trade, economy, science and technology, despite their dissimilarities. In recent years, the GCC has also cooperated more fully on regional security issues. They have, for example,

developed their military capabilities collectively in an attempt to provide a military deterrent sufficient to prevent a military attack on a member state (Guazzone 1988:139). In 1982, the GCC Supreme Council declared that an attack on one member state would be viewed as an attack on all member states (Guazzone 1988:140). If the GCC countries are capable of cooperating in the field of security, they should be able to defy their differences and cooperate with Iran in the nuclear field.

The GCC has been left far behind in the field of nuclear know-how (Stracke 2007:5-8), and there is a widespread feeling among the GCC that some Western countries are trying to "deny Arab states access to modern technology" (Stracke 2007:7). The GCC states will presumably maximize their collective profit if they establish nuclear arrangements with Iran, a country which has already acquired a good deal of nuclear expertise. In addition, the GCC will almost certainly be noticed as a more influential actor in the Persian Gulf and the Middle East if they get involved in a collaborative effort with the IAEA. All this indicates that the GCC could be willing to follow a diplomatic approach towards Iran, and be involved in future negotiations where Iran potentially becomes a credible supplier of enriched uranium.

6.4.3 The major powers' role in the proposal

As of today, the P5+1 are striving for a halt in Iran's uranium enrichment activities. The idea of making Iran a credible supplier of $LEUF_6$ in the Persian Gulf will therefore not emerge in years ahead given the current circumstances. However, the P5+1 should be willing to consider the proposition, bearing in mind the importance of getting stricter control over and greater insight into Iran's nuclear activities. Accepting Iran as a nuclear supplier state in the Persian Gulf can potentially create unique opportunities for further cooperation with Iran, in Afghanistan and Iraq for instance, where key powers in the UNSC could benefit from Iranian assistance. As long as Iran is playing with open cards, and strict regulations are implemented to prevent Iran from developing nuclear weapons, the framework should be suitable to Western interests.

It is our assumption that the inclusion of new actors in the nuclear negotiations will create greater progress and invoke an Iranian willingness to compromise. The Persian Gulf countries will increase their role in the nuclear discussions; however, the UNSC will maintain their authority to reinstate sanctions upon Iran in case of non-compliance. A greater involvement of the GCC in the nuclear talks should be a suitable solution to the world powers, as the majority of the GCC countries enjoy a positive image among these states (Katz 2001:95).

6.4.4 The Iranian viewpoint

It will be challenging for Iran to accept the cooperation model presented in this chapter. Iran becoming a regional nuclear supplier state is obviously a great incentive, but in exchange Iran must give up parts of its nuclear fuel cycle. Iran is also required to allow broader involvement of the GCC. Besides, Iran must comply with the earlier requirements from the IAEA and the UNSC, which includes implementing the Additional Protocol and clarifying all outstanding issues with the IAEA, including the possible military dimensions of the Iranian nuclear programme. The

Ahmadinejad administration has continuously refused to accept the Additional Protocol. Iran has also been determined in its desire to persist in developing the entire fuel cycle.

Despite the difficulties in making the framework appealing to the government in Iran, we believe the model will produce positive outcomes also for Iran. Iran's nuclear enrichment capability growing to commercial levels will bring favorable incentives to Iran when it comes to financial assistance and enhanced prestige. Iran will share the financial burden with multinational partners, and will in this way receive assistance to develop and improve its enrichment technology. This will make Iran's nuclear facilities more efficient. Besides, Iran will be recognized as a reliable and important exporter of enrichment services in the Persian Gulf. In the long run, Iran could also achieve economic gains from exporting $LEUF_6$, as well as securing access to fuel for its future nuclear power plants. All this should appeal to the Iranian elite as well as the general population, taking into account Iran's rapidly growing population and the need to create new ways to ensure enough wealth and jobs to civilians (Miller 2007). It will also provide a meaningful rationale for Iran's continuing its enrichment efforts, in contrast to today's situation, in which the stated ambitions of nuclear self-sufficiency are highly questionable due to Iran's scant uranium reserves.

7 Conclusion

The nuclear dispute with Iran has clearly reached a phase where the negotiations with the P5+1 states and the IAEA have stagnated. The lack of transparency in Iran's nuclear activities continues to represent a non-proliferation concern. Since fuel cycle technology, especially uranium enrichment, is of dual-use nature, and may thus be diverted to nuclear weapons production; it is of great significance that there is sufficient transparency in all fuel cycle activities. It is also important that undeclared facilities may be subjected to IAEA inspections, which is made possible by the Additional Protocol. Allegations of Iranian nuclear-weapons related studies in the past have caused concern that Iran is or has been trying to develop nuclear weapons. The UNSC and the IAEA have to be reassured that Iran's future nuclear development cannot be diverted to nuclear weapons production. There are specific measures that could reassure the international community that Iran is not currently on a path of proliferation. These measures are implementation of the Additional Protocol, and substantial cooperation with the IAEA on questions related to the possible military dimensions of its past nuclear programme. To convince Iran to act in accordance with these demands, an agreement will have to contain some face-saving elements for Iran, including some real benefits in terms of assurance of nuclear fuel supply and the roll-back of certain UNSC resolutions.

We have suggested two different models in which Iran is part of multilateral nuclear fuel cycle cooperation (MNFCC). The first model is a trilateral cooperation between Iran, Kazakhstan and South Africa, in which these countries additionally cooperate with an IAEA-supervised international nuclear fuel bank. The second model is a nuclear energy cooperation between Iran and the other countries bordering the Persian Gulf. The above-mentioned concessions would have to be implemented for Iran to take part in a MNFCC. Iran would also have to stop its enrichment activities in the period it takes to negotiate the multilateral nuclear fuel cycle framework.

Throughout the report we have weighed the positive and negative sides of multilateralizing Iran's nuclear fuel cycle. The negative sides may be summarized as accepting and commercializing the uranium enrichment in Iran; however, we do not believe this is a significant proliferation risk when the Additional Protocol is implemented, as this enables the IAEA to probe for undeclared activities in contrast to today's situation. The positive sides of multilateralizing the nuclear fuel cycle is that the nuclear fuel cycle is divided between different actors who then possess different parts of the fuel cycle, making them codependent of each other. In addition, making sure that significant amounts of low-enriched uranium hexafluoride ($LEUF_6$) are not being stored in Iran at any time, but exported to the cooperation partners for conversion and fuel fabrication, will decrease the possibility of Iran developing a nuclear weapons programme in clandestine.

The two MNFCC models are solutions to the ongoing nuclear dispute in a long-term perspective. This is due to two main reasons: First, the framework that has to be in place for the MNFCC to be implemented is a time-consuming effort in which many different actors have to agree on guidelines, rules, financial investments, technological solutions, nuclear safety and security, and waste management. Second, commercializing nuclear fuel production means major expansion of existing facilities, the establishment of more facilities in Iran and its partner countries, extensive research and development and huge sums of money. Through including new actors in the negotiations, and as cooperation partners in Iran's future nuclear development, it is possible to achieve transparency in Iran's nuclear field. However, the actual full-scale commercial realization of a MNFCC will be time consuming, but still achievable and preferable to today's situation.

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List of abbreviations

AEKhK	Angarsk Electrolytic Chemical Combine
AEOI	Atomic Energy Organization of Iran
CANWFZ	Central Asian Nuclear Weapons Free Zone
CTBT	Comprehensive Test Ban Treaty
CTR	Cooperative Threat Reduction Programme
FEP	Fuel Enrichment Plant
GGC	Gulf Cooperation Council
HEU	Highly Enriched Uranium
HLW	High Level Waste
HWPP	Heavy-Water Production Plant
IAEA	International Atomic Energy Agency
IUEC	International Uranium Enrichment Center
KEPCO	Korea Electric Power Cooperation
LEU	Low-Enriched Uranium
$LEUF_6$	Low-Enriched Uranium Hexafluoride
MNFCC	Multilateral Nuclear Fuel Cycle Cooperation
NAM	The Non-Aligned Movement
NCRI	National Council of Resistance of Iran
NNWS	Non-Nuclear Weapon State
NPT	Nuclear Non-Proliferation Treaty
NSG	Nuclear Suppliers Group
NWS	Nuclear Weapon States
NUFCOR	Nuclear Fuels Corporation of South Africa
PWR	Pressurized Water Reactors
R&D	Research and Development
SAPP	The Southern African Power Pool
START	The Strategic Arms Reduction Treaty
SQP	Small Quantities Protocol
TRR	Tehran Nuclear Research Center
tU	Tonnes of Uranium Metal
UAE	The United Arab Emirates
UF_4	Uranium tetrafluoride
UF_6	Uranium hexafluoride
UNSC	United Nations Security Council
UO_2	Uranium oxide