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Peaceful uses of nuclear energy in the Middle East: multilateral approaches

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Background paper

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Abbreviations

ABACC	Argentine–Brazilian Agency for Accounting and Control of Nuclear Materials
EURATOM	European Atomic Energy Community
GCC	Gulf Cooperation Council
GNEP	Global Nuclear Energy Partnership
HEU	Highly enriched uranium
IAEA	International Atomic Energy Agency
IFNEC	International Framework for Nuclear Energy Cooperation
IUEC	International Uranium Enrichment Centre
LEU	Low-enriched uranium
MESP	Multilateral Enrichment Sanctuary Project
MNA	Multilateral nuclear approaches
NPT	Non-Proliferation Treaty
NTI	Nuclear Threat Initiative
UAE	United Arab Emirates
WNA	World Nuclear Association

I. Introduction

As of today, nuclear power has played a negligible role as an energy source in the Middle East. This will change in the forthcoming years, if the announcements of fourteen regional countries to embark on civilian nuclear programmes are to be accorded credibility. Together with such a nuclear awakening a number of challenges for the region would come to the fore, such as the physical security of nuclear facilities and materials in a region with an endemic terrorist problem, the safety of nuclear installations in countries with (partially) deficient regulatory quality and low government effectiveness and the danger of a (latent) proliferation cascade in a region of strong political tension.[1]

As this background paper will argue that these challenges can only be addressed in a cooperative manner, it is in the best interest of all states to coordinate their nuclear activities with their neighbours' in order to minimize the risks posed to nuclear security, safety and non-proliferation in the region. This paper will investigate possible cooperative nuclear arrangements for the Middle East and will identify their potentials and limits. It begins with a short summary of the status quo of civil nuclear programmes in the Middle East (section II) and a brief outline of existing multilateral nuclear approaches (MNAs) for the nuclear fuel cycle (section III). It then discusses the regional challenges MNAs would face in the Middle East (section IV) before concluding with a number of recommendations for the region (section V).

Caveat: A 'nuclear spring' in the Middle East is not a done deal yet, and will ultimately depend on a number of critical factors. Whereas we can assess the financial and technological prerequisites of the countries in the region—and conclude that only a handful of countries might succeed in launching a sustainable nuclear programme, we cannot predict the impact of the 'Arab spring' and of the Fukushima accident on the ensuing nuclear endeavours at this stage.[2] Thus, as has already happened in the past, the current nuclear enthusiasm might well fade away in the coming years, and the 'nuclear Middle East' thus might not emerge as envisioned in this paper.

II. Nuclear programmes in the Middle East

As of today (July 2011), there is not a single operational large-scale nuclear power plant in the Middle East. Still, this picture might change in the next decade. The Iranian 1000 MW Bushehr reactor is announced to be connected to the national power grid in August 2011, and another thirteen countries in the region are currently evaluating the nuclear energy option (for more details see Mark Fitzpatrick's background paper).

Shared interests, common goals and incentives for cooperation

There are a variety of motives why countries in the Middle East are considering the nuclear energy option these days. First, nuclear energy can contribute to cover a growing demand on electricity for rapidly growing populations. Secondly, it can lower the dependence on fossil fuels for both exporters as well as importers of oil and gas. Thirdly, it can help alleviate the problem of water scarcity (via desalination). However, a security rationale cannot be

[1] Cf. Miller, S. and Sagan, S., 'Nuclear Power without nuclear proliferation?', Daedalus, Fall 2009, pp. 7-18; International Institute for Strategic Studies, Nuclear Programmes in the Middle East. In the shadow of Iran (IISS: East Sussex, 2007).

[2] Cf. José Goldemberg, J., 'Nuclear energy in developing countries', Daedalus Fall 2009, pp. 71:80.

discarded either—in the face of an ambivalent Iranian nuclear programme, some countries might consider the nuclear option as a safety cushion against abrupt geostrategic changes in the region. Furthermore, nuclear energy is considered to be a cutting-edge technology by countries in the region and—even if its economic rationale might not be compelling—it is widely seen as a prestige project, as well. This perception largely explains the insistence on 'the inalienable right' to pursue peaceful uses of nuclear energy as enshrined in the NPT Art. IV, a principle often held up by the NPT members of the region: here nuclear power is seen both as a status symbol and as a legitimate entitlement in the context of the NPT 'grand bargain'. This, of course, does not imply that every country has to exercise this right to its full extent, i.e. going it alone on the full nuclear fuel cycle. A multilateral approach, based on some voluntary self-restraint on some parts of the fuel cycle, in return for substantive economic, security and non-proliferation benefits could represent an acceptable—and even attractive—compromise. The UAE already accepted such a non-proliferation clause in their (bilateral) nuclear cooperation agreement with the US and pledged to forgo uranium enrichment and spent fuel reprocessing in exchange of assured nuclear transfers of nuclear reactors and reactor fuels.[3] Similar multilateral approaches are discussed in this paper. In general, such give-and-take approaches would be cheaper and (technically) easier to realize than strictly domestic programmes. Thus they can help to satisfy the energy demands in the region faster and more efficiently. Furthermore, they would contain the risk of proliferation and therefore offer real security advantages to all parties.[4] One must not forget that the proliferation of nuclear weapons in the Middle East concerns all countries and that hardly any state in the region would be glad to see one of its neighbours being engaged in dubious nuclear activities.

If therefore a cooperative scheme could be worked out, which is acceptable to all parties involved, this proliferation risk could be largely contained. Finally, multilateral approaches in the Middle East would also have positive effects on the aspect of nuclear safety and security, as they would encourage the diffusion of the best practices on the matter and allow for better protection of nuclear installations and materials throughout the region. Thus, pursuing nuclear energy in a cooperative spirit offers clear economic, technological, safety, security and non-proliferation advantages for all countries in the region.

III. Multilateral approaches for the nuclear fuel cycle: taking stock

Attempts to control the spread of sensitive nuclear technologies have surfaced time and again since the dawn of the atomic age. The first endeavour dates back to 1946 and was proposed in the visionary Acheson-Lilienthal Report, a study commissioned by the US Department of State just a few months after the bombings of Hiroshima and Nagasaki.[5] The report called for the creation of an international organization in charge of controlling all nuclear materials—from uranium ores to spent fuel—and assuring their exclusively peaceful application. The Acheson-Lilienthal proposal surfaced at a time when the US was still holding a nuclear weapon monopoly and the Soviet Union was just starting its chase to catch up. The growing

[3] Cf. 'Agreement for Cooperation between the Government of the United States of America and the Government of the United Arab Emirates concerning Peaceful Uses of Nuclear Energy', http://www.carnegieendowment.org/static/npp/treaties/uae_123.pdf

[4] Cf. Shaker, M., 'The Internationalization of the Fuel Cycle. An Arab Perspective', Disarmament Forum, 02/2008.

[5] Department of State 1946, A Report on the International Control of Atomic Energy, Prepared for the Secretary of State's Committee on Atomic Energy.

distrust between the two superpowers in the ensuing Cold War buried the hopes of such a far-reaching agreement very quickly.

A second attempt to multilateralize at least the most sensitive parts of the nuclear fuel cycle was put forward in the 1970s by the USA. Washington feared the spread of reprocessing technologies in the light of closed fuel cycle 'plutonium economies' and actively discouraged the construction of national reprocessing facilities for plutonium separation within its sphere of influence. The proposals for multilateral back-end fuel cycles were never put into practice, because Washington's concerns about a global plutonium economy did not materialize in the ensuing decades. Rather, the growth of nuclear power slowed down in the 1980s, and the price of uranium dropped, making closed fuel cycles and plutonium fuels economically unattractive.

The debate on multilateral nuclear fuel cycles resurfaced in the late 1990s and gathered steam under the International Atomic Energy Agency (IAEA) Secretariat of Mohamed ElBaradei (1997–2009). After a High-Level Panel of the United Nations Secretary General in 2004 highlighted the threats and challenges of an uncontrolled diffusion of sensitive nuclear technologies and proposed a stronger role of the IAEA in securing the nuclear fuel cycle (both against disruption of supply and against horizontal proliferation), ElBaradei convened an Expert Group to address the issue of MNA.[6] The Expert Group issued its report on April 2005, which elaborated on the following issues:

- Options of MNA both for the front end and the back end of the nuclear fuel cycle.
- Policy, legal, security, economical and technological incentives and disincentives to engage in multilateral nuclear arrangements.
- Historical and actual experiences in the multilateralization of the nuclear fuel cycle.[7]

The Expert Group Report triggered a number of proposals, which were submitted to the IAEA by different parties in the years to follow and which will be briefly discussed in this section. These MNA are in the focus of the actual debate on the fuel cycle and are characterized by three elements. First, they focus on the front end of the nuclear fuel cycle, especially on the aspect of uranium enrichment.[8] Secondly, all current proposals prioritize (soft) incentive-based approaches over (hard) regulatory commitments.[9] Third, almost all major proposals were tabled by advanced nuclear technology holders (states, nuclear industry or international organizations) with little or no contribution by the addressees of the regulations, the recipients of nuclear technology. This imbalance is problematic, as the priorities of suppliers and the recipients in an MNA are mostly not completely identical—

[6] 'A more secure world: Our shared responsibility', Report of a High-level Panel on Threats, Challenges and Change (United Nations: New York, 2004).

[7] 'Multilateral approaches to the nuclear fuel cycle', Report of an Expert Group submitted to the Director General of the International Atomic Energy Agency (Vienna, 2005).

[8] The focus on enrichment technologies on the front end can be largely explained by the failed attempts to establish sustainable plutonium economies. Thus, the rationale of reprocessing spent fuel and extracting plutonium in the back end of the fuel cycle is being questioned both on economic as well as on technological and on political (i.e. non-proliferation) grounds today. At the same time the demand for enriched uranium is bound to increase in a—hypothetical—nuclear renaissance, as most of the projected (light-water) reactors (LWR) will use LEU as reactor fuel. If uranium enrichment is carried out with gas centrifuges the conversion of an enrichment plant for civilian purposes (LEU) to weapon purposes (HEU) is straightforward. Hence, the strong (implicit) focus on centrifuge enrichment in most current MNA.

[9] The prioritization of soft regulations takes into account the political climate during which these proposals were deliberated. ElBaradei's proposal of a moratorium on new enrichment and reprocessing facilities in 2005 was unanimously rebuffed by the NAM countries at the NPT Review Conference of the same year.

whereas the former focus mainly on economic and non-proliferation aspects of an MNA, the latter also put strong emphasis on supply guarantees and technological cooperation. Thus, a promising MNA has to balance the delicate needs of proliferation resistance, energy security, know-how transfer and market compatibility.[10]

Before turning to the current MNA *proposals*, it might make sense to look at two *already existing* MNA in the nuclear front end, which have been operative for decades, namely the French EURODIF and the British–Dutch–German URENCO consortium. In the EURODIF model, France is the exclusive technology holder. Whereas the non-French EURODIF partners—currently Belgium, Iran, Italy and Spain—cannot benefit from any technology transfer, URENCO partners fully participate in R&D, manufacture, operation and management of the enrichment endeavour. Both schemes offer advantages and disadvantages. From a mere non-proliferation standpoint, EURODIF seems to be more robust, as it does not spread sensitive know-how to the cooperation partners but grants them just 'drawing rights' of the product (low-enriched uranium, LEU). This restriction nevertheless could make the scheme unattractive to those partners that want to benefit from technology and know-how transfers in sensitive technology areas. Being excluded from both technology ownership and development makes a mere shareholding position unattractive for these countries.[11] For these states an URENCO model would offer more cooperation incentives, but it would also entail higher proliferation risks, as all partners engage in some part of the enrichment business and necessarily share a certain amount of critical know-how and technology. Implementing a strict division of labour among the consortium partners, as has been done by URENCO, can still limit this technology diffusion nevertheless and therefore make a break-out decision rather costly. In the actual debate on MNA the most important proposals—following Müller 2006[12], Yudin 2009[13], Goldschmidt 2010[14], and ICNND 2010[15]—are the following:

In the realm of assurances of supply:

- A three-layer model proposed by the World Nuclear Association (WNA, 2006): a (sufficiently diverse) market, supply guarantees by the enrichment industries and government stocks should provide the three lines of defence against disruption of nuclear fuel supply.
- Six-country proposal (2006): France, Germany, the Netherlands, Russia, the UK and the USA commit to 'un-bureaucratic' generic export licenses, if a recipient faces a fuel shortage and is in good standing with his non-proliferation obligations.
- IAEA Standby Agreement System (2007): this proposal, tabled by Japan, tasks the IAEA with monitoring the nuclear fuel market to detect potential bottlenecks and thus to prevent market failures. Therefore, assurance of supply shall be guaranteed by a healthy and functioning market.

[10] For an elaboration on this delicate balance see Müller, H., Multilateralisierung des Brennstoffkreislaufes: Ein Ausweg aus Nuklearkrisen?, HSFK-Report 10/2006 (Frankfurt, 2006).

[11] Cf. Müller, H. Multilateral Nuclear Fuel-Cycle Arrangements, The Weapons of Mass Destruction Commission (WMDC) No. 35, 2006: 10.

[12] Harald Müller, Multilateralisierung des Brennstoffkreislaufes: Ein Ausweg aus Nuklearkrisen?, HSFK-Report 10/2006, Frankfurt, 2006.

[13] Yuri Yudin, Multilateralization of the Nuclear Fuel Cycle: Assessing the Existing Proposals, UNIDIR, Geneva, 2009.

[14] Pierre Goldschmidt, Multilateral nuclear fuel supply guarantees & spent fuel management: what are the priorities?, Daedalus Winter 2010: 7-19.

[15] Report of the International Commission on Nuclear Non-Proliferation and Disarmament (ICNND), Eliminating Nuclear Threats. A Practical Agenda for Global Policymakers, Canberra/Tokyo 2010, Chapter 15.

- UK fuel bonds (2007), where the bond would consist of an agreement between a supplier and a recipient of nuclear fuel and the IAEA as the arbiter over whether the recipient is entitled to redeem the bond.

In the realm of fuel banks[16]:

- A US nuclear fuel reserve (2005), based on 17 tonnes of highly enriched uranium (HEU) to be down-blended to LEU.
- Nuclear Threat Initiative (NTI) Fuel Bank (2006): a virtual IAEA-controlled fuel bank with a nominal capital of $50m provided by NTI and another $100m to be provided by IAEA Member States.
- Russian LEU reserve proposal (2009): 120 tonnes of LEU held at the Angarsk International Uranium Enrichment Centre (IUEC).

In the realm of multilateral facilities[17]:

- Russian IUEC (2007) as a joint stock company. This proposal would compare to the existing EURODIF-Model and allow shareholders to buy into the IUEC and receive a share of the produced LEU. Management, operation and technology would remain under exclusive Russian control.
- URENCO Model: this multilateral cooperation model would mimic the URENCO example and create a multinational consortium operating and managing a common enrichment plant. Division of labour and interdependency within the consortium would guarantee a low incentive to break out together with some economies of scales.

International Framework for Nuclear Energy Cooperation (IFNEC 2010): a US initiative—formerly known as GNEP (Global Nuclear Energy Partnership)—aimed at developing a proliferation resistant closed fuel cycle. As its predecessor (GNEP), the IFNEC vision is based on technologies, which are only partly available today.

- Multilateral Enrichment Sanctuary Project (MESP 2006): a German proposal aimed at establishing a new multilateral commercial enrichment plant under the control and sovereignty of the IAEA.
- Multilateralization of the Nuclear Fuel Cycle (2007): an Austrian proposal aimed at multilateralizing new sensitive facilities from the outset and existing facilities in a similar manner to the IUEC in Angarsk, Russia.

The above-mentioned proposals differ in their vision, scope, targets and time required for their implementation.[18] Some MNA such as the Russian IUEC (2007) can be implemented on relatively short term, as the physical infrastructure in Angarsk is already there and the

[16] Fuel banks are generally seen as more reliable than the above mentioned assurances of supply, which basically entail just a promise to step in, when a country faces a disruption in nuclear fuel supply. The fuel bank, on the other hand, suggests that replacement fuel shall be readily available upon a (legitimate) request. This does not necessarily imply that fuel banks must have a physical stock of fuel readily available all the time, but rather the equivalent in enriched uranium (LEU; HEU) or in capital.

[17] This list comprises already existing facilities as well as conceptual ideas on new facilities (both technological as well as regulatory concepts).

[18] for a detailed discussion, see Yudin 2009: 60-61

facilities operative. Other proposals such as IFNEC are rather visionary as they entail the development of new fuel cycle technologies and require fundamental research on a variety of potential waste management technologies. The German MESP proposal falls in the middle between the Russian IUEC and visionary concepts such as IFNEC: MESP is based on an established technology (centrifuge enrichment) and requires mainly administrative skills and political will to be implemented.

In the realm of the fuel banks, both the Russian LEU reserve as well as the NTI nuclear fuel bank have been approved by the IAEA Board of Governors in the meanwhile and can be seen as operational: according to Rosatom director Sergey Kiriyenko, the IUEC in Angarsk already harbours a third of the 120 tonnes of LEU at the beginning of 2011. At the same time NTI was able to raise the necessary capital ($50 million, in additional of another $100 million raised by IAEA Member States) for the IAEA fuel bank. Together with the Russian LEU reserve, this virtual fuel bank (based on capital instead of LEU) is now effectively available for backing up politically motivated fuel shortages.

It should be noted though, that most proposals link the supply of replacement fuel to a number of conditions, which do not make every country in every circumstance currently eligible. First of all, the assurance to activate an emergency supply would hold only for *politically motivated* fuel supply disruptions and would not cover any other fuel shortage scenario (e.g. commercial, technical or other failures).[19] Secondly, the conditions to be granted backup fuel vary strongly among the MNA proposals and include some or all of the following criteria: NPT membership; a comprehensive safeguards agreement in force with the IAEA; the ratification of the Additional Protocol; the ratification of the Convention on Nuclear Safety and the Convention on the Physical Protection of Nuclear Materials; and the renunciation to pursue national enrichment or reprocessing program while taking part in the MNA.

IV. Challenges for a multilateral nuclear fuel cycle in the Middle East

Diverging expectations of countries in the region

Proposing a multilateral nuclear fuel cycle for the Middle East will most probably encounter a number of reservations by the countries in the region. These reservations will range from concrete material interests to abstract normative principles.

Some of these dividing issues shall be addressed here. First, as most MNA require states to refrain from domestic fuel-making (or to limit their fuel-making capacities), the issue of energy security will arise. Iran might point to its negative experience as a EURODIF shareholder in this context. In addition, Russia, the host of the first fuel bank in Angarsk, does not have the highest credibility in terms of a reliable energy supplier. Secondly, some countries will expect to share technological know-how with their cooperation partners and thus advance in all modules of the fuel cycle. Remaining a simple recipient of nuclear technology may not be a satisfactory perspective for these countries, as many of them associate nuclear prowess with modernity, development and their chance to catch up with the industrialized world. Third, if an MNA recipient country seeks a break-out option for

[19] To determine whether a fuel disruption is caused by political motives rather than due to technical or commercial considerations, will prove difficult in reality, nevertheless, and most probably need some third party arbitration in the legal dispute between supplier and recipient. This process can be rather time-consuming and could thwart the backup provisions, see also Pierre Goldschmidt 2010, p. 11.

deterrence (or other) purposes, it will deem technology and know-how transfers to be indispensable. This, of course, stands in sharp contrast with the demand of proliferation resistant arrangements. Fourth, an often underestimated demand on MNA comes from the Non-Aligned Movement, in our specific case from the Arab states. Their opinion is that there has to be a fair share when regulating matters of nuclear energy, arms control and non-proliferation in the Middle East. This justice claim comprises the rights and duties of countries in the region, their participation in the decision-making process on nuclear matters, and their chances to benefit from the peaceful uses of nuclear energy. Egyptian Ambassador Nabil Fahmy said recently, every measure has to be applied 'to the region as a whole' and will not be accepted if they are 'only limiting the rights of the Arab states'.[20] His statement points to the special status of Israel as the only NPT holdout state in the Middle East with all its consequences of unequal verification, unequal acquiescing of nuclear weapons activities and unequal security throughout the region. On the other hand, Israel points to its unique security situation and to the absence of a stable peace in the region, which—in the eyes of Jerusalem—overwrites abstract principles of equality, as invoked by the Arab States.

It is beyond the scope of this paper to venture into the very delicate balance between security, stability, peace and disarmament in the Middle East (for that purpose see the background paper of Claudia Baumgart-Ochse and Harald Müller). As far as the MNA are concerned, these reflections should merely illustrate that it will not be easy to conciliate these diverse perceptions of security (both economic and military) and justice in a multilateral nuclear arrangement, which shall satisfy all the demands.

Verification

The proposals discussed in this paper require—to a varying degree—that recipient states abide by a number of non-proliferation commitments in order to be eligible for an emergency supply. A quick glance at the Middle Eastern region shows that numerous countries would not meet these selection criteria today. The non-NPT member Israel has no comprehensive safeguards agreement in force with the IAEA and leaves a number of critical facilities out of the international verification regime. Two key regional states—Iran and Egypt—do not accept enhanced safeguards as foreseen by the Additional Protocol and thus would not be eligible for the six-country proposal, the UK fuel bond option or the US nuclear fuel reserve.[21]

Even if all countries ratified the IAEA Additional Protocol, this might still prove insufficient for the hypothetical scenario of an EURODIF- or URENCO-style consortium in the region. If therefore a number of regional states decided to operate common nuclear facilities (e.g. a common enrichment plant), international IAEA inspections would have to be complemented by additional inspections carried out by countries in the region, if distrust and tensions are to be avoided. The advantage of such a regional verification is that it gives each side strong confidence about the nuclear activities within its neighbourhood. These additional inspections would have to be coordinated by a regional atomic energy institution in a similar manner as European Atomic Energy Community (EURATOM) operates in the EU countries and Argentine–Brazilian Agency for Accounting and Control of Nuclear Materials (ABACC)

[20] Quoted in http://www.armscontrol.org/print/2993, rev. 2011.06.13.

[21] Whether they would be eligible for other MNA is not always clear, as some proposals lack a precise indication of what kind of safeguards are required. See e.g. the Russian LEU reserve proposal calling for 'effective safeguards' being in force (Goldschmidt 2010: 10-11).

manages mutual inspections between Argentina and Brazil.[22] There is currently no comprehensive regional organization through which Arab States, Iran and Israel could explore such a visionary undertaking. Still, a subregional approach at the level of the Arab League or the GCC states might be explored as a starting point.[23]

Enforcement/guarantee of supply

Multilateral facilities placed in the region open up a theoretical break-out option for the host state (if facilities are managed like the EURODIF-model) or—to a minor extent—for the consortium members (if the multilateral arrangement follows the URENCO-model). Still, such a break-out can be deterred and eventually thwarted by credible enforcement mechanisms. The best way to enforce non-proliferation compliance could be achieved by granting far-reaching authority to a suitable regional organization. Again, EURATOM is a good example for such an approach. Article 86 of Chapter VIII of the EURATOM treaty deprives Member States of any ownership of fissile material and instead assigns them to the European Commission. Consequently, if any Member state is found in violation of its non-proliferation commitments, the EURATOM treaty grants the Commission to impose sanctions, which reach up to the 'total or partial withdrawal of source material or special fissile materials.'[24]

Again, no EURATOM analogon exists in the Middle East so far, but—as stated above—the mandate of the Arab Atomic Energy Agency (or on a smaller scale the GCC) could well be expanded to something similar to EURATOM. Hence, a regional agency purchasing fuel and leasing it to all its members in good standing with their non-proliferation commitments could accommodate the demands of energy security and non-proliferation in a more credible manner than the current settings (bilateral agreements between suppliers and recipients and 'basic' IAEA inspections).

Confidence

A minimum amount of trust is required for every multilateral nuclear arrangement, in order to work. Unfortunately, in the current situation this trust is lacking on all sides. It divides NPT members from NPT holdouts, non-nuclear weapon states from nuclear weapon possessors, nuclear suppliers from recipients, the 'West' from the 'Rest'. At a closer glance the situation is even more complex. Within this 'Rest' one probably also has to differentiate between the Arab states and/or the GCC on one side, and Iran and Syria on the other side, between the Sunni and the Shia, etc. Thus, deep distrust seems to be ubiquitous in the Middle East, and places a big burden on any possible cooperative agreement in the region, especially on such a sensible issue as nuclear technology. Still, as the European (EURATOM) and South American (ABACC) example show, this situation can be overcome over time. Neither France and Germany nor Brazil and Argentina saw their cooperation partner as fully trustworthy when they started regional cooperation in nuclear matters. A certain degree of distrust might

[22] For a detailed analysis about the EURATOM and ABACC experience and its lessons for the Middle East, see Kibaroglu, M., 'EURATOM & ABACC: Safeguards Models for the Middle East?', in A Zone Free of Weapons of Mass Destruction in the Middle East (UNIDIR: Geneva, 1996) pp. 93-123.

[23] Mohamed Shaker points to the existence of an already existent, but largely dormant Arab Atomic Energy Agency, cf. Shaker, M., 'The internationalization of the nuclear fuel cycle: an Arab perspective', Disarmament Diplomacy, 2008, pp. 33-41; Cf. Alani, M., The Case for a Weapon of Mass Destruction Free Zone in the Gulf (GWMDFZ), Gulf Research Center, 2006.

[24] EURATOM Treaty Chapter VII, Art. 83.

even be a good kick-start for an MNA based on cooperation and mutual verification in a region dominated by distrust and conflict.

V. Conclusions

Several countries in the Middle East announced their intentions to meet their growing energy demands by launching nuclear power programmes in the coming years. As a nuclear energy programme is a demanding enterprise, both economically as well as technologically (national power grids must have a minimum capacity and resilience), not all nuclear programmes in the Middle East are credible or will eventually materialize. José Goldemberg estimates that within the larger Middle Eastern region only Algeria, Egypt, Iran, Israel, Saudi Arabia, Turkey and the UAE meet the prerequisites for a sustainable nuclear programme and could integrate large nuclear reactors into their power grid.[25] Other countries (like the smaller GCC countries) could still venture into the nuclear option by exploiting synergies and economies of scale. Nevertheless, if the Middle Eastern programmes are not regulated and somewhat coordinated, there is a serious risk of having a second or third Iran in the region soon, i.e. a country operating sensitive nuclear facilities within a tense and volatile region. Such a scenario would greatly increase the risk of miscalculations and ultimately of war in the Middle East.

Multilateral nuclear approaches (MNA) offer a way out of this impasse, as they diffuse the threats of dual-use technologies and furthermore offer economic incentives for cooperation. A number of MNA have been discussed in this paper, but none of them can be seen as the panacea for the many expectations countries in the region associate with their nuclear energy programmes (energy security, economic development, national prestige, dignified treatment and limited deterrence).

Still, some proposals seem to be more viable than others *in the short term* and will be reviewed in these concluding remarks. The Russian proposal of an LEU fuel reserve in Angarsk coupled with the option of buying into the IUEC could be attractive for Middle Eastern states for a variety of reasons. First, the IUEC is already up and running and secondly, the demands on the clients are not excessive: they only have to be in good standing with their non-proliferation commitments and have an (not further specified) 'effective' safeguards agreement in force.[26] Furthermore, the arrangement does not require participants to forgo the option of enrichment and reprocessing and does not collide with the principles of the NPT Art. IV. If backed up by the IAEA fuel bank, a recipient country would have three lines of defence in case of a fuel supply shortage: the world market with currently four large providers of enrichment services[27]; the IUEC in Angarsk as a second line of defence; and the IAEA fuel bank as a last resort. All of these three options are already viable today. There is a surplus of LEU available on the world market today, together with two established fuel banks (Angarsk and NTI), which were approved by the IAEA board of governors.

The IUEC / IAEA fuel banks do not foresee any technology transfer to recipient states and do therefore not solve the issue of domestic uranium enrichment ambitions that some countries in the region might still cherish. This ambition could still be explored in various multilateral settings, if a country is interested in advancing its technological prowess and at

[25] Goldemberg, J., 'Nuclear energy in developing countries', Daedalus, Fall 2009: 71:80.
[26] Cf. Goldschmidt 2010, p. 11.
[27] The European EURODIF and URENCO consortia, the Russian Rosatom and the American USEC.

the same time providing confidence in its peaceful intentions. As said, multilateral settings will function only if there is a minimum amount of trust between the parties involved: this will make some MNA more manageable than others, e.g. common projects within the GCC or the Arab League. Still, more challenging settings should be considered as well, as they bear the potential of contributing to a long-term conflict transformation within the region. Two final examples shall illustrate this idea: Geoffrey Forden and John Thomson[28] crafted a visionary cooperation scheme, where a Western enrichment provider would operate uranium centrifuges in the Islamic Republic of Iran in a way that would meet both Iranian LEU demands and international non-proliferation standards at the same time. Finally Thomas Lorenz and Joanna Kidd point to some first encouraging signs of technological cooperation, which can be seen around the Jordanian based SESAME particle accelerator.[29] The SESAME research centre brought together researchers from Bahrain, Egypt, Iran, Israel, Jordan and the Palestinian Authority, so far. Thus, some cooperation seems to be possible between states where otherwise deep distrust and suspicion prevail. For the sake of nuclear confidence-building in the Middle East it would be desirable that this cooperation would extend to joint training programmes, exchange of best practices in the realm of nuclear safety and security and explorative talks on joint fuel-cycle facilities. These steps should precede the formal establishment of a regional atomic agency (gradually) including all countries in the Middle East.

[28] Forden, G. and Thomson, J. 'Iran as a Pioneer Case for Multilateral Nuclear Arrangements', 2007, available at http://web.mit.edu/stgs/pdfs/IranCrisispdf/Forden-Thomson_Proposal_24_May_2007.pdf

[29] Lorenz, T. and Kidd, J. 'Israel and Multilateral Nuclear Approaches in the Middle East', *Arms Control Today*, Oct. 2010.