Royal Higher Institute for Defence

FOCUS PAPER 32
July 2015

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ISSN 2295-0915

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Executive Summary

Starting from the the hypothesis that nuclear disarmament would succeed in diminishing the total amount of nuclear weapons, it is worth trying to establish the consequence and the dynamics for both military and civilian applications. It is probable that the nuclear technology would be reduced to an embryonic state, comparable to what can be observed today in Iran.

What until recently was the Iranian nuclear puzzle is therefore the ideal case-study to identify the parameters influencing the dynamics driving the embryonic state towards either a full-fledged military program or a civilian and peaceful counterpart. The most probable scenario in that embryonic state would be a hedging posture for both civilian and military applications. That assumption allows for the examination of drivers for the hypothesis to materialise, what might be the consequences, who are the actors involved and which mechanism could be able to curb eventual worst case scenarios. For each one of the possible outcomes, recommendations are at hand that can benefit policy makers to avoid worst case scenarios

Keywords: hedging, scenarios, drivers, dual-use, Iran.

Contents

List of Acronyms

BTWC	Biological and Toxin Weapons Convention
EU	European Union
GDP	Gross Domestic Product
GW	Gigawatt
IAEA	International Atomic Energy Agency
IPCC	Intergovernmental Panel on Climate Change
kWh	kiloWatthour
US	United States
MENA	Middle East North Afrika
NPT	Non-Proliferation Treaty
NSG	Nuclear Suppliers Group
R&D	Research and Development
UAV	Unmanned Aerial Vehicles
UNSC	United Nations Security Council
UNSCR	United Nations Security Council Resolution
WMD	Weapons of Mass Destruction

Introduction

Many issues lend themselves to prospective analyses. Scenarios involving the future of the nuclear domain are no different: in this article we try to develop from the hypothesis that nuclear disarmament would succeed in diminishing the total amount of nuclear weapons. From that onset, we try to establish the consequence and the dynamics for both military and civilian applications. It is probable that the nuclear technology would be reduced to an embryonic state, comparable to what can be observed today in Iran. We therefore analyze the Iranian dilemma as a case-study and henceforth try to identify the parameters influencing the dynamics driving the embryonic state towards either a full-fledged military program or a civilian and peaceful counterpart. The most probable scenario in that embryonic state would be a hedging posture for both civilian and military applications. From that assumption we try to examine what kind of drivers might bring this hypothesis to materialise, what might be the consequences, who are the actors involved and which mechanism could be able to curb eventual worst case scenarios. For each one of the possible outcomes, we try to formulate recommendations that can benefit policy makers to avoid worst case scenarios.

While nuclear disarmament is enshrined in the non-proliferation treaty, it has been the pledge of president Obama on 5 April 2009 in Prague to commit the United States to nuclear disarmament and ultimately eliminate nuclear stockpiles. As president of the only country that ever fired a nuclear weapon, America bears the moral responsibility to take the first steps in that direction, according to what we might call the "Obama Doctrine" (Obama, National Security Strategy 2010). Outlining the increased risk of a nuclear attack, the strain on international peace and security is increased by the horizontal and/or vertical proliferation of nuclear weapons. The rationale behind this evaluation is the cumulative risk generated by excessive Cold War stockpiles, more nations having acquired nuclear weapons since the Cold War, continued testing, black markets trade in nuclear secrets and materials as well as the determination of terrorists to buy, build, or steal a nuclear weapon. As an answer to these challenges, the Obama Doctrine works on five axes in the nuclear issue: pursue a world without nuclear weapons, strengthen the non-proliferation treaty, denuclearise the Korean peninsula and prevent Iran from acquiring a nuclear weapon, secure nuclear weapons and nuclear material and support peaceful nuclear energy (Obama, National Security Strategy 2010, 23):
"We are reducing the role of nuclear weapons in our national security approach, extending a negative security assurance not to use or threaten to use nuclear weapons against those nonnuclear nations that are in compliance with the NPT [Non-Proliferation Treaty] and their nuclear non-proliferation obligations, and investing in the modernization of a safe, secure, and effective stockpile without the production of new nuclear weapons. We will pursue ratification of the Comprehensive Test Ban Treaty. And we will seek a new treaty that verifiably ends the production of fissile materials intended for use in nuclear weapons."

While the goal might turn out to be naive, the steps taken created momentum that was not shown since the advent of the Cold War. Confirming in Berlin the recession of immediate danger as compared to the Cold War era, Obama stressed the lasting concern of the existing burden and the initiatives to reduce the perceived threat from existing stockpiles and candidate proliferators (Obama, Remarks by Barack Obama at the Brandenburg Gate 2013):
"After a comprehensive review, I've determined that we can ensure the security of America and our allies, and maintain a strong and credible strategic deterrent, while reducing our deployed strategic nuclear weapons by up to one-third. And I intend to seek negotiated cuts

with Russia to move beyond Cold War nuclear postures. At the same time, we'll work with our NATO allies to seek bold reductions in US and Russian tactical weapons in Europe. And we can forge a new international framework for peaceful nuclear power, and reject the nuclear weaponisation that North Korea and Iran may be seeking… America will host a summit in 2016 to continue our efforts to secure nuclear materials around the world, and we will work to build support in the United States to ratify the Comprehensive Nuclear Test Ban Treaty, and call on all nations to begin negotiations on a treaty that ends the production of fissile materials for nuclear weapons. These are steps we can take to create a world of peace with justice."

Three years later, the ultimate goal, the intention, reads the same and the instruments are not different! The "negotiated cuts with Russia" were immediately discarded by the partners who linked the fate of the ballistic missile programme to the result of new negotiations encompassing nuclear weapons. The reduction momentum might be on hold for its military applications, it still exists for the civilian use in Western societies: the cause of this totally lies with the Fukushima disaster of 11 March 2011 which generated the perception of the inability to control the consequences of a nuclear disaster. Japan immediately put a moratorium on the use of nuclear energy and Germany has been phasing out its nuclear reactors (Breidthardt 2011), initiating a review of the risks linked to the use of nuclear energy in Western societies: many countries decided to phase out their existing technology (for example Sweden, Germany, Spain and Belgium) and others pledged not to build any: in the European Union the Fukushima disaster sparked the anti-nuclear movement (Fertl 2011) motivating countries like Austria, Greece, Ireland, Latvia, Lichtenstein, Luxembourg, Malta and Portugal to form an anti-nuclear alliance.

But what might be expected from this in the medium to long term? In what follows next, we consider the theoretical situation in which the downturn of military applications lasts and the phase-out of the use of nuclear energy is confirmed, neither of which are confirmed on a global scale today. Starting from a working hypothesis in which the most likely scenario lies in a hedging posture for both civilian and military applications, we will examine what kind of drivers might bring this hypothesis to materialise, what might be the consequences, who are the actors involved in the process and which mechanism could be able to curb eventual worst case scenarios.

Rationale: the probable retention of an embryonic nuclear capacity!

First, while the tenure of the Obama speeches might herald the advent of a new era, the intention of nuclear disarmament is not new: the disappearance of nuclear weapons is laid out in article VI of the Non-Proliferation Treaty (NPT) stating that "Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a Treaty on general and complete disarmament under strict and effective international control." (International Atomic Energy Agency 1970). Entering into force in 1970, it stresses the importance of the cessation of the arms race and the dismantlement of existing stockpiles of nuclear weapons under the supervision of the International Atomic Energy Agency (IAEA): successive bilateral agreements between Moscow and Washington (START I, START II, New START) applied to this principle and reduced the biggest stockpiles of the mightiest military forces. At best one could say that, while Obama did not invent the principle of disarmament, he created a new impetus drawing public attention on his discourse and included the topic in the foreign policy of the Unites States of America. While the intention to disarm might be there, it will not be accomplished soon: pragmatism teaches us that the reduction of nuclear arsenals of the US and Russia will take decades to complete (Smedts 2011). In the end the available fissile material could be used for peaceful purposes such as the production of energy. And what is even more troublesome is the consideration that if all arms are retrieved from operational status and dismantled, the knowledge and the capacity to build new ones will remain: it could allow for a disruptive breakthrough capacity in short time. The strain that will be put on the competent control organisms and the applied procedures to create confidence will be even greater than today. For that day to arrive, the partners of the treaty and the entire international community alike will have to trust the ability to enforce the compliance with the NPT which obviously, looking at the decades-long issue with Iran, is not the case today. The existence of dual-use material, for example the surplus of fissile material, will enforce measures for trade, control and prosecution of eventual offences beyond any suspicion. We will try later to identify tracks which may conciliate herewith.

Second, civil applications still require the nuclear option today: the need of energy provisions exceeds the supply, and nuclear energy is one of the factors that constitute the energy portfolio that stabilises the oil price. In the long run, if nuclear has to disappear, it has therefore to be replaced by some other energy source. But which one? The advantage of the existing capacity resides in its ability to satisfy the energy demand and at the same time to meet the objectives of reduced carbon emissions. In 2009, erasing the nuclear option would have increased the carbon dioxide emissions by 2 billion tons (The Economist 2011) while it is the aim to reduce those emissions by 44 billion tons. While the nuclear share might not seem that impressive, it is assumed that each amount will contribute to the further increase of global temperature. The pessimistic estimates of fossil fuel reserves have been revised by the shale gas manna as an alternative energy resource which would be able to reduce emissions more cheaply than renewables. The expansion of this form of energy however requires better grids, more exploitation experience and identification of the associated risks. So we might come to a first estimate of the future of nuclear energy in terms of capital investment versus the benefit of energy production combined with reduced carbon emission. It is assumed that a

country with a GDP of less than USD 50 billion (Goldemberg 2009) is unable to build, purchase and maintain the necessary infrastructure to operate the plant. The inherent residual risk of its exploitation as well as the expenses for investment will not induce an expansion of its growth in the next ten years regarding the cheap alternatives amongst which shale gas. However, regarding the legacy of the equipment as well as the know-how and the economic advantage for those countries that have invested in these, it is highly unlikely that this resource will disappear. We might further stress that the know-how once acquired, as it is the case in the military applications, will never disappear.

We might come to a first conclusion which establishes the nuclear option to remain present at the horizon 2030 and thereafter. On occasions it might exacerbate feelings when the spectacular consequences of a disaster appear in the media and the attention might in intervals be turned to the military and/or the civilian applications. Instead of a total disappearance, we might occasionally notice the intentions for the downscaling of civil nuclear applications at local level but the refurbishment of ancient stockpiles of nuclear weapons and the development of new ones continue, even in the United States. At the same time the planning for the development of new capacity in nuclear power continues, in the Middle East (Jordan, Egypt), Asia (China) and even in the European Union (France, the United Kingdom, Czech Republic, Finland).

At dual-use crossroads: the importance of controls for a better outcome

Having examined both options and described how the long-run hedging scenario looks like, two tracks are open for the development of the invoked scenario: the military or the civilian option, might turn out for better or for worse. First, the planned reduction and universal compliance with disarmament requirements is the best outcome for the military option. While reductions might not occur as smoothly as planned, this would not be the worst case: eventual zero-option might hold two dangerous outcomes. A first one that cannot be solved is the existence of the knowledge to build and use nuclear weapons and vectors. Whatever the amount of the reductions and the compliance, there will always be a risk of breakout, the control of it being the major task of any future control mechanism. The existence of this know-how might at all times materialise as such, constituting a disruptive alternative in possible scenarios influencing multilateral relations. Second, the safeguarding and control of huge amounts of nuclear material require safe and secure repositories which are not necessarily under military control and, regarding the long half-life of these materials, unstable or changing regimes might not be able or willing to guarantee the security of these stockpiles.

Second, looking at the options of the civil applications we might evenly identify a better and a worse outcome: the better option allows for the safe use of nuclear energy during the phase-out and, when completed the know-how would allow for the existence of an alternative form of energy production when needed in the far future, possibly in new, safer and proliferation resistant forms of nuclear energy (tritium cycle, fusion energy) based on the control of the inherent dual-use property of the feedstock. The worse scenario being the uncontrolled and uncontrollable accumulation and/or dispersion of fissile material linked to the simultaneous reductions of nuclear weapons and the accumulation of the nuclear waste.

Each one of the described outcomes leads to one common denominator being the fate of dual-use items and the importance of control mechanisms and organisms. In what follows we will describe dual-use items as materials and/or technologies that can be used for both civilian and military purposes. An additional difficulty is to detect and identify the illegal trade as an offence against existing law: this has proven difficult in the past, for example in the case of trade with Iran, and the increasing complexity and speed of international trade will not make this any easier in the future. Against this complexity no international standards are steering the penalties for transgression of anti-proliferation regulation: even the NPT does not point to that direction and United Nations Security Council Resolution 1540 points at countering non-state actors from obtaining “materials, equipment and technology covered by relevant multilateral treaties and arrangements, or included on national control lists which could be used for design, development, production or use of nuclear chemical and biological weapons and their means of delivery.” (United Nations Security Council 2004). To that purpose, the resolution stipulates that members states are obliged to “develop and maintain appropriate effective border controls and law enforcement efforts to detect, deter, prevent and combat, including through international cooperation when necessary, the illicit trafficking and brokering in such items in accordance with their national legal authorities and legislation and consistent with international law” (op.cit. 3.(c)) and “develop, review and maintain

appropriate effective national export and trans-shipment controls over such items, including appropriate laws and regulations to control export, transit, trans-shipment and re-export and controls on providing funds and services related to such export and trans-shipment such as financing, and transporting that would contribute to proliferation, as well as establishing end-user controls; and establishing and enforcing appropriate criminal or civil penalties for violations of such export control laws and regulations" (op.cit. 3.(d)).

States are obliged to refer to national legislation to comply with the directives of international law. As can be expected, "ad hoc" regulation is not uniform in the different member states and even relates to different legislative specialties: dual-use trade control could be subordinate to a variety of acts such as weapons control acts, economic acts and custom legislation. Henceforth the penalties vary accordingly between administrative and criminal alternatives: fines, revocation of licences, confiscation, loss of access to trade and imprisonment are some of the possible sentences (Bauer 2013). In the EU, a combination of EU regulations and national laws are the framework for dual-use trade control: while the regulation of trade is done on both tracks, the repression of transgression is the sole responsibility of the member states through their penal law. The concrete regulation of export, brokering and transit for example, in line with the requirements of UNSCR 1540, is obtained under EU Dual-Use Regulation 428/2009 which urges member states to take appropriate action in order to have effective, proportionate and dissuasive laws (Art. 24). However, as the interpretations are not uniform and the culture is different, it is not surprising that the national laws translating the EU regulation have no common ground and that the number of interpretations of the regulation equals the number of member states. At least the regulation allows for an EU-wide common definition of terms as 'transit' 'trans-shipment' and 'brokering', of which the interpretation is still subject to discussion on the international scene: the investigation of transgressions of trade in dual-use material is by definition a trans-national activity, often requiring long-term coordination before a transgression is satisfactorily documented in such a way that it can serve as proof in national courts. The regulation therefore allows for a common understanding of basic terms in the EU, still lacking worldwide. As far as the violation of embargoes of weapons of mass destruction (WMD) and their delivery vehicles or dual-use material is concerned, both the prosecution and penalties differ. Therefore basic questions have to be solved in order to have worldwide appropriate laws sanctioning transgression.

First, a common understanding of definitions with regard to dual-use trade has to be agreed upon, underscoring its international character and the multiplicity of the actors involved with the distinction of their respective involvement and responsibility in the organisation of the transgression. Second, the range of administrative and criminal penalties varying, a common approach should encompass a common direction in the application of penal law and the definition of the acts to which penalties will be applied requiring legislator's action worldwide. Third, the end-user certification should be controllable, allowing as a proof of intent and international legal recognition as such.

The embryonic nuclear status: Iran as an example

It might also be interesting to look at what a deceptive attitude may bring about in the future: what happens today when control mechanisms are evaded or rendered useless? No better example than the case of Iran illustrates this. As a signatory party of the non-proliferation treaty it pledged to engage in non-proliferation while the peaceful use of nuclear energy is guaranteed. Henceforth, it might be worthwhile to discover to what extent the intentions of Iran in the current framework have been identifiable and in compliance with the pledge not to contribute to proliferation in its broadest sense being the spread of nuclear weapons (beyond the restriction permanent members of the United Nations Security Council). For more than a decade, the international community is at grips with Iran, accusing the Islamic republic to pursue a covert military agenda in addition to its civilian applications of nuclear energy which is an inherent difficulty of dual-use material and their applications. Serious concerns remain mainly due to the covert activities, only acknowledged once disclosed. Until today there has been no technical proof in that direction and reported as such by the IAEA, but outstanding military issues remain to be clarified: amongst them activities related to the development of the nuclear payload for a missile and an explosive containment vessel, which site remains to be accessed (International Atomic Energy Agency 2013). Iran has to this respect not fulfilled the obligations needed "to establish international confidence in the exclusively peaceful nature of Iran's nuclear programme" (op.cit.). But the absence of legal proof until the deliberate confidence building openness of Iran is cause for concern: the deal between the EU 3+3 (Germany, France and the United Kingdom + the United States, Russia and China) and Iran of November 2013 (Joint Plan of Action) was first in a series of positive signs for future negotiations and confirmed by the joint statement of April 2015, but confidence building will be an everyday job for the years to come: The final deal struck on 14 July 2015 will have to deliver certainty on the absence of earlier mentioned breakout capacity without any doubt, as this is the necessary condition for absolute zero disarmament to succeed. In this specific case, the absence of technical proof was not even necessary as "obstruction of the activities of IAEA inspectors, interference with the operation of safeguards equipment, or prevention of the IAEA from carrying out its verification activities" is part of the definition of non-compliance with the same token as diversion or the failure to declare nuclear material (International Atomic Energy Agency 2002). Future will tell if lasting confidence can be reconstructed

Iran's nuclear programme has peaceful purposes… for its civilian activities! At the same time it can serve military applications, which is the essence of dual-use and the danger of nuclear activity. Besides the civilian aspects, a military option could therefore remain open to Iran. As from the beginning of the rhetoric about their programme, the peaceful character of the activities was underscored, but when challenged about undeclared activities, authorities had to acknowledge covert activity had been carried out.

The dubious outcome of the programme in the perception of the international community has led to more stringent sanctions as asset freeze and banking restrictions are preventing the government from accessing some of its remaining overseas reserves: according to Iranian officials, the inflation rate reached 45 percent in July 2013, while the Central Bank of Iran announced the 12-month inflation to hit 37.5 percent (Mehrnews 2013).

Restriction of payment has hampered commercial activity leading unemployment rate to record highs. As a result "the economy is set to contract for the first time in three decades" (Benari 2013). The ongoing deal will therefore alleviate economic sanctions if Iran continues on the path towards openness with regard to its nuclear programme: the enrichment levels are to be limited to peaceful application requirements and the total amount of centrifuges should not increase.

The covert character of many activities will have further increased the cost of the nuclear programme in the past and will have had influence on the presidential elections of 2013. The negative outcome of the cost-benefit analysis for nuclear energy production and the consequence of stringent sanctions may have contributed to the economic and political stance: the economic shift to alternative income has been stepped up as more refineries, petrol transit routes and bilateral commercial agreement have been concluded in the region. Furthermore, the technological advances of Iran have been remarked: the launch of a satellite, drone capture, increased cyber defences since the Stuxnet-attack and the design of indigenous missiles, tanks and fighter aircraft show that the country is making efforts to speed up R&D. Political change is also an option in addition to the aforementioned economic and technological agenda: the election of President Rohani seems to have initiated new relations with the international community. It is the only way out for a country that has been isolated for years; at the same time, it is the only way for the international community to find a solution to regain stability in Syria and Iraq: Iran, as Shi'ite power broker, has a leading role to play in the region which should not be downturned by other countries or in the international arena. Rohani might be the president of the most moderate and liberal representation, Iran's revolution has demonstrated that social and economic motivation can easily be emulated with cultural and religious background (Kepel 2000): the martyrdom of Imam Hussein under the Sunni caliphate can easily motivate the resistance against the Sunni adversaries or what is interpreted as the remains of the imperialistic caliphate. Therefore, whether Iran has come to change will depend on the concrete impact on daily life and expectancy of Rohani's electorate, the chance he will be given to generate social and economic reforms and at the same time break-out from international isolation. The alternative might be a new wave of violence in the Islamic revolution.

But what can be imparted to us from the international control mechanisms of nuclear activity? Not only the detection of activity seems to be limited in the Iranian example but even the compliance seems to be difficult to enforce. For the first problem we've mentioned that a legal framework allows for the early detection of activity, even if the technical acts are hampered: the obstruction in itself does constitute a breach of compliance. However, to come to this conclusion in one case impels consequent handling in others which seems to be problematic at times. Response to the IAEA's requests with regard to the 2012 Safeguards Implementation Report were not handled adequately since "twenty-two States [with an Additional Protocol in force] did not submit any additional protocol declarations during 2012, as required under their additional protocols; 16 of which have not yet submitted their initial declarations. An additional 24 States had not dispatched some of their additional protocol declarations that were due in 2012, and an additional 53 States dispatched some of their additional protocol declarations after the dates specified in the additional protocol" (Goldschmidt 2013). This is exactly the type of infringement for which Iran is criticised. Furthermore non-NPT states were granted the selection of sites submitted to controls: non-signatory parties of the NPT do not have to submit to IAEA inspections, however the perception does generate the sense of double standards application with regard to the Iran case, especially when sanctions are applied. The international community helped Iran in a sense on the path by allowing inconsistent attitudes favouring economic goals above a sound

unanimous political concern. As long as economy will prevail, Iran's past attitude not to comply voluntarily might feed the ground of distrust, jeopardising the engagement of the international community towards stability in the Middle East region.

Scenario drivers determining the better or worse outcome

The Iranian example draws attention to some key drivers in the nuclear dilemma, which, while specific to the Iranian case, might enlighten us on the driving forces of any decision process determining the fate of a nuclear program. Therefore, we will briefly broach the points of relevance to the example and from that point on extrapolate on what might be of interest to our scenario in more general terms. As mentioned, the eight years of Ahmadinejad's presidency culminated in the nuclear stand-off and were marked by a series of sanctions which resulted in the country's political and economic isolation. In a previous study we underscored the unsound economy of the Iranian nuclear programme (B. Smedts 2012) and, in addition to that, it was estimated to cost $100 billion in lost oil revenue and foreign investments while "oil exports plummeted by 40 percent in 2012 due to the sanctions, complicated the repatriation of petrodollars, valued at nearly $5 billion a month". At the same moment, inflation was estimated at more than 30 percent and Iran's rial had lost around 80 percent of its value since early 2012 in June 2013. The same source reveals that the price of a household's "basket of goods" had increased by 63 percent over a year, with the cost of some basic commodities having doubled (Saudi Gazette 2013). The consequences for the population were felt in the daily purchase, but evenly in the health care. Indeed, while the sanctions were cause for two foreseeable consequences as to create a bottleneck in the banking facilities necessary for trade and to lead to scarcity of hard currency, the population experienced the economic isolation even beyond humanitarian medical assistance. In the framework of a study on the repercussion of sanctions on medical care, it was shown that "…there is no mistaking that the scarcity of medicine and medical equipment in Iran started with the tightening up of sanctions. Nearly every one of our interviewees—including senior officers of American and European companies that supply pharmaceutical and medical products to the country—attested to this fact….yet Iranian patients did not lack in healthcare in the same way that they do today. Shortages began when the continuous tightening of sanctions eventually placed overwhelming obstacles in the way of humanitarian trade." (Namazi 2013)

Inductive reasoning brings us from the details of the Iranian case to the motives of a hedging scenario in general terms. The described hedging scenario occurs against the backdrop of a general framework of drivers having their influence on proliferation issues and at the same time in turn influence (enhance or damp) the influence of aforementioned drivers. Drivers considered will include: economy, technology, demography, environment and geopolitics. First and as the introductory example of this paragraph demonstrates, the economic drivers are crucial in our scenario: the cost-benefit balance will determine to what extent a nuclear civil and military programme will develop. Our current economic and financial constraints will take into consideration the huge amount of initial investment of new nuclear facilities, especially in Western Europe where most of the existing reactors are reaching the end of a life cycle: Germany has therefore banned the idea of building new reactors. But will this pay off in the long run? The Fukushima disaster was nothing else than an incentive to curb the nuclear future of Germany, but when emotion and scare ebb, the nuclear card in the available energy pallet might be a non-negligible ace in a reduced carbon emission policy. Economic motives therefore inevitably lead to the discussion of energy security: the increased demand for energy and raw materials on the one hand and the lack of

fossil fuel generated energy combined with the limitations of alternative energy resources and unknown consequences of shale gas exploitation on the other hand motivate the expansion of the reactor park in developing countries. As an illustration of the planned expansion, the Indian former chairman of the Atomic Energy Commission, Anil Kakodkar, stated that an increase of at least 625% in electricity production would be needed for India to maintain its economic growth, provision of which can only be delivered on a sustainable basis by a combination of both nuclear and solar energy (World Nuclear News 2013). The operational nuclear capacity of India reaches 4.4 gigawatt (GW) and the construction of new reactors will add another 4.9 GW by 2016. The expansion aims for a nuclear capacity of 20 GWe by 2020 and 60 GWe by 2032. The downsizing of the nuclear share in some Western countries might therefore not be representative of the global share in the future. The end of life of Western societies' park might therefore be a crucial moment for our economies to conciliate with the shortcomings in energy resources and infrastructure of the future which, if confirmed, will put a burden on economic activity in 2030. Liberalisation of the energy markets as well as the economic sovereignty of oil exporting countries will be limited by real life concerns as exemplified by the Iran case: the distribution of power for daily consumption of families on the one hand and on the other hand the availability of sufficient power for industrial production will have a major influence on social stability and economic return. By the same token, the expenses for "military nuclear" will enjoy less support from the population in times of crisis. The general push to less military nuclear may therefore continue provided the security of the nation is guaranteed.

Second, technology and know-how will be key to the development of new proliferation resistant nuclear technology especially in a hedging scenario. Not only in cases where local phase-out programs would be applied, like in Germany, but evenly in areas where new reactors are build, safety and security will be major arguments for the guardianship of states and the limit to total and unbridled liberalisation. The fusion of safety concerns with security aspects became daily reality after the Stuxnet contamination in Iran. From that day on it has become clear to everyone that the connected world could have its dark side. At the advent of the Internet of Things, it has been demonstrated that even nuclear technology could be targeted by enemies from inside or from abroad. A network security item has therefore led to safety concerns as it may induce harm to nuclear installations. Combined with the Fukushima catastrophe, the apocalyptic consequences of a successful cyber-attack on any nuclear site have caused the greatest fears among citizens and politicians alike. The historical skills of the pioneers in nuclear technology are therefore no panacea any more: while not negligible, especially in case of hedging when the countries with the most experience will have some kind of repository of nuclear knowledge, merging the old technology with new applications (like cyber) and its derived concerns (safety and security) will be crucial in future applications of nuclear technology. The discussion of the technologic drivers at the backdrop of a hedging scenario therefore extends beyond the concerns of the reinforcement of the sole technological aspects on the basis of proliferation resistance: the safety and security are now concerns that are no longer confined to the weaponisation of technology. The future of any nuclear technology might therefore lie in the applicability of a safer and proliferation resistant fuel cycle (e.g. thorium): in the liberalised market the economic competitiveness of nuclear electricity will remain key in the marketable energy portfolio. The IAEA estimated on the basis of 2002 data that some 441 nuclear power plants generated some 16% of global electricity. In the reference scenario, the annual average rate of growth of world nuclear capacity is expected to be in the range of 0.9% up to the year 2025 by which time the total installed nuclear power would be 438 gigawatt (International Atomic Energy Agency 2005). The sole economic argument will therefore not eliminate nuclear energy any time soon. For that reason the activity of the Nuclear Suppliers Group (NSG) will

not decline any sooner. This group of suppliers subscribes to article IV of the NPT allowing the peaceful use of nuclear energy while seeking to contribute to the non-proliferation of nuclear weapons beyond the existing nuclear weapon states. The support of the US, the UK and France to the adhesion of India reveals an inconsistent discourse of the international community vis-à-vis candidate proliferators: as non-signatory to the NPT, India obtained an exceptional status allowing for nuclear economic trade in 2008. While the country is not party to the NPT, it would be a dubious message to allow India to the NSG platform for economic reasons while it is stockpiling nuclear weapons. The transition to zero military applications of nuclear technology, if technically attainable, will be on the edge of a metastable equilibrium: each ground of distrust will be politically exploited and immediately translated into a moratorium on further reduction of stockpiles. While these stockpiles may feed the new proliferation-resistant technology to produce energy, economic motives as shown by the Indian example are often used to motivate political decisions, even when this can hamper the essence of the non-proliferation principles. Notwithstanding the fact that technology would be no drawback for dismantlement of stockpiles, it is hardly unlikely that its economy will be put aside. Civilian actors will be key players in the future of nuclear technology while for mentioned safety and security reasons, more and more actors will be part of the exploitation agenda. The sole existence of a remaining capacity or uneven decrease in stockpiles could be perceived as a game changer and will therefore influence the direction in which the equilibrium evolves. While economic and technical demonstrated the unlikeliness of a complete wipe-out of the technology any time soon, other drivers may be of directional influence between the civilian and the military option. In what follows we examine the possible options.

Third, while demography and social motives may at first sight not seem to have any importance in the nuclear dilemma, population growth and ageing have put an increased burden on economic policy. The financial and economic crisis has shifted to social issues and has made clear that one of the main challenges of the working class will be an extrapolation of the challenges in today's Nippon society: an ageing population with reduced active working class to rely on. Therefore, a first argument could be that the workload provided by the nuclear sector, especially for the countries with an expertise in the field, will be a welcome factor to provide work within the concerned country and abroad.

Extrapolations of the world population vary a lot on the longer term (2100). By 2025, the population of our planet is projected to reach between 7.7 and 8.3 billion. An increased population is expected to lead to an increased burden for food production, education, energy production and an increased risk for exacerbated differentiation in between population groups leading to physical separation lines (geography for example) or social ones (education for example). Expected variations relate to the degree of education on the one hand (lower birth rate is associated with higher education) and poverty on the other hand (reduced birth rate correlated to an increased investment for poverty reduction). Noteworthy is the expected decrease in the portion of the population that is younger than the age of 30 in Africa, Southeast Asia and South America, increasing even further the ageing expectancy on the longer term also in these parts of the world (United Nations 2010). Furthermore, an increased number of areas hold a population under the age of 30 years which is lower than 30% of the grand total, which indicates a decrease of the active population segment. This trend is expected to be more pronounced in Europe by 2025. A decrease in active population in Europe (like in Japan) cannot be correlated to the population density however, a factor that influences migration patterns. Until 2030, the same top five of most populated areas remains unchanged although a quantitative rearrangement may occur. In addition, a population shift is expected towards urban areas, creating a larger number of megacities. By 2050 some estimate that up to 80% of the world population will be living in an urban environment (Nezhad

2009). This increase, combined with the growing economic activity to sustain the population needs, will coincide with a greater demand for energy. Even if the expectancy of shale gas exploitation is proven successful in the future, and mitigate the danger of future shortages in fossil fuels, climate change mitigation will cause a shift in the use of fuel resources. Alternative forms of energy production do not satisfy a constant output, a problem which, if maintained, will generate huge changes in the near future. Therefore one available option for constant production of required energy remains the nuclear option. At the horizon of the scope of this paper, nuclear energy will continue to play a crucial role in the transition to stable alternative sources which can be exploited on demand. Demographic data tend towards an ever-increasing energetic demand in the future. In the available range of nuclear options, the existence of peaceful use allows in this instance for a shift from the military to the civil applications. Therefore, with the parameters under study, we might come to the partial conclusion that demography and its derivative seems to favour the increase of civil nuclear energy. With the available amount fissile material, it seems to be a more viable option to drain this vast amount into a useful option rather than stockpiling it. Demography and social motives have brought us to the conclusion that an increased energy demand is to be expected and the available pallet is not sufficient without considering the nuclear option worldwide.

Fourth, previous argument has to be augmented with the observation that closing down nuclear power plants is not viable in the long run for many countries. With the Fukushima catastrophe, nuclear power stations were shut down in Japan, starting a period of fossil fuel energy production. The emissions of greenhouse gas before and after the incident therefore give us an idea about the contribution of fossil fuel to emission levels in the country. Fiscal year 2010 ended with the disaster and the closure of reactors: during that period the CO_2 emission level was established at 350g/kWh. The next year, fossil fuel was imported for power generation and the emission level rose to 476 gCO_2/kWh in 2011 or a 36% increase. The same trend continued in 2012 as emission levels were measured at 487gCO_2/kWh (World Nuclear News 2013). Before the accident, this trend was exacerbated by the full substitution of electricity generation by fossil fuels and yet we know that increased average temperatures are correlated with the emission of greenhouse gases. Symptomatic indications for global warming are melting of the ice caps and glaciers, the expansion (sea level rise) and the acidification of the oceans. However quantifying the impact is not an easy task as the complexity of the phenomenon itself and the feedback loops as a result of policy change cannot all be accounted for. Policy agreements sought to limit global temperature rise to 2°C in comparison with the pre-industrial era but the capacity to limit the temperature increase to that level is already questioned today. That the global temperature increase is attributable to increased concentrations of greenhouse gases, amongst which CO_2, is characterised as purely anthropogenic (IPCC, 2011, p.7) but the numerized impact of emissions on temperature rise, announced for the fifth IPCC report (March 2014), is still lacking. Next to adaptation for the mitigation of consequences, the concentration increase should be limited by measures as reforestation, reduction of fossil fuel combustion, adaptation of industrial processes and agriculture management. The influx of fossil fuels in Europe today is extremely dependent on Russia, whether as primary producer or as transit country. The United Nations have indicated that climate change may directly and indirectly give rise to security issues (United Nations Secretary General 2009): “Both governmental views and relevant research… identify five channels through which climate change could affect security:

· Vulnerability: climate change threatens food security and human health, and increases human exposure to extreme events;

· Development: if climate change results in slowing down or reversing the development process, this will exacerbate vulnerability and could undermine the capacity of States to maintain stability;
· Coping and security: migration, competition over natural resources and other coping responses of households and communities faced with climate-related threats could increase the risk of domestic conflict as well as have international repercussions;
· Statelessness: there are implications for rights, security, and sovereignty of the loss of statehood because of the disappearance of territory;
· International conflict: there may be implications for international cooperation from climate change's impact on shared or undemarcated international resources."
To that respect nuclear energy indirectly serves the reduction of greenhouse gas emission, diversification of the available energy pallet by a non-fluctuating output and the aforementioned security concerns. As a repository of nuclear technology, Europe has therefore a lot to lose by rejecting this option that could also give a renewed impetus to more civil and less military applications.

Finally, geopolitical drivers and the outcome on the nuclear issue are linked to the existence of security issues in the nuclear equation. In the world scenario imagined for this foresight paper, many transversal and geographical issues intersect, all of which are interlinked to some extent. It is beyond the scope of this paper to review them all but some of them have a particular influence on the outcome of our subject. In the imagined world of 2030 the West is no longer the first player economically: while it is still leading the political agenda, it can mainly be catalogued as an historical relic. A lot of new actors in our hypothetical world have outdone the Western world and have taken over the Western way of life. But what is especially interesting for our subject is how the international organisations will be represented in this new reality. Are these new actors to be introduced to the inner circle of international decision makers or, more probably, will the existing inner circle defend its privileges and try to maintain the international decision-making agenda? One of the most important consequences to this issue will be the composition of the future UN Security Council on the one hand and on the other hand the efficiency of the verification regimes. That the UNSC composition would remain the same as today is unimaginable: the permanent members of the Council are the example of a relic of the Cold War. It has become evident that other countries have been eager to gain access to the same privileges as the P5: India for example, is striving to that status and its economic, political and military position all confirm a reality that reflects the relative supremacy over some ancient Cold War superpowers. The ancient powers might resist to the hand-over of the "ancient regime", economy will drive the agenda and for the time being this is in India's advantage. As a strong partner, the country will enjoy bilateral support and trade, even by P5 members, but we can expect the privileges to be the main motive for inertia towards the reflection of reality. The extension of this issue guides to the verification regime, for India is not a member of the NPT, yet it is a repository of nuclear weapons outside the regime like Pakistan and Israel. As such it is not subject to the line of force of the regime being the non-proliferation, disarmament and the peaceful use of nuclear energy. The actual NPT regime is unsustainable without these three fundamental and indivisible pillars. The Indian example puts a burden on the NPT regime as the country wants to pick the economic advantages of international trade on nuclear material and the indigenous use of nuclear energy without the need to comply with the non-proliferation and disarmament requisites. Granting this would be perceived as a double standards approach to other actors and would endanger the survival of the only most comprehensive control regime on the international scene. As exemplified by the UNSC and the Indian example, the future of international organisations will be put under strain as new actors will claim recognition with regard to true contributive value instead of legacy rights. In this instance compensatory

dynamics may arise as compared to the other discussed drivers: in the nuclear issue, geopolitical motives, notwithstanding the fact that they are fundamentally driven by economic forces, will, in a highlighted political context of international recognition, exceed this rationale and generate a movement that drives and motivates the military nuclear applications more than the civil applications.

Each of the aforementioned drivers impacts and motivates governments. Internally, the government makes the rules and enforces them and at very best invests in social policy, environmental policy, police, justice, defence and migration. The internal motives will evenly impact on the position of the state on the international scene, influencing the position towards other actors on that scene. Our nuclear example has demonstrated that all drivers under consideration have consequences on the dynamics of the nuclear issue stretched between the choice for civil and/or military applications. To what extent kinetics is influenced remains an undetermined factor driven by the perception of existential threat and political bargaining.

The great unknown: are religion and resources parameters of influence?

In what was discussed above, the drivers of the presented scenario and their consequence have been analysed. Parameters not accounted for have also to be taken into consideration however. It would be an ideal situation to be able to identify unknowns and to establish to what extent they contribute to a specific outcome in our scenario. But that would be in contradiction with the definition of an unknown event or parameters of influence. What might be done instead is to imagine influences from not previously discussed items: it would be impossible to determine the kinetics of the influence but it would be interesting to try to figure out to what extent these might influence the direction of the dynamics in our hedging equilibrium. Religion and resources might become such parameters.

First, religious motives can be used to exacerbate tension which was demonstrated in the Arab Spring revolution and in theory they could also upset our equilibrium but as said it is ultimately politics that determines the military nuclear stance. This does not erase the importance of religious radicalisation in the decision-making. When the Arab Spring revolutions stirred up, the demands of the demonstrators were very day to day necessities: enough jobs, affordable food, water, energy and education. None of them had religious motives but the religious movements have stepped forward and have been acting as if the demonstrators had granted them a wild card to act as in between, allowing them to motivate the demands with a religious backdrop. The religious movement did not satisfy the basic demands and were therefore the reason for a second revolutionary wave in Egypt with the same demands. It is therefore clear that the dissatisfaction with regard to religious parties has led to an uprising sometimes backed up by the military. But the time lag needed to experience the inadequate management of these parties as to satisfy the accessibility of the basic needs of the working class can be sufficient to increase tension with neighbours and could even generate armed conflict when it is observed that the internal policy is unsatisfactory and an external enemy would suffice to rally the people behind the country's banner. For the military stance, provided the country in question would be at the brink of a break-out capacity, religious extremism could tip over the balance or an extremist group might try to steal nuclear warheads from existing stockpiles in Pakistan for example. The intention and the capacity are established: the window of opportunity will decide whether we will witness some news report about the theft of warheads or nuclear material by terrorist groups. As shown by the Egyptian example, it would rather be the instrumentalization of religion for geo-political or ideological motives that would generate the impression of religious influence in the stance of nuclear issues.

Second, resources were touched upon when discussing the energy concerns, but will have even more pronounced interest for the Middle East region: the role of petroleum. Whether there is enough shale gas and if it is exploitable will not change the game for the region as oil reserves, its most important income, are limited. The consequences of this factor are a concern for the nuclear issue as well, since the main actors of countries with high oil revenues are also the ones who are willing to invest in nuclear energy from this day on: all players in the oil equation are diversifying their own energy pallet. Two reasons motivate their decision: own dependence, as explained earlier, has to be relieved by diversification under the form of an energy portfolio to guarantee energy availability. Second, lessening the

consumption of endogenous production increases the option of more income from export. Whether the role of oil in the region is set to increase or decrease, civil nuclear applications will have their own place, whether it is for the production of energy, nuclear isotopes for medical diagnostics or water desalination, the Middle East will not abjure the civil technology. In Egypt alone, a report of the Ministry of Energy planned for the construction of four new nuclear reactors. This only exemplifies the interest for nuclear energy in the region. Thirteen states in the MENA region planned the pursuit of nuclear energy (Russell 2013). While most of them do not pursue an indigenous nuclear fuel cycle and therefore limit the risk of proliferation, the intent of all is not as clear as it seems. Saudi Arabia officials referred repeatedly to the necessity for the kingdom to accede to nuclear weapons to counter a possible nuclear armed Iran and Israel (Cecire 2011). Third, the role of religion might not be that pragmatic: while it is indifferent to the civil part, the use of nuclear weapons is considered to be *Haram*[1] in Iran but that is far from being the case everywhere. Neither state, nor non-state actors foreswear the use of nuclear weapons: there might be a greater call for the prohibition of those weapons, it is regrettable however that those who are calling for the total ban of nuclear weapons are the decision-makers who had once the authority to restrain their use or the threat thereof. An increased role of religion might therefore stress the inhuman nature of these weapons, the role of politics will not be less compensatory as their use is still justifiable in case of existential threat, as a sort of legitimate defence before imminent annihilation. The interpretation of the imminent nature is the problem and remains political, whether from state or non-state actor origin. Religious motives can therefore be used to exacerbate tension; it is ultimately politics that determines the validity of the military nuclear stance.

Other resources than petroleum will also remain of crucial importance in the future and determine the geostrategic positioning of countries. Therefore existing centres of expertise are an important added value and the maintenance and support thereof constitutes an investment for the future. Beside the know-how, the raw material is evenly important and that is the reason why the East Congo basin will remain central to the attention for each actor wanting to play a role in the nuclear sector for the years to come. Private actors, local warlords and states will therefore continue to fight for their interests in that region. Considering the raw materials involved, uranium ore is the most obvious one. It might therefore seem evident to alleviate the pressure on the possession of this material by the use of nuclear weapon stocks. Uranium is far from being the sole material pursued for the discussed goal. Even more disturbing than uranium, tungsten and tantalum are at the centre of a local business which sparks tension in that region. Two alternatives exist to reduce the burden on that specific region namely the use of fissile material extracted from former weapon cores and alternative mining sites for rare metals as can be found in Australia, Thailand, Malaysia, and China, provided the lost trade is compensated for. It seems China will continue to play the important role it used to play in recent years: whether the economy will continue its unbridled growth or not, Chinese policy with regard to nuclear energy and weapons will influence the position of the rest of the world. Therefore it is not unimportant to know that the no-first-use stance of China was no longer retained in its defence white paper of April 2013 (The Information Office of the State Council 2013). The example China has set to the other members of the UNSC during half a century has therefore been overruled and beside its intention to facilitate the civil energy issue, it endorses a stance that reinvigorates the importance of nuclear weapons.

[1] Arabic for forbidden.

The danger zone of the fragile embryonic state

The forced reduction of nuclear applications by diminishing the number of deployed nuclear weapons on the one hand and the civil applications on the other hand might exacerbate economic and political/geostrategic tension in specific regions on the globe. While the total disappearance of nuclear weapons and not only their deployment might be a challenge, the maintenance of a stable balance in reduced numbers and in the management of know-how during the absence of military capacity might be a much greater one. At all times exacerbated tension in the hedging phase holds the risk of a new proliferation wave. The conditions for this to happen are attributable to the same actors as the ones driving towards the hedging scenario: for military applications, the position of states and the effectiveness of the international organisations and their ability to enforce non-proliferation measures will be critical to avoid the worst outcome. For the civil applications, both economic and climate change adaptation issues will drive the survival of the technology: efficiency of exploitation of alternative energy sources, the compared return on investment and the effect on emission of greenhouse gases will determine to what extent and in which region the technology will be exploited in the future. Safety and security concerns will remain in both cases but in the end it will be money and politics that will set the nuclear future. Inevitably, other factors will facilitate the direction of the dynamics. Drivers cover a vast array of possibilities: examples such as the crash of a BRIC member, religious extremism, continuous strive for violent pan-Islamic jihad might end up in a new wave of proliferation especially when instability concerns a country that holds a legacy of nuclear weapons.

Whatever the driver, consequences will be instantly sensed in the Persian Gulf region and the Middle East. A new proliferation wave, for example the break-out of Iran to the nuclear threshold or the concession of a minimal nuclear capacity to that country by the international community, will exacerbate tensions in the region with Egypt, Turkey, Saudi Arabia and Israël. As a defensive stance, these states would require the accession to the same capacity than their neighbour in order to reset the balance. The reaction in the Middle East could at that point be expected from Israel that would experience a proliferation wave in its immediate vicinity as an existential threat. These consequences would inevitably lead to the end of the main pillars of NPT and political stability, necessary condition for economic trade with the region. It is therefore interesting to analyse which factor would hold the potential to rein in such a destructive dynamic. The hypothesis of a new country with a recognised nuclear capacity would require the assurance of its neighbours that guarantee that both their safety and security are guaranteed. In our example, a proven military retaliatory capacity (conventional and non-conventional) would be required to meet that objective: an extended protective umbrella of the United States could match that objective but this would require the US not to be reduced in weaponry to such a point that it would not be in a position to export their protection anymore. At this point we come to a circular reasoning whereby the actual dynamics for nuclear disarmament would require the greatest stockpiles to disappear while at the same time the guarantee for reigning in a renewed nuclear arms race would require the existence of a minimum nuclear weapon capacity to match an emerging nuclear threat while alternative protective architecture develops. The denial of proliferation is also essential for the control of non-state actors: the emergence of a new nuclear threat increases the risk for uncontrolled material and the possibility for non-state actors to acquire those weapons. At

present it is only via state acquisition that non-state actors could get access to these weapons, reason why the denial of a new proliferation wave is an efficient way to prevent that risk.

Alternative end-state: the worst outcome

A new wave of proliferation is not just an alternative to the hedging scenario, but a permanent menace the perception of which will be driven by the efficiency of verification possibilities of dual-use material and demilitarisation. This perception will for a great part be politically driven. An example of the tension this could generate was experienced with the Iran negotiations and evenly with the discussions regarding the overdue conference on the establishment of a zone free of nuclear weapons and all other weapons of mass destruction in the Middle East. The concluding document for the 2010 NPT Review Conference planned this meeting for 2012 but the political agenda did not match its goal. Today the distrust between the actors in the region is too high to make a diplomatic exercise of that level acceptable. Yet this is exactly the state of mind that will be required all along to avoid hedging rolling over in the unwanted alternative end-state materialising in a new proliferation wave. The elements for verification are accomplished by the IAEA, but until now the world has experienced the limitations of its verification ability during the past negotiations with Iran: it has been demonstrated that this extends beyond the sole nuclear issue. For compliance or non-compliance with the NPT to be technically established the NPT should be the norm accepted by all, which is not the case yet. Even in the Middle East region, not all parties have ratified the Treaty, hence carrying out verification is technically impossible. Suppose such a norm is agreed upon by all parties or that all parties adhere to the most well-known norm (the NPT), not only in the Middle East but all over the world. The conditions for verification, understand the rules by which a party will recognise another party to be compliant with the norm, will be a political decision. Therefore it is hardly unlikely that geopolitical motives will not interfere with the rules for verification. All instruments from it (declarations, monitoring, inspections) and the eventual determination of compliance or non-compliance will be politically laden. Beside the fact that the establishment of the norm is a political exercise, the execution mechanisms can be considered more as a political act than a technical one and as such they might be perceived as an intrusion in a sovereign state. It is therefore of utmost importance that impartiality and consistent execution is required would one expect a party to partially “give up” its sovereignty. It is probably one of the main causes for the failure of the post-2010 NPT review conference discussions and the absence of a final statement of the 2015 NPT review conference. However, the use of universal standards for compliance of parties has to be based on the same norm/treaty: there is no workable basis with a tailored agreement favouring a party for commercial reasons for example. Here again, the importance of civil applications, at the backdrop of negotiations on the outcome of military applications, have their role to play. The agreement set with India, a non NPT state, might be better than no control at all, it does not create the conditions for the perception of impartiality and consistency. The biggest difficulty will not even be to settle the norms, make them acceptable for all and additionally to verify declared material and plans. It will be much more difficult to prove with acceptable limits of confidence that undeclared material is absent. In essence, an absolute proof that concerned parties are not cheating can never be given, but the whole exercise will be a matter of trust. This is only achievable in an atmosphere of confidence constructed over the years. Therefore, the absence of trust and confidence will be a sufficient reason for hedging to fall over into horizontal and vertical proliferation, the worse of the possible end-states.

As the failure to gather a conference on the creation of a Middle East WMD free zone shows, this region will once again be decisive for the outcome of non-proliferation globally

hence for bringing the needed stability to avoid for nuclear disarmament tipping over in renewed proliferation: whether it comes from Israel or Iran today, the ambiguity of nuclear programmes is creating the environment prone to reinvigorate military nuclear proliferation. Mentioning these two countries does not limit the expansion of possibilities in the future: the intentions of regional actors make it clear that the present uncertainties turn nuclear disarmament into an illusion. The organisation of a conference on the establishment of a zone free of nuclear weapons and all other weapons of mass destruction in the Middle East will therefore create the necessary support as to build confidence amongst participants in and outside the region: whether or not all actors of the region are taking part in the begin phase is not important. The aim is to generate a platform to exchange visions on the execution of nuclear disarmament and all related issues. It is for example to be expected that nuclear weapons will not be the hardest issue to handle but the other weapons of mass destruction on the one side and the delivery vehicles on the other side. It is established that actors of the region possess chemical and biological weapons. If the chemical weapons control is an experienced mechanism, there is not such a thing as a verification regime for biological weapons. There is even no practical standard to establish what constitutes an offensive biological weapon outlawed by the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (BTWC) on the one hand and on the other hand an agent for which the production is justified for prophylactic, protective or other peaceful purposes. As far as the means of delivery are concerned, it has been shown for years that the bipartite negotiations between the US and Russia have been difficult at times under the START umbrella. To what extent will vectors, whether they are deployed or not, create tension in the negotiations between multiple partners in the region, each one having defence industry interests to defend or third parties interfering to safeguard the defense industry market share? The example of the delivery vehicles is of prime importance for all actors: from the perspective of the countries, one has to create the confidence that another party cannot use its delivery vehicles for unconventional load, but in essence most delivery vehicles hold a dual-use potential. From the perspective of defense industry, the Middle East market is important for sales but equally for R&D since new weapon systems can be used and tested in real conditions. New vectors like Unmanned Aerial Vehicles (UAV) will therefore have to be considered for inclusion in the debates about the future zone free of WMD and their delivery vehicles. As our discussion demonstrates and whether the subject is the weapon or the vector, it is the dual use of the technology that creates tension between the civil applications and their military derivatives: the civil part has proven advantages in each of the domains covering nuclear, chemical, biological and vector technology and the sole possibility of a military deviation is not a sufficient reason to discard all the advantages the technology provides especially in this region. It is therefore the perception of confidence that has to lead the way for the outcome of the possibility of this conference in a region which is a key to stability on the subject of nuclear disarmament in the future.

Finally, an additional aspect of perception becomes important: perhaps even more sensitive than building confidence over time is the perception of infringement of sovereignty. Each control mechanism will hold to a certain degree the sense of losing full control of the sequence of events. Today sovereignty is limited by the responsibility of each party for the effects that might be generated inside and outside national boundaries. The unknown in this issue is how this limited “freedom to act” is perceived locally and whether it is compatible with the objectives set by a conference on disarmament. The importance of such a perception might be compared to the dissatisfaction of Americans and non-Americans alike after the Snowden leaks: the understanding that preservation of physical safety against terrorism holds the consequence of increased surveillance is unacceptable for many. Yet it is a reality that

will have to be overcome. The same kind of transition to acceptance of reduced sovereignty might be a key for the success of nuclear disarmament as a first step to limit other WMD as well as their means of delivery. To initiate the aim of banning all kind of WMD and delivery vectors might therefore undermine the onset of the Middle East conference from the start: it could be more valuable to try to solve the problems separately in the region. Given an agreement is reached on nuclear weapons and the ambiguity of regional players is lifted, the tangle of all connecting matters could be sorted out in a later stage. The inclusion of all types of WMD, such as biological weapons for which even outside the Middle East region there is no agreement on the extent of its definition and any control regime, equals the certainty of a failed conference or at least the start of a discussion that will never turn into tangible results.

Conclusion: hedging remains the most probable scenario

A pragmatic approach learns that the conditions for an unconditional reduction of the nuclear weapons stockpile are not met: dismantling existent stockpiles will take decennia and both input and output of the process will have to be secured. One way to handle the output is to use it as a fuel for nuclear energy. First, it would never produce more weaponizable nuclear waste than in its original form, being after down-blending or even after combustion. Second, it constitutes return where the stock and securing premises would only cost. Third, the return under the form of carbon-free energy is an added value that is not negligible in climate change conditions requiring reduced greenhouse gas emissions in order to rein in the mean global temperature rise. Geostrategic conditions for the disappearance of nuclear weapons are not met either: last decennia have seen the number of possessors of nuclear weapons increase and tensions about dubious outcomes of programmes or countries not yet signatory parties of the NPT rise on a regional level. The accession to a minimum nuclear break-out capability of Iran could trigger a new arms race in neighbouring countries. The preliminary condition for countries perceiving an existential threat to give up nuclear retaliatory measures resides in guarantees of protection like the American nuclear umbrella. But a reduction by the US of their number of deployed nuclear weapons would impair the effectiveness of that umbrella. A valuable "replacement"-should be operational and extendable to the regions that profit that protection today, whether that be a missile defence shield or some other technology yet to be developed or fielded in order to guarantee the disappearance of nuclear weapons. But the know-how cannot be erased, hence hedging (for better and worse) will be the most likely scenario if nuclear weapons were to disappear: possessing the ability to produce a nuclear weapon in short time can be a disruptive game changer. The challenge for the international community in such a scenario will be to enforce a credible control regime on dual-use material and technology. It is a challenge to have a reliable mechanism that allows for the early detection of undeclared activities: the experience shows that on many occasions the international community, mandating the IAEA, has been unable to confirm the absence of undeclared activities in Iran, the vital second tier of verification. Suppose such a mechanism does exist or is created, it has to be enforced but above all it has to be perceived as credible and satisfactory to all actors involved: the perception of an insufficient control or enforcement ability will generate a new proliferation wave. The danger for the metastable balance between hedging and novel proliferation to tip over in the worst case scenario will be permanent and difficult to temper. The international organisation must ensure the credibility of the system failure which will generate a new proliferation wave. All elements of decision are not known and in the future the uncertainty of the influence of religion in the equation will play to the extent that it might exacerbate existing tension and tip over aforementioned equilibrium. Once again the Middle East is a region where all the tensions are concentrated: not only is the ambiguity of nuclear programmes creating an atmosphere capable of reinvigorating military nuclear proliferation but in addition it hampers the establishment of a conference on the establishment of a zone free of nuclear weapons and all other weapons of mass destruction in the Middle East. Participation of the actors of influence will be a key for the success of the outcome: the parties driving at brinks in the region far beyond the sole nuclear issue are Israel, Iran and Saudi Arabia. It has for instance often been argued that Russia holds the key to resolving the crisis in Syria. It is much more probable that this crisis and many other issues in the Middle

East cannot be resolved without the Cold War-like rivalry between the aforementioned whether it be in transversal issues like proliferation discussed in this paper or local ones (Iraq, Syria, Yemen, ISIL,…). The problem of the conference on the establishment of a WMD-free zone extends therefore far beyond proliferation issues and it will not be made any easier by including all types of weapons of mass destruction as well as their delivery vehicles: it creates an insurmountable tangle before essential problems as the control of dual-use material and technology will be accounted for. The aim of such a conference should be to build on confidence to such a stance as to reaching the point where the control regime is not perceived as the infringement of sovereignty. These conclusions bring us to possible recommendations that may lead to the most favourable (or the least bad) outcome.

The return of Iran on the Middle East and world economic markets will change the game. The economic exploitation of oil and gas might therefore be an indirect factor of influence in nuclear proliferation negotiations. The Indo-US nuclear deal, signed in 2010 (followed by France two days later) is yet another example of the importance of economic issues above a consistent anti-proliferation stance: to avoid the hedging scenario to morph into reinvigorated proliferation, it will be of prime importance to take the step of decoupling economic advantage from non-proliferation stances. If not, the perception of double standards will hamper confidence getting to the point where military denuclearisation is brought to fruition.

Second, it was shown that military denuclearisation will be linked with the availability of missile defence systems integrated into a protective umbrella. Supposing nuclear weapons disappear in the long run, the know-how will remain and hedging (with the option of nuclear revival) will therefore be the most likely scenario. To build credible control regime on dual-use material and technology and at the same time enforce it will be essential to avoid the worst case outcome. Verification, that is the control of non-deviation of declared materials and actions as well as the absence of undeclared materials and actions will have to allow for the stability of the metastable balance between hedging and new proliferation.

Third, the premises to initiate a conference on the establishment of a zone free of nuclear weapons and all other weapons of mass destruction in the Middle East are to be rethought. While there is not such a thing as a comprehensive solution for all issues in the Middle East at once, the progress has to be made in steps, without which the intent is predestined for failure. The conference has therefore to tackle nuclear weapons as a separate issue since other WMD issues (biological weapons) are not agreed upon outside the Middle East area. In addition the issue of the delivery vectors has to include new types of vectors not accounted for in the past such as unmanned aerial vehicles.

Fourth, it will be of prime importance for the future of the Middle East WMD free zone to convene at least all regional actors to the negotiating table. That is Israel, Iran and Saudi Arabia. The international community will be represented as well, but the bottom line for the achievement of tangible results will lie with the participation and involvement of the aforementioned. The non-existence of a final statement to the 2015 NPT review conference proves the hurdles in the Middle East region too high to realize nuclear disarmament any time soon.

Belgium can not change the game on its own in this context: it is only multilateral engagement than can obtain result as latest negotiations have shown. Therefore, the EU and its Member States surf on the observation that the nuclear option will remain present at the horizon 2030 and thereafter. On occasions it might exacerbate feelings when attention is turned to the military and/or the civilian applications: the downscaling of civil nuclear

applications in some areas will be compensated for by development of new capacity in the Middle East (Jordan, Egypt), Asia (China) and even in the European Union (France, the United Kingdom, Czech Republic, Finland). For the military applications, the refurbishment of ancient stockpiles of nuclear weapons and the development of new ones will continue during the same time-frame, even in the United States. So what can be done by the EU and its member states to favour the best outcome in both the civil and military scenarios? Remember that the best outcome for civil use allows for the safe use of nuclear energy based on the control of dual-use feedstock; the worst outcome being the uncontrolled accumulation and dispersion of fissile material due to unbridled and uncontrolled horizontal proliferation. The best outcome of the military scenario is the planned reduction and universal compliance with disarmament requirements; the worst outcome being a new break-out capability, hence horizontal proliferation, or a new arms race (vertical proliferation). The common ground in these issues is the instrumentation of the international community in general and the EU in particular: a combination of EU regulations and national laws are the framework for dual-use trade control. While the regulation of trade is done on both supranational and national level, the repression of transgression is the sole responsibility of the member states through their penal law. The concrete regulation of export, brokering and transit for example, in line with the requirements of UNSCR 1540, is obtained under EU Dual-Use Regulation 428/2009 which urges member states to take appropriate action in order to have effective, proportionate and dissuasive laws (Art. 24). National laws translating the EU regulation have no common ground and should have a common interpretation but more than that: a uniform prosecution and penalties for the transgression of dual-use regulation and violation of embargos for WMD material should be standardised among the Member States. This implies indirectly a reform of the legal system to strive for a common legal framework. Next, the problem with the path to worst outcomes seems to be the early detection of illegal activity and enforcement of compliance: therefore all states should adhere to the additional protocol requirements and submit their declarations to the IAEA in a timely manner but above that the main challenge will be to enforce a credible control regime on dual-use material and technology: the experience has shown that on many occasions the international community, mandating the IAEA, has been unable to confirm the absence of undeclared activities in Iran, the vital second tier of verification: until now only confidence building would allow inspections to be that intrusive in the future as to confirm the absence of undeclared material at very low numbers. It will take years of dedication of all member states to be willing to submit to such a stringent regime. The specific role of Belgium as an important entry-port to Europe will be to field as much inter-agency cooperation as to make dual–use control and interdiction measures effective in the port of Antwerp and at airfields.

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