Civil Nuclear Safety in the Middle East: An Analysis

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Abstract

This paper aims to analyze civil nuclear safety in the Middle East. The first section describes IAEA safeguards arrangements, which seek to contain proliferation and protect the unsafeguarded nuclear material and technology. Three sorts of safeguards arrangements with Additional Protocol are discussed to acquire an understanding of nuclear safety in the Middle East. Second section deals with the presence and possibility of civil nuclear programs in the Middle East. In the last section, an effort has been made to highlight how Pakistan can help set some precedents for any future Middle Eastern nuclear safety regime and how Pakistan's application at NSG can facilitate this process.

Keywords: Nuclear energy, Middle East, IAEA Safeguards, Civil nuclear safety, Pakistan

Introduction

Nuclear power has become indispensable due to the growing need of energy around the world. There are 440 nuclear power plants operating in 31 countries. They produce 390,000 MW of electricity that constitutes around eleven per cent of global electricity generation.[1] Nuclear energy is reliable and environment friendly, without carbon dioxide emissions.

Despite large deposits of fossil resources in the Middle East, there exists a developing need to have energy mix in the wake of environmental issues of global warming, green house gas effects and above all, fast depletion of fossil fuels. This requires the Middle Eastern countries to adopt strategies for renewable energy sources. The nuclear energy provides a viable option as a renewable energy source, however there are associated risks involved with dual use of nuclear technology, especially in regard to nuclear fuel cycle and reprocessing issues.

The fear of possible nuclear proliferation led the global community of nations to develop non-proliferation regime in 1960s and 1970s. The Nuclear Non-proliferation Treaty (NPT) serves as a cornerstone of the regime. To compliment the NPT, a verification mechanism was assigned to the International Atomic Energy Agency (IAEA). The role of IAEA and its safeguards is significant to ensure non-

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proliferation and encourage civilian applications of atomic technology. The IAEA safeguard arrangements provide a broader understanding of nuclear safety regime.

IAEA Statute and Safeguards:

The IAEA provides an institutional framework for nuclear safety. It was established on July 29, 1957 to achieve a dual purpose, as pointed out in Article II of the IAEA statute. First purpose is to promote the peaceful applications of nuclear energy. Second purpose is to ensure that countries may not covertly divert nuclear technology for military purposes.[2] IAEA safeguards are primarily based upon IAEA statute, which has been amended three times so far. The agency is mandated with the task of ensuring nuclear safety. The IAEA established safeguards system under Article III. A. 5 of the Statute to serve its two objectives. This article permits IAEA to administer and supervise "nuclear material, services, equipment, facilities, and information provided by IAEA" so that it could not be used for military purpose.[3] The article "also authorizes the IAEA to apply safeguards to any bilateral or multilateral arrangement, at the request of the parties, and to any of the nuclear activities of a State, at that State's request."[4]

The NPT entered into force in 1970 to curtail proliferation of nuclear weapons, encouraging peaceful applications of nuclear technology and seeking disarmament. To date, there are 191 members of the NPT, making it the near universal treaty of the world.[5] The Article III of the NPT requires non-nuclear weapon states to accept IAEA safeguards.[6] The IAEA finalizes agreements with states and regional inspectorates for adherence to safeguards. There are three types of safeguards agreements[7]:

1. Voluntary offer safeguards agreements (VOAs) between the nuclear weapon states (NWS) within NPT.[8] They include agreements between P-5 nuclear weapon states and IAEA.
2. Comprehensive safeguards agreements (INFCIR/153) for the NPT non-nuclear weapon states (NNWS).[9]
3. Item specific safeguards (INFCIRC/66/Rev.2) for non-NPT states.[10]

The IAEA additional protocol was adopted in 1997 (INFCIRC/540), which also complements the existing three types of agreements. The Additional Protocol includes "information about, and access to, all parts of a State's nuclear fuel cycle, from the mines to the nuclear waste."[11]

The IAEA safeguards are in place in 181 states around the world as of 2015. A total of 173 states accept comprehensive safeguards. There are

five states (P-5 Nuclear Weapon States) with voluntary offer agreements and three (India, Israel and Pakistan) have item specific safeguards.[12]
It is pertinent to analyze these three types of agreements in order to understand safeguard agreements of the Middle Eastern states.

Comprehensive Safeguards Agreement (CSA)

The Non-Nuclear Weapon States (NNWS) within NPT are required to have agreement of comprehensive safeguards with the IAEA under its document, INFCIRC/153. The basic assumption of the comprehensive safeguards is that a state party accepts IAEA safeguards on all nuclear material on its territory or under its control anywhere for the purpose of verification. There are two parts of agreement. First part deals with general provisions and the second part deals with technical formalities of safeguards agreement. The agreement is comprehensive as it encompasses national system of accounting for and custody of nuclear materials. It holds that "the agency make full use of the State's system of accounting for and control of all nuclear material subject to safeguards under the Agreement."[13] The agency will be provided with information regarding nuclear material. State parties will make arrangements that agency inspectors can perform their duties.

Small Quantities Protocols (SQP)

To lessen the burden of CSA, Small Quantities Safeguards were introduced by the IAEA in 1970s for those states where nuclear activities are absent or very limited.[14] There are over 100 countries with very limited nuclear materials thus they have concluded other protocols instead of CSA, known as Small Quantities Safeguards.[15]

1. Item-specific Safeguards Agreements

Item Specific Safeguards as specified from its name include only those nuclear material, non-nuclear material, facilities and other items, which are mentioned in the safeguards agreements between the IAEA and non-NPT states. INFCIR/66/Rev.2 provides a procedural framework for the agreement. Under the agreement, states commit not to manufacture any nuclear weapon or for any military purpose, by using nuclear material, facilities or other items subject to the agreement.[16] Three states outside the NPT have these arrangements including India, Pakistan and Israel.

2. Voluntary Offer Agreements

The P-5 NWS under the NPT have arrangements with the IAEA under Voluntary Offer Agreements (VOAs) to include selected or entire peaceful nuclear activities. The states notify facilities to the IAEA and offer for the implementation of safeguards. The VOAs with the NPT declared NWS are Russia, China, France, UK and the U.S.[17] As the NPT distinguishes between nuclear haves and nuclear have-nots, similarly the

IAEA also contains different safeguards arrangements for NWS and NNWS.

Additional Protocol of IAEA Safeguards

The Additional Protocol is a stringent and robust safeguard measure adopted by the IAEA in 1997. They are in addition to the above-mentioned three safeguard arrangements. Though the Additional Protocol is separate from the above three safeguard systems yet it compliments them in ensuring nuclear safety. The states with CSA must sign the Additional Protocol based on INFCIR/540 however, "states with item-specific or voluntary offer agreements may accept and implement those measures of the Model Additional Protocol that they choose".[18] The agreement provides for extended inspection and monitoring of the state's nuclear facilities. The country would be required to permit IAEA inspectors to access nuclear site with 24 hours notice along with multiple entry visas (at least for one year). It also allows for monitoring through satellite systems and various forms of telecommunication.[19] Pakistan has not concluded additional protocol with the IAEA.

Peaceful Nuclear Programs in the Middle East

The demand for renewable energy sources keeps growing with each passing day. Nuclear energy provides for safe and environment friendly energy source. According to World Nuclear Association, over 45 states are contemplating the commencement of a nuclear power program.[20]

There have been 31 countries so far which operate around 450 nuclear reactors around the world. However, there are only 27 operational reactors in South Asia and the Middle East.[21] The percentage of nuclear reactor operation is far less in the two regions (the Middle East and South Asia) vis-à-vis developed countries. Besides nuclear reactors, there are 245 research reactors operating in 55 countries. Moreover, 140 ships and submarines are also powered by 180 nuclear reactors around the world.[22]

All Middle Eastern states except Israel are signatories of the NPT and are legally entitled to provision of peaceful nuclear energy under Article IV of the treaty. Despite legal rights enshrined in the NPT, there is less focus in the Middle East on nuclear energy, mainly because of the existence of fossil fuel in many countries in large quantities. However, there is emerging realization of nuclear power in the Middle East as well. There is progress in nuclear weapons programs among the Middle Eastern countries.

- UAE: 4 nuclear power reactors are under construction.

- Jordan: Committed plans. Developing regulatory and legal infrastructure.
- Saudi Arabia: Well-developed plans but commitment pending.
- Qatar: Discussion as serious policy option.
- Kuwait: Officially not a policy option at present.[23]
- Iran: A large nuclear power reactor is operating and two more are planned.[24]

Except Israel, all Middle Eastern countries are members of the NPT with a status of non nuclear weapon state. This entails them to adhere to the comprehensive safeguards of IAEA. The progress and prospects for nuclear energy in the Middle East is analyzed in the following section.

Gulf States

Gulf States mainly comprise of six countries of Gulf Cooperation Council including Kuwait, Bahrain, UAE, Saudi Arabia, Qatar and Oman. They have been cooperating in politico-economic fields. In December 2006, the six-member council announced to commission a study about the peaceful uses of nuclear energy. Two states came forward to offer help. France expressed agreement to cooperate with them and Iran promised help with atomic technology. By February 2007, GCC states decided to cooperate with IAEA on a suitability report for a region-wide atomic energy and desalination program.[25] The progress among the GCC countries in pursuit of nuclear energy is not uniform.

UAE; Fast track Nuclear Energy Set up:

The only country to adopt nuclear technology for peaceful purposes on fast track in the Middle East is United Arab Emirates (UAE). There are four nuclear reactors under construction in UAE with a proposed capacity to generate 5380 MW.[26] This country relies mainly on gas (some of which is imported) for electricity generation. Its energy demands are increasing by nine per cent per year. As a hub of commercial and socio-economic connectivity, the UAE direly needs increase in energy production.

A report published by UAE in 2008 said that the country would have required over 40 GW in 2010 whereas natural gas was sufficient to fulfill just half of the expected energy demands. Nuclear energy was sought as a promising option. There were 14 nuclear power reactors being planned. There are four reactors under construction at Barakah and would be operational by 2020. Accordingly the UAE established "Emirates Nuclear Energy Corporation", which is a public holding with a hundred million US dollars funding to assess and apply the plan. The Federal Law on the Peaceful Uses of Nuclear Energy was promulgated in 2009. The Federal Authority on Nuclear Regulation (FANR) was established. The ENEC agreed to the bid of Korea Electric Power Co.

(KEPCO) -led Consortium to construct, commission and fuel load four APR-1400 reactors in December 2009 with a cost of 20 billion US dollars. The first plant is almost 85 per cent complete and is expected to operate in 2017. The site for the plants is "Barakah" on the coast fifty-three kilometer in the western area of Ruwais. It is nearer Qatar in distance as compared to Abu Dhabi city. Dubai, despite being among the seven emirates that form UAE, is contemplating atomic power options other than Abu Dhabi's "Barakah" plant.[27] In October 2016 KEPCO and ENEC signed a joint venture agreement named, Barakah One PJSC, for operational and commercial interests.[28]

The IAEA integrated nuclear infrastructure review (INIR) mission stated in January 2011 that the UAE had abided by recommended 'milestones' plan. The UAE ENEC submitted 15,000-page application for operation of units 1&2 in March 2013 for an independent safety review and a probabilistic risk assessment summary report.[29] Subsequently, the ENEC also submitted a ten thousand pages application for a license of construction for units 3 and 4 to FANR in March 2013.[30]

Saudi Arabia; Planning and Establishing National Regulatory Institution:

Saudi Arabia produces power from gas and oil. It is the main consumer and producer of electricity in the Gulf States. In 2009, the KSA government showed its intention to establish nuclear power program. The "King Abdullah City for Nuclear and Renewable Energy" or KA-CARE has been set up at Riyadh to carry out the task of making arrangements for renewable energy sources. In 2010, Saudi Arabia appointed the Swiss and Finland consultancy firms to seek renewable energy options. Worley Parsons, an international engineering company was appointed for site analysis and regional surveys to select suitable locations in 2011. There were two sites shortlisted for establishing nuclear power plants, Jubail on Gulf, and Jizan and Tabuk on Red Sea. An agreement was penned for a high-temperature gas-cooled minor Chinese reactor.[31] Saudi Arabia plans to establish sixteen atomic energy plants in a 20-year period, which is estimated to cost more than eighty billion US dollars. Public-owned "Saudi Arabian Atomic Regulatory Authority" (SAARA) was established to start in 2014. An agreement was signed in May 2014 between KA-CARE and Finland's "Radiation and Nuclear Safety Authority" (STUK) to facilitate recruitment training of personnel and establishment of safety standards.[32] As KSA has very limited nuclear capabilities, it negotiated a Small Quantities Protocol with the IAEA, which limits the declaration and inspection.[33]

Qatar; Serious Policy Option:

Most of Qatar's energy production source is owed to gas. Though Qatar sought an investigation for possibility of nuclear energy in 2008, yet there was no forward proceeding because most of its needs had been met. It called for regional project of nuclear generation in 2010. It also penned a nuclear cooperation deal with the Russian Rosatom in the same year.[34] The agreement with Russia included bilateral cooperation in nuclear energy legislation, fundamental and applied research, design, construction and operation of nuclear power and research reactors, including production of radioisotopes and their use in medicine, industry and agriculture. [35] In 2015, South Korea and Qatar formalized a Memorandum of Understanding for collaboration in training of atomic experts and on the construction of a research reactor.[36]

Oman; Nuclear Energy Option Ruled Out:

Oman fulfills its energy needs mainly from gas. It sought nuclear option in 2008 yet did not conclude upon this option as appropriate. However, it signed an agreement with Russia in June 2009 for atomic energy cooperation.[37] After Fukushima nuclear incident, Oman withdrew from its option of nuclear energy in 2011.[38]

Kuwait; Modest Nuclear Plans:

In 2009, Kuwait sought to introduce nuclear applications in the country. It moved to establish state commission for nuclear energy in cooperation with IAEA. Kuwait penned a deal with France in 2010 for peaceful applications of nuclear technology, which included research, biology, electricity generation, agronomy, water desalination, earth sciences and medicine. The Kuwait Investment Authority acquiesced to provide six hundred million euro equity or 4.8 per cent in Areva in December 2010. It has atomic cooperation deals with the U.S., Japan and Russia.[39]

Kuwait expressed the intentions to construct four 1000 MW atomic reactors but withdrew from the idea in 2011. Most of Kuwait's energy needs are met by oil.

Bahrain; Financial Constraints:

Bahrain is a small producer of oil and gas and it needs other sources of energy. In late 2010, it called for using nuclear energy by 2017.[40] Though the country is interested in establishing nuclear power yet it is facing financial constraints.[41]

Among the GCC states, only UAE has been actively engaged in adopting nuclear technology in the country. Saudi Arabia, Qatar and Kuwait have been struggling hard to seek nuclear energy option with a slow pace. However, Oman gave up nuclear option in the aftermath of Fukushima incident. Bahrain needs alternative energy options yet faces financial constraints. There are four other Middle Eastern countries

besides the GCC states, which seek nuclear technology. This includes Jordan, Syria, Iran and Iraq.

Jordan; Serious Policy Option:

Jordon mainly relies on imports for over 95 per cent of its energy demands. It generates energy from imported oil and gas. It possesses region-wide energy grid interconnectivity of 500 MW with Egypt and 300 MW in the case of Syria. Its 2007 survey estimated 6 per cent nuclear energy production from nuclear by 2020. The Jordanian government set up a "Committee for Nuclear Strategy" in 2007. It provided a plan for atomic energy to provide 30 per cent of electricity by 2030, and to develop an export-focus. The nuclear regulations were modified in 2007 to set up the Jordan Atomic Energy Commission and the Jordan Nuclear Regulatory Commission. These organizations were tasked with environmental roles including radiation protection.[42] It aims at having two 1000 MW nuclear power units to be operational by 2025. It has considerable uranium stocks, some in phosphorite sediments. It has nuclear cooperation agreements for exploration of uranium resource and nuclear infrastructure building with Romania, Spain, France, UK, Canada, Italy, South Korea, Russia, IAEA, China, Japan, Turkey and Argentina.[43]

Jordan carried out an agreement with Russia's Rosatom in 2013 on build-own-operate (BOO) basis for two 1000 MWs reactors at Qasr-Amra, about 70 kilometer south east of Amman. Rosatom would provide the entire uranium and recover the spent fuel. The feasibility study for the 10 billion US dollars project would be completed in 2017. It is expected that the first unit would begin operation in 2023 and second in 2024-25. The two units will contribute about 48 per cent of the country's electricity.[44]

A smaller research and training reactor of 5 MW was built in 2015 by a consortium under the Korean Atomic Energy Research Institute (KAERI) with Daewoo at the Irbid-based Jordan University for Science & Technology. An agreement of safeguards agreement with IAEA has been in force since 1978. Since 1998, an Additional Protocol has been in force.[45]

Syria; Contested Nuclear Program:

Syria is member of the NPT and has an agreement of Comprehensive Nuclear Safeguards with the IAEA. However, it is alleged that it was clandestinely building a production reactor of plutonium at Al-Kibar or Dair Alzour site, which was attacked by Israel in 2007. Syria denied the allegations of plutonium production reactor at Al Kibar. In May 2011, the IAEA concluded after three years of investigation that the destroyed building at the Dair Alzour was most likely a nuclear reactor which

should have been declared to the Agency." It was found that Syria was not in compliance with its obligation under its Safeguards Agreement in the IAEA Board of Governors' meeting held on June 9, 2011. This issue was then brought to the notice of the UN Security Council.[46]

As member of NPT, Syria started nuclear technology in the country in cooperation with Argentina, China and Russia in 1980s. Syria agreed with China to build its first research reactor at Dayr Al Hajar, which was a SRR-1 30 KW miniature neutron source reactor. In 2008 and 2009, undeclared anthropogenic uranium particles were discovered by the IAEA, though not critical for proliferation concern.[47]

Iran's Contested Nuclear Program and JCPOA:

Iran is member of the NPT and thus retains the freedom for civilian use of nuclear power according to the Article IV of the NPT. However, its nuclear program had been subject to international skepticism and suspicion before the July 2015 Joint Comprehensive Plan of Action atomic deal between P-5+1 and Iran.[48]

Iran's nuclear pursuit dates back to Atoms for Peace program. Iran established its research reactor in 1967 as Tehran Research Reactor. The facility is under IAEA inspection. It is 5 MW pool type research reactor.[49] In 1970 Iran signed the NPT and signed safeguards agreement in 1974. Iran penned the Additional Protocol of safeguards but did not ratify it.[50]

Iran started building two 1,293 MW (gross) PWR units in Bushehr by Siemens KWU, modeled on the Biblis B reactor in 1975 in Germany. However, the construction halted in the wake of Iranian revolution. Later, Iraq damaged these plants through aerial bombardment in the Iran-Iraq war during the 1980s. In 1992, it carried out an agreement with Russia for building and operating these reactors. After many technical challenges, the first reactor started operating in 2011. An agreement of two more 1000 MW nuclear reactors at Bushehr was also signed with Russia in 2014. The construction started in September 2016 and will be completed in next ten years.[51] Light water reactors of 100 MW and 300 MW are planned at different sites in Iran.

The most striking revelation regarding Iran's nuclear program occurred in 2002 when it was found to have undeclared nuclear facilities at Natanz without notice to the IAEA. An IAEA investigation revealed that it was ultra vires of the NPT. Nonetheless, Iran went on enriching uranium despite the US Security Council resolution.[52] Iran brought Natanz into IAEA notice after being notified in 2002 by an opposition group. Two plants known as the Pilot Fuel Enrichment Plant, above ground and a huge beneath-the-surface Fuel Enrichment Plant were built at Natanz. It is estimated that uranium produced in these facilities might

be used for Tehran Research Reactor. The PFEP produced about 1950 kilogram of Low Enriched Uranium (LEU) by February 2010. Iran utilized 1,631 kilogram of 3.5 per cent LEU to accumulate 202 kilogram of 19.75 per cent uranium at PFEP from February 2010 to October 2015. Under JCPOA, the production was ceased in October 2015. The low-enriched UF6 (3.5 per cent U-235) of the quantity of 8,271 kilogram was produced at the plant at Natanz.[53]

In 2009, Iran told the IAEA about construction of another uranium enrichment facility at Fordow. In 2012, the facility produced 19.75 per cent enriched uranium with the rate of 10.6 kilogram per month. However, in the October of 2015, the facility was enriching only 3.5 per cent.[54]

Iran is constructing a heavy water-moderated reactor 40 MW at Arak. It utilizes natural uranium to replace Tehran reactor. The facility is in IAEA safeguards, however, there are concerns of its being involved in possible production of weapons grade plutonium. These concerns were mitigated by the interim agreement in April 2015. According to the agreement, the Arak reactor was to be redesigned and its original core, which can produce considerable amount of weapons grade plutonium, would be dismantled and rendered dysfunctional. In January 2016, the core was removed.[55]

There are two major reasons, which raised concerns in regard to Iran's nuclear activities despite it being an NPT member and signatory to the IAEA safeguards. First, the revelation of Natanz nuclear facility in 2002 and the other was Fordow facility, which Iran notified to IAEA in 2009. A November 2003 IAEA document established that Iran had hid its work on critical techniques, which can be used for atomic weapons. Iran accepted this as fact but responded that they were trivial. The IAEA and UNSC asked Iran to discontinue enrichment of uranium and activities related to reprocessing. However, Iran in 2010 asked its Atomic Energy Organization to commence uranium enrichment to 19.75 per cent for Tehran Research Reactor.

In August 2013, the government of Mr. Hassan Rouhani came into power, and the Iranian policy went from competition to cooperation. In the November of 2013, an interim Joint Plan of Action known as Geneva Agreement was signed between Iran and foreign ministers of P5+1 and senior EU representative, allowing for innovative inspections, limited sanctions relief and significant pressure on Iran. The agreement was signed for six months during which Iran would not enrich uranium more than 5 per cent nor expand facilities at Natanz, Arak and Fordow. In reciprocation, the states undertook to withdraw some U.S. and EU sanctions in certain categories and no further sanctions by UNSC or EU,

starting from January 2014. In March 2014, the IAEA gave a positive report in respect of Iran's compliance towards the deal. In April 2015, a framework agreement was finalized to carry forward the 2013 interim Joint Plan of Action.

As a result of the July 2015 JCPOA signed between Iran and P5+1, Iran will significantly reduce the quantities of LEU over the next fifteen year. Research activities will be carried out only in Natanz. However, uranium enrichment will not take place at Fordow. Arak reactor will be redesigned. Along with the JCPOA, a separate agreement was concluded between Iran and IAEA entitled, "Road-map for the Clarification of Past and Present Outstanding Issues regarding Iran's Nuclear Program." [56] This road map provided IAEA with extended monitoring and verification mechanism. The IAEA concluded inspections by October 2015 and concluded its findings by December 2015. In return, sanctions on Iran were to be progressively lifted. The IAEA acknowledged Iran's position of implementing Additional Protocol to the Comprehensive Safeguards.[57] In January 2016, the IAEA verified that Iran was abiding by its commitment under JCPOA. The document was presented to the IAEA Board and the UNSC.[58]

The JCPOA is a step in the right direction, which is mutually beneficial to Iran and the IAEA. The agreement has also strengthened non-proliferation regime and paved way for intensive nuclear safety measures, being carried out by the IAEA. Iran is a member of NPT, however, it has not signed on to the IAEA Convention on Nuclear Safety. With an operating nuclear reactor, it is the only country that is not a party to it.[59]

Iraq; Proliferation Concern Neutralized:

Iraq is signatory of NPT and reached an agreement of safeguards with the IAEA in 1972. Israel attacked and destroyed Iraq's 40 MW Osirak nuclear reactor in 1981, claiming it to be a reactor potentially for military purpose.[60]

In 1991, Iraq was involved in developing capability to carry out Electromagnetic Isotope Separation by utilizing its own uranium. It was developing two well-developed facilities at Tarmiya and Ash Sharqat. In 1990, the First Gulf War broke out. In 2008, 550 tonnes of uranium oxide concentrate were found in Tuwaitha. It was then sold to Cameco, a Canadian based uranium trading company. Iraq was not complying with the IAEA in 1990. Iraq's nuclear weapons capability was to be removed, destroyed or rendered harmless by IAEA. These facilities were removed by 1998. Iraq then ceased all cooperation with IAEA.[61] The US invaded Iraq in 2003 under the pretext of the latter possessing Weapons of Mass Destruction. However, no evidence was found to substantiate the claim

that Iraq would have reactivated nuclear weapons program during the inspection hiatus. Iraq later signed the Comprehensive Nuclear Test Ban Treaty (CTBT), and IAEA Additional Protocol.[62]

There was suspicion and international concerns for nuclear weapons development/designs in three countries in the Middle East, Iraq, Iran and Syria. The three states, however, had to accept the non-proliferation guidelines either due to incentives in case of JCPOA with Iran, or through air attacks on nuclear facilities in Iraq and Syria. Jordon, with acute energy crisis, seems to be seriously considering nuclear power for energy production. Now in light of the analysis of nuclear programs of the Middle East, an attempt is made to evaluate peaceful program of Pakistan under IAEA to draw a comparative analysis between the Middle East and Pakistan regarding nuclear safety. Pakistan's nuclear safety record and long experience of nuclear technology could provide nuclear safety and security-related lessons for the Middle Eastern countries.

Lessons from Pakistan for Civil Nuclear Programs in the Middle East

Pakistan possesses more than forty years of experience in using and maintaining atomic technology. It has large deposits of uranium as natural resource. It has been cooperating with international community in pursuit of nonproliferation and peaceful applications of atomic energy. It has been advocating measures including arms control and disarmament in pre-nuclearization phase, and called for Strategic Restraint Regime in post-nuclearization era. It resorted to the nuclear option primarily due to the security factor. It detonated nuclear weapons as a response to India's overt nuclear explosions during the second week of May in 1998.

In post-nuclearization era, Pakistan has adopted state of the art measures to ensure nuclear safety and security. It has been actively engaged in Nuclear Security Summit process. Its institutional framework including National Command Authority, Strategic Plans Division, Pakistan Atomic Energy Agency and Pakistan Nuclear Regulatory Authority make it a responsible nuclear state. Its legal framework includes the national Export Control Act of 2004, which helps contain the proliferation/transfer of WMDs and other sensitive technology to other countries.

Pakistan's institutional and legal framework can be adopted in the Middle East under international safeguards. It has large quantity of human and material capital for export of atomic technology for civilian applications to the Middle East under global safeguards arrangements. Pakistan calls for 48-nation Nuclear Suppliers Group membership. The NSG operates as a cartel of nuclear-exporting states. If Pakistan gets the NSG membership, it would open avenues of nuclear energy cooperation

between Pakistan and the Middle East. This would help entrench a regional nuclear security regime under IAEA safeguards and expand cooperative nuclear risk reduction.

Conclusion

The rising apprehensions of global warming, green house effects and most importantly, depleting fossil resources of the Middle East, are compelling the countries to seek other renewable energy sources. Iran has been using nuclear technology but remained under international spotlight because of concerns of proliferation. After JCPOA between P5+1 and Iran, these concerns could be mitigated and Iran could economically benefit from the lifting of sanctions. The UAE has embarked upon the journey of using nuclear technology by constructing four large nuclear reactors. Iraq and Syria were subjected to aerial bombardment on their nuclear facilities. Saudi Arabia, Qatar, and Kuwait, are seriously pondering upon introducing the nuclear technology in their respective countries. Oman ruled out nuclear energy option in the wake of Fukushima incident. Bahrain is facing economic hurdles. Jordon is finalizing its legal modalities and feasibility studies.

All the countries in the Middle East are NNWS and signatories to the NPT, except Israel, which did not sign the NPT. These Middle Eastern states are legally entitled to civilian applications of atomic power under the nuclear treaty's Article IV, within the IAEA comprehensive safeguards.

Pakistan is a responsible nuclear weapon state. It has been cooperating with international community on non-proliferation and safeguards. Pakistan has been using nuclear technology for a long time and retains rich human and material resources to use nuclear power. Pakistan possesses institutional and legal framework, and can help to establish this in the countries in the Middle East that seek nuclear energy option. Pakistan's bid for the NSG if materialized can open avenues for nuclear energy cooperation between Pakistan and the Middle East.

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[8] NPT differentiates nuclear weapon states (NWS) and non nuclear weapon states (NNWS). The NWS are defined as states, which were able to manufacture and explode a nuclear weapon or other nuclear explosive device before January 1, 1967 i.e. Russia, China, France, the UK and the U.S. These five states are also termed as P-5 states.

[9] There are 191 members of the NPT. Except P-5 states, all other parties are non nuclear weapon states and are entitled to have complete access to peaceful uses of nuclear energy and technology under IAEA comprehensive safeguards agreement. India, Israel and Pakistan never signed the NPT. North Korea was a party to the treaty but withdrew in 2003. India, Pakistan and North Korea claim to have nuclear weapons. However, Israel neither accepts nor denies the possession of nuclear weapons.

[10] Non NPT states are those which are not members of NPT. They include India, Pakistan, Israel and North Korea. Except North Korea, all three non NPT states have some IAEA safeguards under item-specific safeguards arrangements (INFCIRC/66/Rev.2) for peaceful application of nuclear technology.

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