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Peaceful Nuclear Cooperation in the Middle East: Short and Mid-Term Future

Policy memo

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One of the major obstacles facing the deployment of nuclear power for peaceful use in the Middle East is the concern of proliferation which fundamentally rests on the ability to enrich and reprocess nuclear fuel. The Nuclear Club states, along with the rest of the world, are concerned with spread of this ability beyond the confirmed membership of the Club. A short-term work-around is for new entrant states to seek cooperation agreements that forgo their right to develop enrichment and reprocessing capabilities. It appears that such agreements are in fact working and managed to attract willing followers whose hunger for clean reliable nuclear power outweighs the apparent shortcoming of giving up, of what some opponents have termed as, the sovereign right to enrich and reprocess. However, it is premature to see whether those agreements will withstand the test of time as opponents claim that signatories will intentionally forgo the right to develop sustainable and economically feasible access to nuclear power in the long run. This, ironically, is the same reason the signatories have decided to enter the nuclear age in the first place.

A mid-term solution for the proliferation issue is the creation of international fuel banks whereby signatories are guaranteed access to market-priced reactor-grade fuel in a reliable and nondiscriminatory way in return of forging their right to enrich and reprocess. This is different from the above solution in that fuel access is controlled by an international body not by one single provider in a bilateral agreement. This will definitely smooth out any polarization any one provider may try to exercise over the rest of the bank members. However, it does not address the fuel market volatility in case of price war. A country that has developed its own capability to enrich and reprocess its own fuel will have a better chance to ride safely the waves of such a hypothetical, but quite probable, war.

Another obstacle to the deployment of peaceful nuclear energy in the Middle East is the initial huge capital needed to build nuclear power plants which are expensive to

build but relatively cheap to run. There are two basic ways of financing a nuclear power project: government and private finance. However, since the electricity market in the Middle East is regulated and heavily subsidized, government finance is almost the guaranteed way for a nuclear project to move forward. For developing countries additional resources are required and may include directly allocated development funds from international aid organizations and development banks, or other government sponsored aid programs, export credit agency insurance schemes or institutions like the Overseas Private Investment Corporation and the Multilateral Investment Guarantee Agency and equity investments and commercial loans. However, multilateral finance agencies are required to balance the views of their Member States, which have strong and diverse views on nuclear power in particular and on proliferation in specific. In addition, they may require investment selection criteria to demonstrate that a proposed nuclear plant will be the least cost alternative for electricity generating capacity expansion, and/or cost efficient for solving environmental, security and other social problems. This will, one more time, infringe on countries sovereign right to pursue their national agendas of introducing nuclear power independent of the lenders' own political and ideological preferences.

A third barrier to the deployment of peaceful nuclear power in the Middle East is lack of infrastructure and support industries (a.k.a. hard infrastructure) that are needed to have a sustainable nuclear power program. These include physical facilities such as grid, physical protection facilities, component manufacture and material supply, standard calibration laboratory facilities, storage/disposal of low and medium radioactive waste, spent fuel storage and disposal facilities, safeguards plan and equipment, emergency response facilities, emergency notification of nuclear incidents and many others. A short term solution is to purchase these capabilities through a turnkey agreement for at least the first one or two reactors. A long-term solution, however, will definitely require the new entrant country to develop these capabilities in-house and in so doing will need to get into cooperation agreements with willing partners. This would most probably happen with ease since these agreements could be restricted to only non-sensitive technologies that a new-entrant country could secure from a variety of potential partners even outside the Nuclear Club states.

A fourth obstacle is lack of skilled human resources capable of running (as well as regulating) the nuclear power program safely and efficiently (both combined are a.k.a. soft infrastructure). Specific expertise in nuclear physics and nuclear materials science for reactor operation and fuel cycle management is crucial along with a strong commitment to a safety culture. Human resource development needs vary widely, depending upon the national decision to fill the needs through indigenous development (long term) or purchase the capabilities through a turnkey project (short term). Even if a turnkey project is the preferred approach, consideration of developing indigenous capabilities should be considered for the long term. The development of such indigenous capabilities will require significant attention to education and training

that can be obtained from the vendors and suppliers of the nuclear systems and components as short term solution. However, it is desirable for a nation to develop its own educational and training capabilities to better assure the long term availability of the crucial human resource and to provide opportunities for its citizens. While the development of human resources requires investment, this investment brings overall benefit to the economic development of the nation.

Finally, as the countries of the Middle East, and especially those of the GCC, aspire to take their position among the advanced and developed nations their hunger for energy is unprecedented. Therefore, for any meaningful development to take place, sustain its momentum and stand the test of time the GCC has to diversify its economy and find alternative sources of energy in addition to oil. This led to the choice of nuclear and renewable energies as the two energy sources of choice to develop and rely on for the council's future energy needs.

In addition, the region does not have much of water natural resources to satisfy its needs for growth and development which makes seawater desalination the main source of potent water. Seawater desalination is very much energy-intensive and therefore makes its availability directly tied to that of reliable and economical energy source. This water-energy nexus necessitates developing integrated water-energy solutions to meet the council's needs for growth and development in an economical and sustainable way.

The use of nuclear power in seawater desalination is being developed at Masdar Institute of Science and Technology (MI) to address this unique situation of water-energy nexus. This is particularly relevant since several member states have recently chosen nuclear power to meet their individual's energy needs which will hopefully means meeting their water needs as well.

The vision of MI research team is to create and develop the blueprints of a Self-Sustainable Nuclear Oasis (2SNO). Central to this vision is a Small Modular Reactor (SMR) capable of producing about 330MWe which is used for providing electricity to the grid, producing hydrogen to power a future fleet of hydrogen cars and desalinating seawater for drinking and industrial applications. The SMR design under consideration is especially suited for this task since; it's small so the construction is simplified and its capital investment is minimized, it's modular so the initial unit could be small and additional units can be added as the need for water and energy grows, it's inherently safe because of its small size and passive safety features that requires no human intervention even in case of beyond-design-basis accident, it's proliferation-resistant due to its very long fuel cycle (about 60 years) that does not require human access to nuclear fuel for the lifetime of the plant.

Preliminary results showed that an oasis that consists of one reactor of that size will supply (1) about one-third (100 MWe) of its electricity output to the grid and use the rest along with some of its process heat to produce (2) enough hydrogen to power

280,000 light vehicles through High Temperature Electrolysis of Steam (HTES) and produce (3) enough water for about 20,000 inhabitants through hybrid Reverse Osmosis (RO) and Multi-Stage Flashing (MSF)

Therefore, it is believed that peaceful nuclear cooperation in the Middle East has a better chance of seeing the light if it offers integrated solution to these two basic problems namely; energy and water