



Contemporary World Affairs

Iran's decision to enrich its Uranium by 20 per cent: What does it mean?

NIAS-GP Conversation with Dr N Ramamoorthy

Dr N Ramamoorthy is currently an adjunct faculty at the NIAS. Earlier, he served as Director of the Division of Physical and Chemical Sciences at the International Atomic Energy Agency (IAEA), Vienna, Austria. The NIAS Global Politics team had a conversation with Dr N Ramamoorthy on the capabilities and significance of Iran's latest announcement on nuclear enrichment. Following is a report based on the conversation.

Iran announced in the early days of January 2021 that it would resume the enrichment of Uranium up to 20 per cent at the Fordow facility. This announcement coincided with the anniversary of the killing of Iranian Military leader Sulemani and two months following the assassination of Iran's top nuclear scientist, Mohsen Fakhrizadeh. IAEA released a statement on 4 January saying, "Iran today began feeding uranium already enriched up to 4.1 per cent U-235 into six centrifuge cascades at the Fordow Fuel Enrichment Plant for further enrichment up to 20 per cent."

Sukanya Bali: Is it a necessity for Iran to enrich its Uranium? Why is Iran doing it right now?

Prof Ramamoorthy: Nuclear ambition or nuclear aspiration is desired by all the countries. For example, the oil-rich UAE has gone for nuclear power. Countries tend to have nuclear ambition because they do not want to be left out of an important technology. Nuclear has manifold uses, from energy to defence to health. So it is not unnatural for Iran to have nuclear ambitions, particularly in the post-Islamic revolution political situation. Moreover, there is always this geopolitics and rivalry between many Islamic countries and Israel. It is believed that Israel has, or has access to, nuclear capabilities. That might be the underpinning point, why a country like Iran would be interested in nuclear programs. A lot has happened with Iran, its nuclear program, and uranium enrichment in the last nearly 20 years, and therefore the current issue is nothing new. They have been there, and Iran has tried to be as compliant as possible (of its commitments). However, in contemporary times, there is much distrust among nations and no meaningful progress made in diplomatic engagements.

Abigail Miriam Fernandez: What is the significance of the location, the sensitive Fordow nuclear facility Iran has resumed enriching the uranium to 20 per cent?

Prof Ramamoorthy: The Fordow plant was Iran's second declared enrichment plant, but the Natanz enrichment plant was first opened up to international scrutiny for verification under the

safeguard agreement with IAEA. Technically, Iran has agreed under the JCPOA that all enrichment activities would be confined to the Natanz facility. Iran committed to this requirement perhaps as a way to drive home a point of their agreement to a code of conduct, or some form of the framework; and in this regard, Iran has committed to follow through with all requirements to be observed by the IAEA.

However, why Iran decided to go again with Fordow could be their way of not putting all their eggs in one basket. Thus, having a parallel second facility would become a backup if having a problem with one facility.

Akriti Sharma: As part of JCPOA deal, Iran decided to redesign its main plutonium related facility, that is, the Arak Nuclear reactor plan. When the deal has fallen apart, and Iran is increasing uranium enrichment, why is it not simultaneously reviving its Arak nuclear facility and pursuing the plutonium path to making weapons?

Prof Ramamoorthy: Iran has offered that the Arak (heavy water) Reactor project will not be further on, and calandria removed. It was about the fears of Iran's ability to make plutonium. Whether Iran has the reprocessing capability to produce plutonium is unknown, unlike the uranium enrichment capability where the centrifugal technology has been demonstrated and used. From the configuration of natural uranium fuel and heavy water moderator arrangements, it would seem that they could be creating the potential for plutonium capability. It requires, however, strong technology capabilities. They have so far declared that they will not take the Arak reactor further, but one may have to take that with a pound of salt if cooperation measures continue to take a downward slide.

Apoorva Sudhakar: In terms of capability, what does increasing uranium enrichment from 4.5 per cent to 20 per cent mean? What difference can it make?

Prof Ramamoorthy: Usually, 0.7 per cent U-235 is available naturally. This can be used for nuclear power production; however, the fuel element replenishment will be very frequent and demanding. Therefore, to acquire better power density and power production, it is better to use a slightly enriched fuel material. For this purpose, the nuclear power program runs based on up to around three or four per cent enriched U-235; five per cent is about the maximum, and one does not use more than that in NPP for various reasons. Within this five per cent enrichment, most of the power requirements, or power fuel requirements, can be met. This need, which stems from the desire or preference in building a country's own capacity to produce fuel for its power plants, is genuine and cannot be easily challenged. However, the process of learning to do the enrichment remains the same, and the West builds its fears on this concept: once a country owns a certain level of technical capability, it could further aim to raise the same later on (including for defence purposes).

Another aspect to consider is the entire industrial base in Iran, not just it's (nuclear) scientists and engineers because something cannot be built in a laboratory alone; it needs a large, competent industrial infrastructure. In the current situation, barring any tacit support from State actors, Iran would find it difficult (impossible) to acquire the resources. Despite this, the Western fears linger on.

Further, when Iran shows that they could hold on to sizable quantities of enriched material, it indicates that it could be used to go to higher enrichment level. The 20 per cent enrichment limit is a kind of a thumb rule fixed to categorise low enriched Uranium (LEU) and all the above as highly enriched Uranium (HEU). Keeping in mind a protective, non-proliferation angle, the limit for LEU was kept at 20 per cent. However, having a 25 per cent or 40 per cent enriched material does not mean the country has weapon capability.

The 20 per cent enrichment LEU is predominantly used for research reactor fuel purposes. In nuclear electricity production, where a country can manage with four to five per cent enrichment and run the reactor for a very long time (here, one looks at it mostly as electricity generation feeding into the grid). However, in a research reactor, one looks at it as a kind of 'neutron warehouse' or a 'large neutron vessel' for research, isotope production, activation analysis, material testing, etc. and probably even produce plutonium.

To have the required high level of neutron fluxes or intensity, one needs higher enrichment of U-235, which means which one gets a much more compact core, and the neutron density becomes very high. For the same power level generated, a smaller core means higher neutron density and intensity. As a matter of fact, for the isotope production, scientists/engineers had initially built many reactors, which contained around 90 per cent enriched uranium as the fuel element! Over many decades, they have brought it down (under global initiatives involving USA, Russia, others and with IAEA support) and the optimal enrichment for research reactor fuel was fixed at not more than 20 per cent; with enrichment of 19.5 to 19.8 per cent, one will be able to satisfy a large amount of the research reactor goals and interests - be it for isotope production, which are much used in medical applications or for industrial applications, or for material testing, power reactor fuel development, etc.

The 20 per cent enrichment, which is the low enriched uranium (LEU), came into the picture as Iran cited the need for high flux for isotope production, research, material development, analytical work, etc. However, the threat of 20% enrichment they have given today is not new. More than 10 years back, Iran did enrich the material close to that level. The question arose whether that should be addressed under the agreement with the West and down-blended to around 3-4 per cent. However, that perhaps never took place; Iran already had shown its capacity to enrich up to 20 per cent.

Therefore, the current threat could also be Iran's attempt to flex its muscles, as the 20 per cent limit lies within the LEU limit. It is, therefore, easy to justify that they are enriching uranium for their own research reactor requirement.

Lokendra Sharma: Can Iran scale up the enrichment levels from 20 per cent to above 90 per cent (weapons-grade)? Does Iran have the capability to do so? What would be the time frame?

Prof Ramamoorthy: The higher-level enrichment can be done. Somebody who has the capability to set up, operate and produce at 20 per cent level, can decide on a campaign mode to raise the enrichment level. They also seem to have a reasonable industrial infrastructure in place. The

West certainly fears such a scenario. Iran has commitments and obligations to the international community and has to comply with its safeguards obligations. There is a fairly elaborate mechanism in place to keep monitoring by the IAEA. However, what happens when everything breaks down? Yes, Iran seems to have (or can develop) the capacity and capability to enrich uranium to higher levels - weapons-grade.

Theoretical capability is there, but how good and how fast? That is difficult to say. It cannot be said that Iran is not technically capable. However, then possessing raw material does not become a directly usable nuclear weapon. When an assessment is to be made of the capability part, there are plenty of 'ifs and buts' involved.

Israel has been deeply concerned about the Iran nuclear programme. This would imply that their own assessment of the capability of Iran is high. This was probably why Israel had earlier threatened Iran with attacks on their facilities; they also produced a large amount of documents to give to the US government to canvass support for doing something about Iran. That also probably had a role to play in the Trump administration's decision of withdrawal from the 2015 JCPOA.

Harini Madhusudan: What is the source of Uranium for Iran? We have known data of their Uranium imports till 2005, but after that, there is not much information on where they get their nuclear resources from, and how do the investments in the Iranian nuclear programme work? Can we correlate the timing of the announcement of nuclear enrichment that Iran is making with the leadership transition in the US? Does Iran see this timing as an opportunity to make their announcement?

Prof Ramamoorthy: The source of uranium and the related question was on my mind but could not get much details. Basically, before the controversy related to the Iranian nuclear programme, they seem to have acquired the material, or whatever they could, gradually. One can look up the data of the availability of the uranium resources across the world, in the Red Book of the Nuclear Energy Agency (NEA-OECD) and the IAEA, available on the internet. The Red Book has a fairly good representation of the worldwide distribution of the uranium, and the Iranian natural resources are shown there to be quite low.

There is no international free commerce with which the uranium can be procured by Iran. The uranium that they use now must have been procured locally and acquired from the past. One can recall that one of the sources for Iran was its stake or link with an African country, known to have uranium resources, and which is also likely to be their only such source. It is unclear whether there are other sources of uranium and determines which would be very difficult in the current situation. It is doubtful whether any new uranium material actually came into the country.

The second part of the question is political-related about the leadership change in the US. There has been the distrust, between Iran and the West. The power dynamics in recent months have been striking, particularly regarding the responses by Iran. For a long time, the US and the European Western leaders have felt that remaining engaged with Iran gives a good leeway to have some form of control and understanding, rather than remaining completely unaware or have

Iran doing anything drastic. In general, there could be plenty of policy advances or changes from the US with the new government now set to take over soon.

Therefore, that could augur well for a certain amount of fresh pressure on Iran. JCPOA will have to be reworked because Trump has declared withdrawal. If there would be a return to the JCPOA terms, Iran will insist on being given upfront a few things, in a give-and-take manner. The bloc of the West would also expect a few things from Iran. And then only, the sanctions might be relaxed. So this will become a continuous hard bargain- balancing situation, and who will concede first? So, a combination of political will and some degree of trust between the governments will be necessary to happen. Hence, it would be difficult to predict.

With every change in the US government, we certainly expect some change in the case of Iran. For some time in the previous decade, there was better hope in the West to deal with Iran things. However, during the Trump Presidency, things have changed. In the same context, the recent violent attack episodes will have to be remembered - one of the anniversaries of one of their very senior military leaders being killed (was yesterday or the day before). And second, the killing of a nuclear specialist. With the more recent event fresh on every Iranian authority, one can expect a strong reaction from Iran.

It all depends on how much political concession will be coming to them regarding the sanctions, essentially a large amount of finance/economy-related. So that could really boil down to driving the final decisions (on concessions). The leadership in Iran will have to bring out a careful combination of bargaining power to the negotiating table, while keeping the stick on hand, and at the same time holding also a flower! So if Biden (administration) can manage that, it would be for the welfare of the world. One can seriously hope that the two sides continue to remain to talk and not go to the point of complete breakdown, or any other situation that calls for provocative action, like in the case with the Syrian nuclear facility attacked by Israel, and which will be catastrophic. Nobody will wish for such a thing.

To that extent, political stewardship working jointly would be beneficial. And what would be Iran's attitude? These, we really do not know. Accountability and 'suitable response' will still be debated a lot in Iran. The US was involved directly in killing the military leader, whereas the nuclear scientist part, nobody knows. The common speculation is that the capability shown is of the highest degree of technology involved and that Israel is only capable of such technology. This is, of course, a guess-work.

***Sourina Bej:* With the enrichment, is Iran violating any norms of the international treaty like the NPT and agreement such as the JCPOA?**

Prof Ramamoorthy: Along with the NPT obligations and the verification checks undertaken by the IAEA, Iran has also signed the JCPOA, which adds another dimension to the verifications. The IAEA report document to the Board of Governors, the highest body, chronicling Iran's safeguards verification matters (and in the light of UNSC Resolution 2231) noted in Nov 2020 that the country had fulfilled its part under the JCPOA. According to its commitments, Iran is obligated to announce many activities such as enrichment. Hence the current announcement of

the 20 per cent enrichment to the IAEA is an obligatory action by Iran, though posing a challenge to the JCPOA.

Also, as part of enhanced verification measures under NPT, the concept of Additional Protocol of IAEA is there; Iran has accepted the AP but not implemented (ratified for entry into force) it yet (*Iran continues to provisionally apply the Additional Protocol to its Safeguards Agreement in accordance with Article 17(b) of the Additional Protocol, pending its entry into force.* – DG, IAEA). Presently, one needs to wait until the release of the next report of the IAEA Director-General due towards the end of February 2021, which will throw further light on how Iran has been complying with its safeguards agreement with the IAEA, and on IAEA verification actions under UNSC Resolution 2231 and under JCPOA, especially concerning its nuclear enrichment programs.