The Challenge of Containing Iran's Enrichment Activities

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Brief Analysis

With talks between the P5+1 (the United States, Russia, China, Britain, France, and Germany) and Iran set to resume in Istanbul on April 13, officials are discussing possible compromises that might persuade Tehran to give up any ambition of developing nuclear weapons. Apparently, one of the principal components of these proposals is acceptance of Iran's right to enrich uranium to around 3.5%, a level suitable for civilian power reactors. But this could turn out to be a fatal bargain: centrifuge technology is easy to hide, and there are few barriers to continuing enrichment up to 90%, the level needed for an atomic bomb.

BUYING LITTLE TIME

Natural uranium contains just 0.7% of the fissile isotope U-235, which is the key to both controlled chain reactions in nuclear power plants and uncontrolled, explosive chain reactions in atomic bombs. Enriching this material is a progressively easier process. For example, if the aim is to produce 90% enriched uranium, reaching the 3.5% level requires some 75% of the work. By the time 20% enrichment is reached -- the level Iran currently achieves -- 90% of the work has been done. Therefore, cutting a deal in which Iran gives up enriching to 20% but continues enriching to 3.5% would buy relatively little time. Worse, it would not solve the more fundamental problem: the unknown scope and nature of Iran's nuclear program.

In 1943, when the United States was trying to enrich uranium to make a bomb, it used two different methods. One scheme, based on magnets called calutrons, used huge amounts of electricity and employed more than 10,000 people. The other, using diffusion through specially made barriers, was housed in the largest building ever constructed. The beauty of the centrifuge method, used in Europe to fuel civilian nuclear power plants since the 1970s, is that it requires much less: a building the size of a supermarket and electricity equivalent to a small industrial plant. The danger is that the same technology, when mastered, can easily make the high-enriched uranium (HEU) needed for nuclear explosives. And the building where this is being done can be difficult to detect, as evidenced by North Korea's surprise 2010 revelation that it had built a centrifuge plant in its Yongbyon nuclear

complex, and Iran's 2009 admission of work on a new facility at Fordow.

IRAN'S CENTRIFUGES

Currently, Iran's capabilities appear limited because of operational problems with its IR-1 centrifuge, based on a design received from Pakistan but originally developed in Europe. The IR-1 is prone to breaking down, and Tehran's efforts to develop more advanced models have been hampered by international restrictions on its ability to import the requisite high-strength steel, carbon fiber, aluminum, and other components and machine tools.

Nevertheless, Iran has built a formidable number of IR-1s and has succeeded in enriching uranium to around 20%. Tehran claims it has enriched to only 19.75%, thereby avoiding the 20% level, which is notionally the divide between low-enriched uranium and HEU (so designated because it is theoretically possible to make a nuclear explosive using 20% enriched uranium, though such a device would be so bulky and otherwise impractical that it would hardly qualify as a bomb).

Originally, the government's enrichment activities were confined to the giant facility at Natanz in central Iran. Recently, however, the higher-enrichment centrifuge cascades were transferred to Fordow near the holy city of Qom. This new facility was built under a mountain so as to be immune from attack. Tehran has publicly stated that it plans to build ten such facilities, so other locations may already be designated or even under construction. Similarly, Pakistan -- the source of Iran's technology -- began with a main centrifuge plant at Kahuta, then built a second facility at Gadwal, housed in one building on the grounds of a huge munitions factory near Islamabad. Pakistan also has one or more small centrifuge plants hidden in mountain tunnels.

Without a diplomatic breakthrough, Iran would likely be able to produce weapons-grade HEU eventually despite the IR-1's limitations, since even inefficient centrifuges seem capable of success given enough time. Although many Western experts sneer at the IR-1's poor performance, some estimate that Iran could make enough HEU for a bomb perhaps later this year or in 2013. If Iran chose the breakout path, it could conceivably make several bombs' worth of HEU within a matter of a few weeks or months, depending on the number of centrifuges deployed.

STRICTER SAFEGUARDS AND MORE OPENNESS

The compromises that will be considered in Istanbul likely include tight safeguard arrangements to prevent undisclosed Iranian activities and/or the diversion of nuclear material, as well as inspection of any suspicious sites. But a more immediate challenge is for Tehran to answer existing questions about suspect activities that suggest it has, at least in the past, worked on nuclear weapons designs and breached its obligations under the Nuclear Nonproliferation Treaty. This is a fundamental part of restoring international confidence in the peaceful scope of Iran's nuclear program, in both the immediate and long term. Without this more complete sort of understanding, the reputation and work of the International Atomic Energy Agency (IAEA) would be fundamentally undermined.

Throughout past discussions, Iran has repeatedly offered "transparency" to build international confidence in its activities. Thus, the first step going forward should be to secure a clear commitment by competent Iranian authorities to full openness and cooperation with the IAEA. Tehran must fully implement its obligations under the IAEA statutes and Safeguards Agreement. It must also return to provisional implementation of the Additional Protocol, which strengthens inspection regimes, and work toward early ratification of that protocol. In addition, it must provide all necessary access and cooperation as the IAEA verifies the correctness and completeness of its declaration.

Restraining Iran's enrichment activities might also involve limiting its number of operational centrifuges from around 10,000 to just 1,000 -- a figure commensurate with estimates of the country's maximum conceivable need for enriched uranium. In reality, though, Iran has no need to make enriched uranium at all -- the fuel for its Bushehr

power reactor is supplied by Russia, and the fuel rods in the Tehran Research Reactor (used to produce medical isotopes) could be supplied from abroad if Tehran permitted it. In the past, Iran has explained its activities by speaking of elaborate plans to become a global supplier of enriched uranium for nuclear power stations. It could try this gambit once again in Istanbul or later talks.

CONCLUSION

Even if the parties make some diplomatic progress at the Istanbul summit, they are unlikely to build much trust. Yet such confidence building -- which includes an even stricter safeguards regime -- is essential if compromise is to work. In the absence of progress, Iran could be tempted to pursue clandestine programs. And in the meantime, its centrifuge skills and ability to produce enough high-enriched uranium for a small arsenal of bombs are steadily increasing.

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