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Natanz Enrichment Plant: How to Measure Progress

Rev.1

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Several recent news articles have interpreted the latest IAEA's safeguards report on Iran to indicate that the country's uranium enrichment program has slowed. This conclusion is based on the information in the report which, implied that on August 12, 2009, the number of centrifuges at the Natanz Fuel Enrichment Plant (FEP) being fed with uranium hexafluoride had decreased. On this day, Iran was feeding uranium hexafluoride into 4,592 centrifuges, down from 4,920 centrifuges in June 2009. This represents a decrease of 328 centrifuges, or two cascades out of a total of 28 cascades that had been enriching uranium earlier.

It is a mistake to assume on the basis of this piece of information that the enrichment program has slowed. A more accurate assessment is that the number of centrifuges at the FEP continued to increase and the rate of production of low enriched uranium (LEU) remained steady through July 2009.

Measuring progress in the Iranian enrichment program is a challenge because the IAEA receives relatively little information under the weakened inspection arrangements demanded by Iran, in particular information about the operation of the Natanz centrifuge plant. Based on the information that Iran does provide and that the IAEA publishes in its periodic Iran safeguards reports, there are three indicators of progress. The first is the number of centrifuges at the FEP being fed uranium hexafluoride. The second is the number of centrifuges installed in addition to the number enriching. As of August 12, 2009, another 1,312 in 8 cascades were under vacuum ready to enrich and 2,296 were in 22 cascades but not yet under vacuum.[1] A third indicator is the amount of low enriched uranium produced at the FEP over a given period of time. From this data, the average amount of LEU produced per day over a given time period can be calculated.

[1] Another 108 centrifuges were also installed.

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Progress at Iran's gas centrifuge uranium enrichment plant at Natanz cannot be determined using any single metric, and only a combination of all the data provides the most comprehensive picture of Iran's uranium enrichment program and its progress. A more accurate reflection of the program's progress is a combination of the average LEU output per day, the number of centrifuges enriching, and the total number of centrifuges installed at Natanz, enriching uranium or not.[2]

The amount of LEU produced on an average per day reflects Iran's ability to reliably enrich uranium using a large number of gas centrifuges. This value is calculated by dividing the total LEU output during a reported period by the number of days in the reporting period. The number of centrifuges enriching uranium over the last two reporting periods has remained about the same, which also allows for a comparison of the LEU production per centrifuge. During the previous reporting period, from November 18, 2008 to May 31, 2009, the average amount of LEU hexafluoride produced at Natanz was approximately 2.75 kg per day.[3] Over the latest reporting period, Iran produced an average of 2.77 kg per day—virtually the same rate as before.

The total number of centrifuges installed also reflects Iran's ability to manufacture and operate centrifuges. In the previous reporting period, Iran had a total of 7,052 centrifuges installed, under vacuum or enriching uranium. In the latest reporting period, that number increased by over a thousand to 8,308.

Using all three criteria, the performance of the Natanz FEP does not appear to have slowed. Over the summer, the plant continued to grow in size and was steady in its production of LEU. Any further conclusions about the plant's performance since early August require more information.

Why the decrease in the number of centrifuges enriching uranium?

Iran did not provide the IAEA with a reason for the decrease in the number of centrifuges enriching uranium. In addition, this recent safeguards report is the first to contain such a value. Earlier reports stated only the number of centrifuges enriching without providing a value for the number undergoing maintenance or replacement at any given time.

Mark Heinrich reported that an "informed senior diplomat" told Reuters that the batch of centrifuges had been taken down for maintenance or repairs. If this is the case, Iran would be expected to restart them soon.

Drawing on information from past safeguards reports, the average estimated LEU output per machine has been lower than expected for this type of centrifuge. One explanation for this is that during each period, some of the centrifuges were down for maintenance or repair. In other words, each centrifuge might be performing better than the average value

[2] An ISIS report analyzing the latest IAEA report on Iran calculated and highlighted these measurements: http://www.isis-online.org/publications/iran/IAEA_Iran_Report_28August2009.pdf

[3] This was a 20% increase in LEU output from the previous reporting period: http://isis-online.org/publications/iran/IAEA_Iran_Report_5June2009.pdf

would suggest, but the average is taken over all the machines in this category despite some of them being out of operation for portions of the reporting period.

Given that some centrifuges at Natanz are likely routinely under maintenance, it is difficult to interpret the slightly reduced number of centrifuges enriching uranium on August 12, 2009 as a political signal by the Iranian regime. Likewise, it is unlikely that Iran would have concluded that such a move would be interpreted politically.

If the number of centrifuges enriching uranium is not restored to previous levels or further decreases, Iran could be encountering significant, unexpected technical problems in its centrifuges. However, this conclusion cannot be drawn from data for only one day, particularly since the normal operation of the Natanz plant would be expected to include temporary reductions in the numbers of centrifuges enriching uranium.

Why is Iran not using more centrifuges to enrich uranium?

One perplexing issue is why Iran is not using more centrifuges at Natanz to enrich uranium. As of August 12, 2009, about half the installed centrifuges, or 3,716 centrifuges, were under vacuum or installed but not enriching. This value seems unusually high, although judgments about the reasons for this value must be tempered by the fact that Iran does not need more than small quantities of LEU. Given that its stock of LEU hexafluoride now exceeds 1,500 kilograms, Iran has little need to produce more LEU. Nonetheless, several additional factors could account for the relatively large number of idle centrifuges:

- These roughly 4,000 centrifuges might soon enrich uranium. It is a relatively quick process to enrich uranium after centrifuges are installed.
- Iran might face a persistent technical issue with cascade operation that, while resulting in adequate LEU output, is not ideal and, until settled, is not worth endangering new cascades.
- As noted above, Iran does not need the LEU and may have a limited ability to produce more centrifuge cascades, leading to a decision to limit the number of centrifuges enriching to prevent losses in their number as a result of breakage, which is inevitable in any centrifuge plant;
- Iran may place a premium on rapidly installing more centrifuges at the FEP in anticipation of a future negotiated freeze, but it does not have congruent plans to increase the number of centrifuges enriching uranium. In essence, it may seek to establish facts on the ground prior to any negotiated freeze of its enrichment program.
- Iran may have calculated that any rapid increase in the number of centrifuges enriching uranium would weaken its position internationally and possibly even stimulate additional international sanctions.

Unfortunately, available information is insufficient to determine whether Iran's actions at the FEP are guided by technical or political considerations. Therefore, favoring one or the other seems unsupportable in the absence of additional information.