

JINSA's Gemunder Center for Defense and Strategy

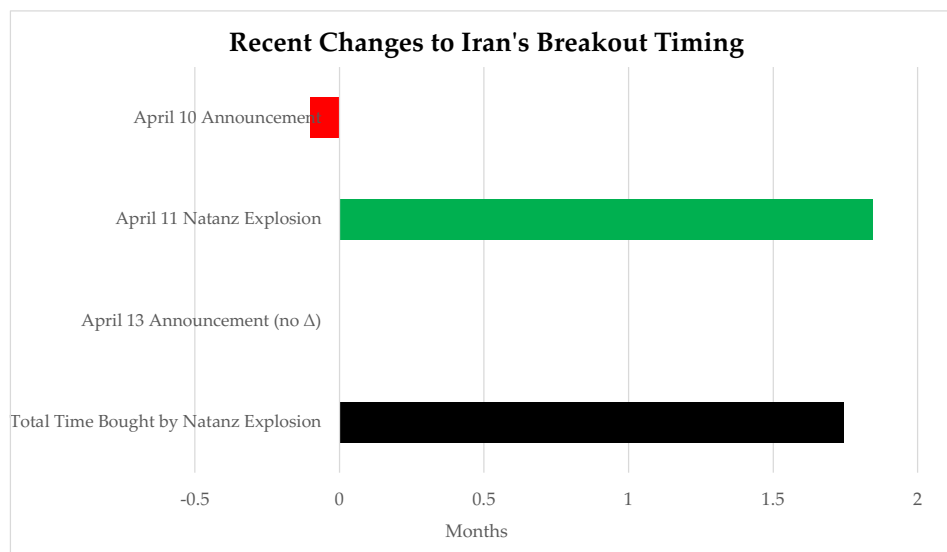
Iran's Newest Nuclear Steps Won't Make Up for Delays Caused by Explosion

Blaise Misztal - *Vice President for Policy*
Jonathan Ruhe - *Director of Foreign Policy*

Iran has attempted to make up for an April 11 explosion at its Natanz enrichment facility by announcing new nuclear advances: enriching uranium to 60 percent and installing an additional 1,000 advanced centrifuges. Though these moves are designed to regain leverage and convince the United States to grant Iran sanctions relief, neither of these announcements will, for now, materially accelerate Iran's ability to sprint for a nuclear weapon. Instead, the explosion at Natanz appears to have set back Iran's "breakout" clock — the amount of time needed to produce enough weapons-grade uranium for a single nuclear weapon — by roughly two months.

What Happened?

- On Tuesday, April 13, two days after an [explosion](#) deep inside Iran's main Natanz enrichment facility, Iran announced two new nuclear advances. Iran will now:
 - Enrich uranium to [60 percent](#) purity, up from the current level of 20 percent and the country's highest level ever. This enrichment will reportedly take place at a small, above-ground facility designed for research and development, also at the Natanz complex.
 - Replace damaged machines from Sunday's explosion "with more-advanced centrifuges," reportedly 1,000 IR-6 [centrifuges](#) with 50 percent more capacity.

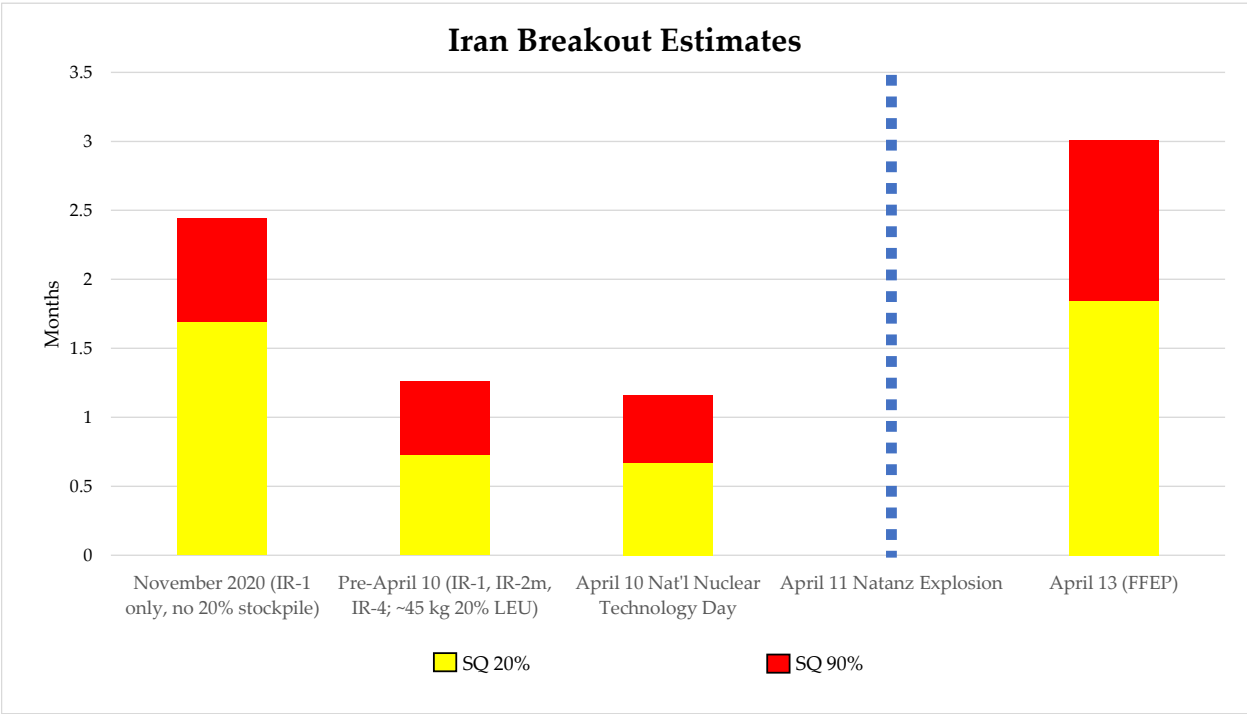


Why Does it Matter?

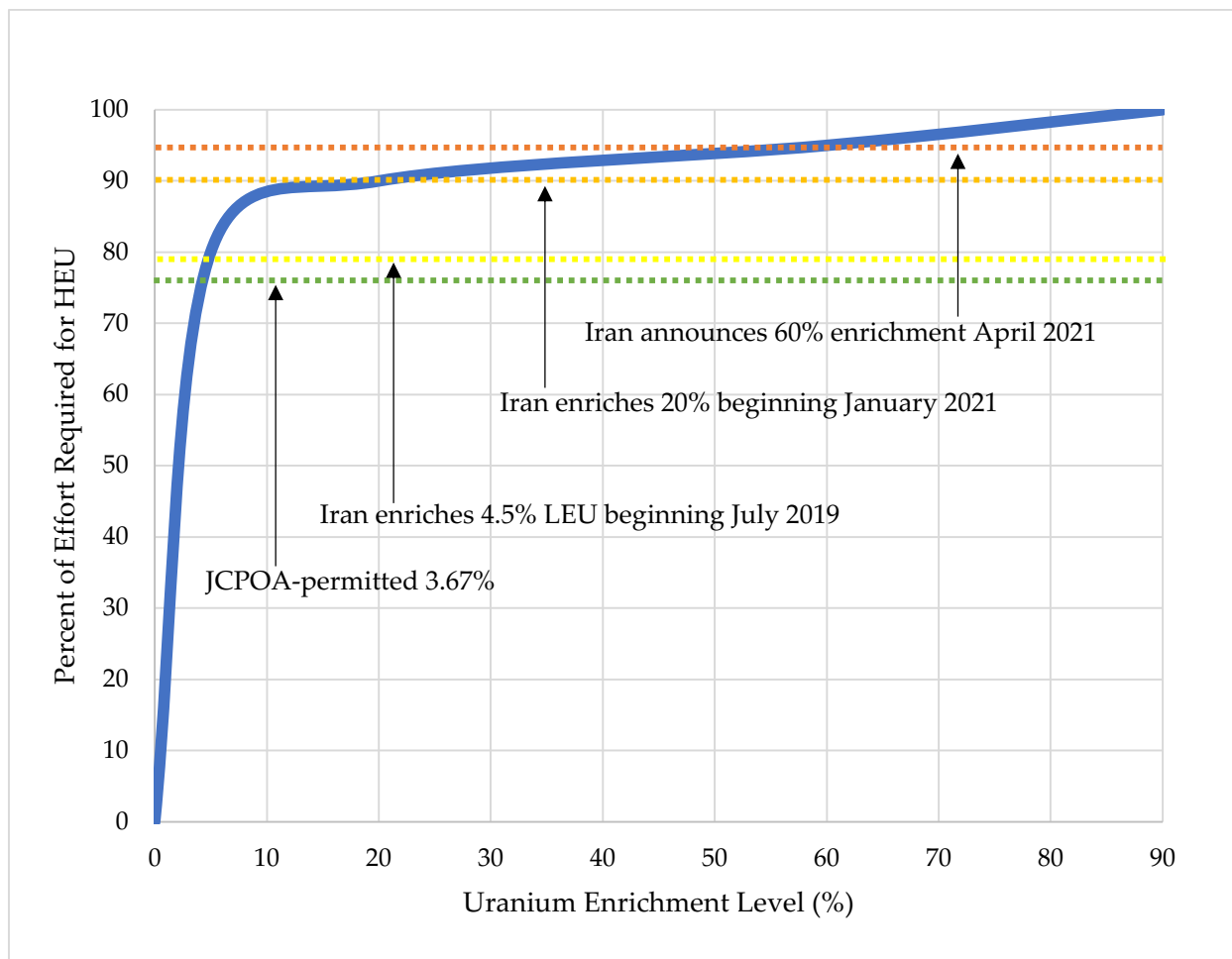
- These announcements are clear attempts to compensate for the April 11 explosions at Natanz, which Iran has accused Israel of perpetrating.
 - This seeming major nuclear advance is meant to convince the United States and other international actors that its nuclear program, rather than being set back, is in fact accelerating.
 - Iran hopes to stoke fear that its “breakout timing” – the amount of time needed to produce enough weapons-grade uranium (about 20 kilograms enriched above 90 percent) for a single nuclear weapon – is shrinking and thereby increase pressure on the Biden administration to reenter the Joint Comprehensive Plan of Action (JCPOA) before time runs out.
 - Iran also is trying to save face domestically, attempting to cover up the fact that its nuclear program has been heavily compromised and its security services are ineffective, with claims of new technical prowess.
- To the contrary, however, the Natanz explosion has delayed Iran’s nuclear program, and slowed its breakout timing, regardless of the April 13 advances, including the move to 60 percent enrichment.
- **According to our calculations, based on what is known about the damage to Natanz, the events of April 11 added nearly *two months* to Iran’s breakout clock, pushing it back to roughly three months (see charts below), despite recent advances in enrichment capacity.**
 - Iran’s breakout timing had been decreasing steadily since November 2020, as it has serially violated JCPOA restrictions, and especially since January 2021, when it began enriching uranium to 20 percent.
 - On April 10, Iran announced a major expansion of the Natanz Fuel Enrichment Plant (FEP): the addition of a cascade of IR-6 centrifuges (164 machines), which are [estimated](#) to be its most efficient centrifuges used to date.
 - This was part of an ongoing Iranian [process](#) since November 2020 of expanding enrichment capacity by adding operational cascades of IR-2m, IR-4, IR-5 and IR-6 centrifuges at Natanz, and starting to install two cascades of IR-6 machines at its separate Fordo enrichment site, known as Fordo Fuel Enrichment Plant (FFEP).
 - Once this expansion was complete, along with the pre-existing centrifuges at Natanz and Fordo, Iran’s breakout window would have *shrunk to one month, down from three months as recently as late last year.*
 - The Natanz explosion on April 11, by apparently taking offline 5,060 IR-1 centrifuges, added back almost two months to the nuclear clock, effectively counteracting Iran’s major expansions of its enrichment capacity since November 2020.

Centrifuges pre-April 10 Announcement						
	IR-1	IR-2m	IR-4	IR-5	IR-6	Total
Natanz FEP	5,060	696	174	0	0	5,930
Fordo FEP	1,044	0	0	0	0	1,044
Total	6,104	696	174	0	0	6,974
Centrifuges as of April 10 Announcement						
Natanz FEP	5,060	696	174	30	164	6,124
Fordo FEP	1,044	0	0	0	0	1,044
Total	6,104	696	174	30	164	7,168
Centrifuges post-April 11 Outage						
Natanz FEP	0 (est.)	1,044*	174	30	164**	1,412
Natanz PFEP	0	0	0	0	328	328
Fordo FEP	1,044	0	0	0	328	1,372
Total	1,044	1,044	174	30	820	3,112
*Includes two additional IR-2m cascades (348 machines total) currently under installation.						
**On April 13, Iran announced plans eventually to deploy 1,000 IR-6 machines at FEP.						

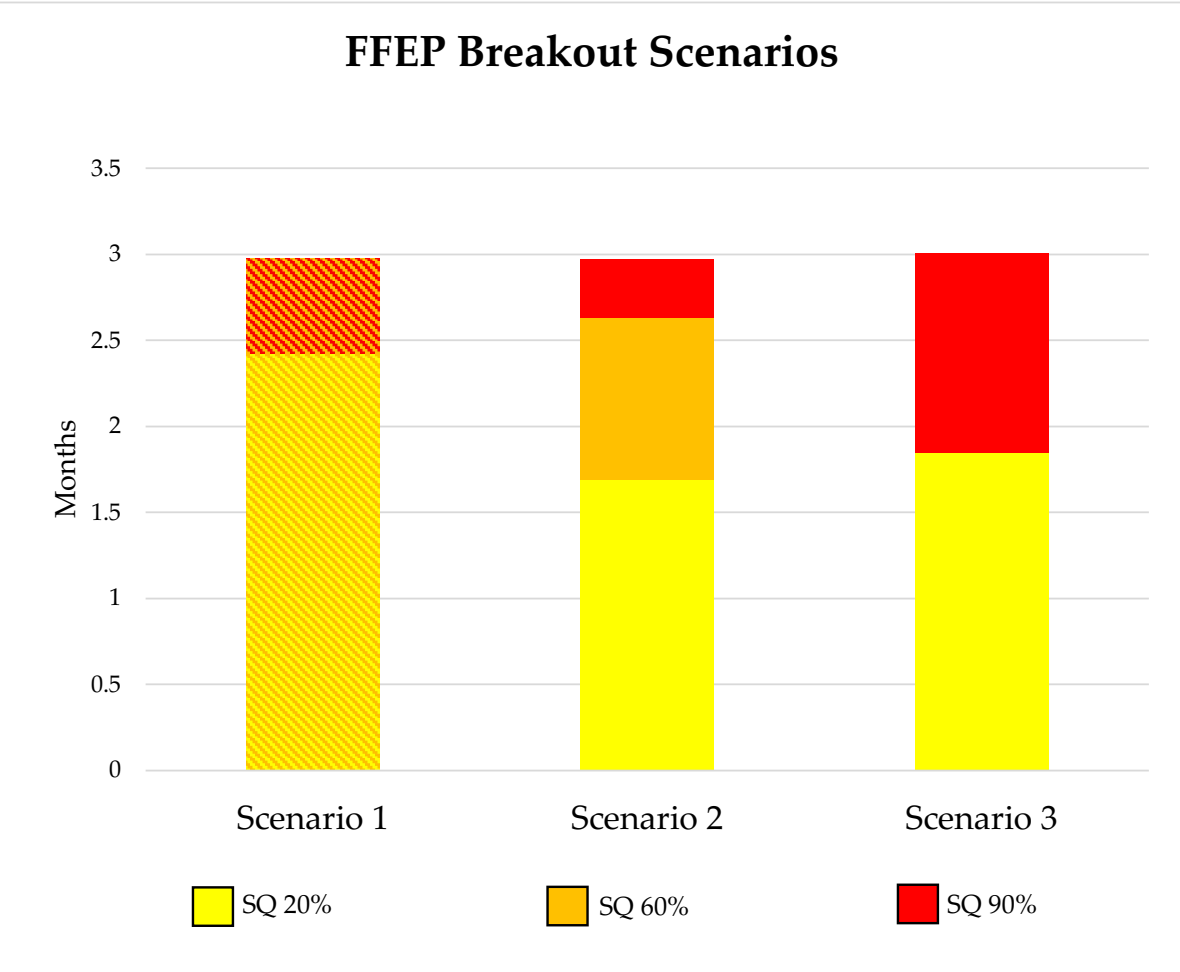
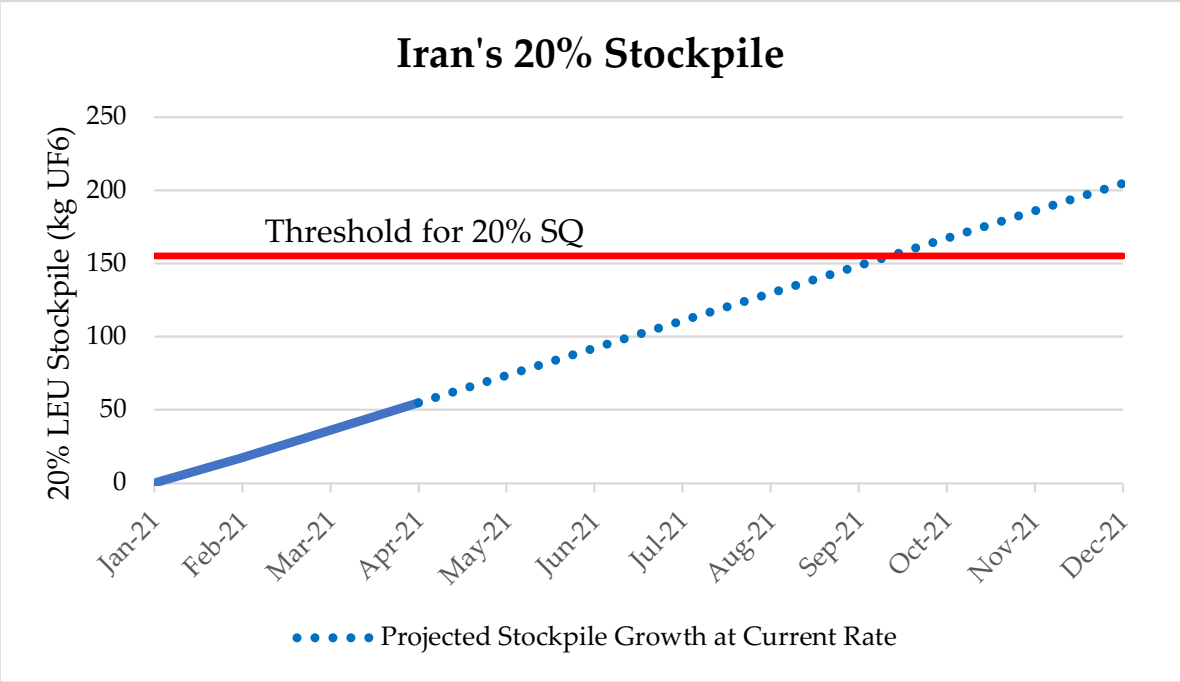
- Although some reports say it might take Iran up to nine months to recover from the explosion, that is the amount of time to rebuild the Natanz facility. However, Iran could still breakout using centrifuges at other plants, chiefly Fordo.
- Even if Iran chooses to, and succeeds in, breaking out, it would still likely require 6 to 12 months to assemble a nuclear weapon from that weapons-grade uranium. This activity would be much harder to detect and therefore stop than an attempt to breakout at an internationally inspected facility like Fordo.

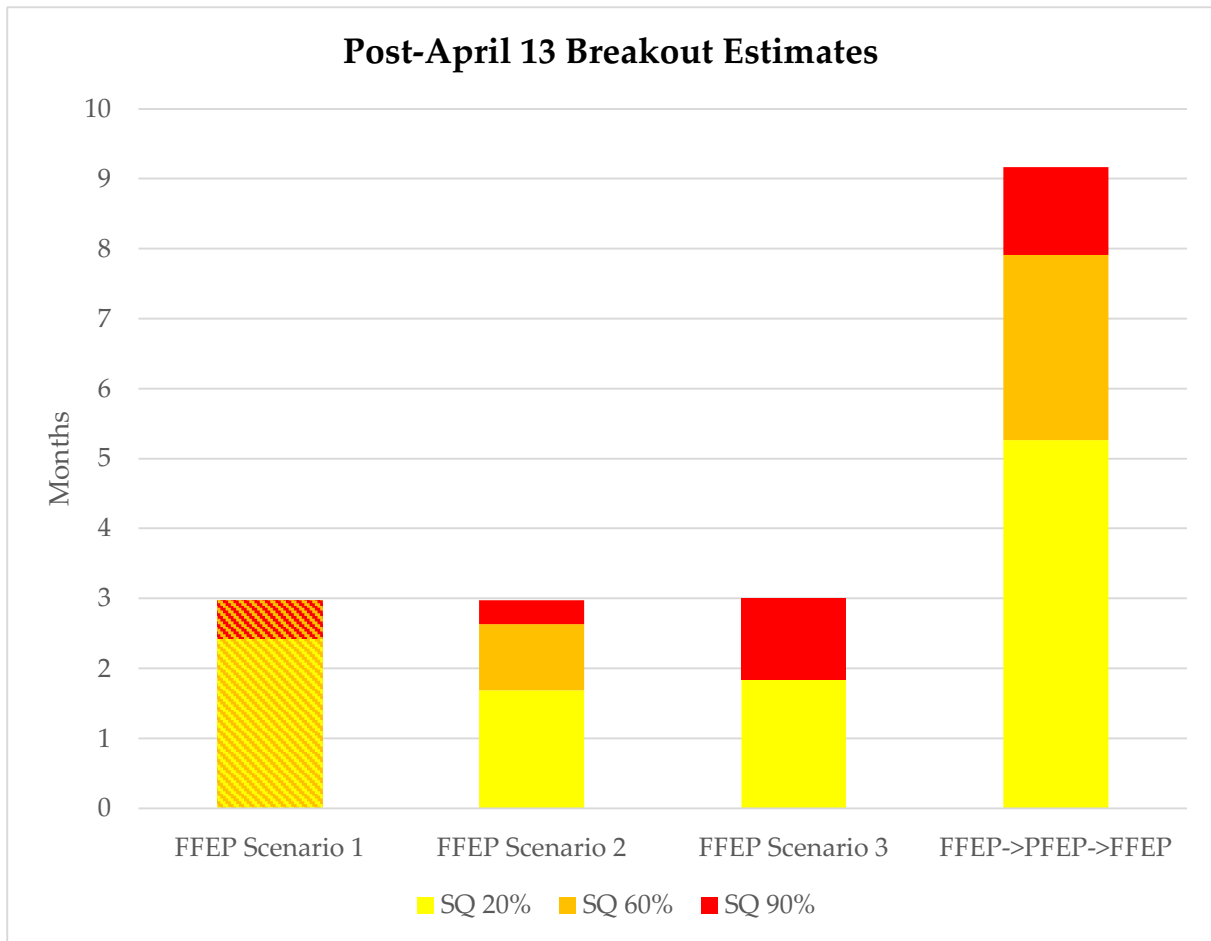


- There are two major limiting factors in Iran's breakout timing right now: the centrifuges it has available for enrichment and its stockpile of 20 percent enriched uranium.
 - The more centrifuges Iran has, and the more efficient those centrifuges are, the faster it can enrich. However, the Natanz explosion appears to have taken offline, for now at least, almost 60 percent of Iran's centrifuges.
 - Iran currently has approximately 55 [kilograms](#) of 20 percent enriched uranium. This is still short of the 155+ kilograms of 20 percent enriched uranium needed to produce, with further enrichment, enough weapons-grade 90 percent uranium for a nuclear device.
 - This threshold is known as a significant quantity, or SQ, of uranium enriched at a given level.
 - To shrink its breakout time Iran needs to:
 - increase its enrichment rate by installing more and/or more advanced centrifuges; and/or
 - increase its stockpile of 20 percent enriched uranium.
 - By damaging up to 5,060 IR-1 centrifuges, the Natanz explosion *decreased* Iran's enrichment capacity, at least for now, thereby *lengthening* its breakout timing.
- **The announcements Iran made on April 13 do not immediately impact either Iran's enrichment capacity or its 20 percent enriched uranium stockpile, thus having no major effect on its breakout timing for now.**
- As inherently concerning as Tehran's nuclear escalations are, the decision to proceed with 60 percent enrichment is not necessarily a "[major jump](#)," and does not take any time off Iran's breakout clock because it does not increase Iran's uranium stockpile.
 - Even though 60 percent enrichment would move Iran closer to weapons-grade uranium (roughly 90 percent purity), it [already](#) enriches to 20 percent, a far more significant landmark.
 - Reaching 20 percent enrichment [represents](#) roughly nine-tenths of the enrichment effort required to reach weapons-grade uranium.
 - Going from 20 to 60 percent enriched uranium requires only some five percent of the total enrichment work.
 - While a major symbolic advance, the move to enrich uranium to 60 percent is less significant than it might sound. Especially in light of additional limitations discussed below.



- Even if it wanted to, Iran cannot right now produce a weapons' worth of 60 percent enriched uranium, because it lacks sufficient 20 percent enriched uranium stockpiles to use for that process.
 - Whether Iran begins enriching its stockpile of 20 percent uranium to 60 percent first (scenario 1 below), or waits until it has accumulated a sufficient stockpile of 20 percent enriched uranium (155 kilograms) and only then enriches to 60 percent (scenario 2), or converts a sufficient 20 percent stockpile to 90 percent, does not appreciably impact on its breakout timing.
- Indications so far suggest Iran is planning to only produce a small, symbolic quantity of 60 percent enriched uranium at its aboveground R&D facility at Natanz (called the Pilot Fuel Enrichment Plant, or PFEP), rather than seek to build a sizeable stockpile at its underground Fordo site (where it currently enriches 20 percent uranium).
 - Given the small size of the PFEP, it is not well-suited to a breakout attempt. Trying to produce enough 60 percent enriched uranium for a weapon at PFEP would actually push its breakout time out to nine months.





- Similarly, Iran’s other Tuesday proclamation, that it intends to replace the affected IR-1 machines at Natanz with 1,000 more efficient IR-6 centrifuges, does not appear to have an immediate effect on its enrichment capability.
 - Iran’s ability to mass-produce these machines is inadequate to match its ambitions, as it still has not [recovered](#) from last July’s devastating explosion at a separate Natanz facility dedicated to advanced centrifuge manufacturing.
 - Though its current bandwidth for producing advanced centrifuges is unknown, last summer’s explosion is estimated to have [set back](#) any large-scale manufacturing capability by 1-2 years.
 - By comparison, Iran has thousands of IR-1 centrifuges [in storage](#), presenting a much readier if less efficient route to rebuilding its enrichment capacity in the wake of Sunday’s explosion, assuming those machines are still functional after years of being mothballed.
- Over the medium to longer term, Tehran’s ability to mass-produce advanced centrifuges will pose a primary challenge to preventing a nuclear Iran, as large numbers of these machines could bring Iran’s breakout time to near-zero and enable it produce multiple bombs’ worth of fissile material on short order.

- Sunday's incident, on top of last July's explosion at the centrifuge facility, the November 2020 [assassination](#) of Iran's top nuclear scientist and other events, suggests the very real vulnerabilities of Iran's nuclear program to – and the leverage American policymakers could accrue from – physical sabotage.
 - However, Tuesday's announcements by Iran also underscore the risks such sabotage will drive its nuclear program deeper underground, both literally in the case of expanded enrichment at Fordo and the new centrifuge production facility under construction, and figuratively in terms of reducing inspectors' access to key facilities.
 - This relates to the eventual problem of Iran being able to mass produce advanced centrifuges, since their greater efficiency means they require fewer cascades – i.e. at Fordo, as compared to Natanz – to enrich the same amount of uranium as Iran's longstanding IR-1 workhorse.
 - In this light, Iran's [decision](#) earlier this year to install two IR-6 cascades at Fordo (where installation appears to be ongoing) to [contribute](#) to 20 percent enrichment is at least as problematic as its intent to enrich 60 percent uranium.

DISCLAIMER

The findings and recommendations contained in this publication are solely those of the authors.