

RISKY BUSINESS

Laser enrichment is cheaper and more efficient than other techniques for concentrating uranium-235 to make reactor fuel — but that could make it vulnerable to abuse, some non-proliferation experts fear.

GASEOUS DIFFUSION

Cost per SWU*
\$160

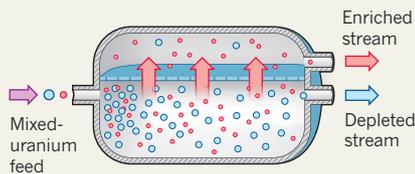


Energy cost

Proliferation risk

Because it is lighter and more active, ^{235}U is more likely than ^{238}U to bounce into walls and to cross a semi-permeable membrane.

^{238}U ^{235}U



GAS CENTRIFUGE

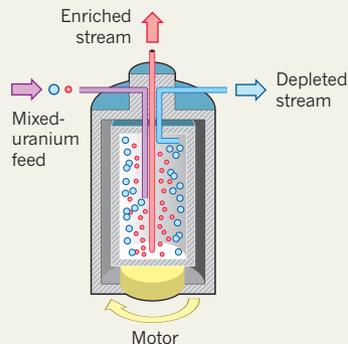
Cost per SWU*
\$100



Energy cost

Proliferation risk

A spinning centrifuge pushes heavier ^{238}U towards the edges of the chamber, leaving a stream of enriched ^{235}U in the middle.



LASER ENRICHMENT

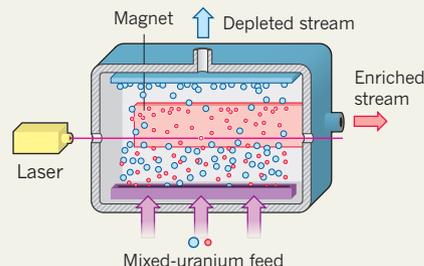
Cost per SWU*
\$30



Energy cost

Proliferation risk

A tuneable laser excites and ionizes the ^{235}U in the mixed uranium feed. Magnets are then used to separate the ^{235}U from ^{238}U .



* Separative work unit

PROLIFERATION

Laser plant offers cheap way to make nuclear fuel

Experts worry that uranium-enrichment technique could be used to make bombs.

BY SHARON WEINBERGER

A controversial uranium-enrichment technology is on the cusp of making it cheaper to create fuel for nuclear power plants. But some non-proliferation experts are concerned that the efficiency of the laser-based technology will smooth the path for bomb-makers too.

On 11 July, the Atomic Safety and Licensing Board of the US Nuclear Regulatory Commission (NRC) will hold a final hearing on a proposal by General Electric (GE) of Fairfield, Connecticut, and Hitachi of Tokyo, Japan, to build the first commercial laser-enrichment plant. A decision on the plant, to be built in Wilmington, North Carolina, is anticipated in September and is widely expected to be favourable. But in a sign of the concerns that surround the technology, what is supposed to be the last public hurdle for the venture will be conducted in secret. “Although we would like to keep it as transparent as possible, the only practical thing to do with this mandatory review is to close this hearing in its entirety to the public,” says Paul Ryerson, one of the NRC’s administrative judges.

Separating the tiny fraction of uranium-235 from the uranium-238 that dominates natural uranium is the major hurdle to making fuel for commercial reactors and fissile material for weapons. Separation of Isotopes by Laser Excitation, or SILEX, a proprietary technique being developed by GE, promises to be much cheaper than either gaseous diffusion or gas centrifuging (see ‘Risky business’), two techniques currently in use that date back to the Manhattan Project. Although the exact details of SILEX are classified, the principles are well understood: a laser tuned to a specific frequency excites and ionizes the ^{235}U in a gaseous form of uranium, so that the charged atoms can be siphoned off.

GE and Hitachi are thought to be first companies to have sufficient skill with the process to build a commercial facility.

But many scientists and non-proliferation experts are concerned that a viable commercial facility would encourage countries wishing to start bomb projects. The American Physical Society in College Park, Maryland, for example, has lodged a

petition with the NRC, urging the commission to review proliferation risks for all licences. The society says that laser enrichment could be a “game changer” for those wanting to pursue proliferation, because it would fit into compact facilities — just one-quarter of the size of a centrifuge plant — and would therefore be difficult to detect through surveillance.

Scott Kemp, a nuclear expert at Princeton University in New Jersey, adds that many countries have a cadre of laser experts who could work on the technology. “That expertise does not exist for centrifuges, which are a bit esoteric,” he says.

CONFLICT OF INTERESTS

Former NRC commissioners disagree on whether the licensing process weighs up the proliferation risks carefully enough. Dale Klein, who was a commissioner during the early days of the GE–Hitachi proposal, says that proliferation risks were carefully considered for such applications. He notes, for example, that input was sought from the US defence department. But Victor Gilinsky, another former commissioner, says that other agencies involved in assessing proliferation

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risks were not regularly consulted. Gilinsky sees a tension between the United States' goal of safely commercializing nuclear-power technology and its efforts to control the proliferation of nuclear materials. "They are at cross purposes," he says. "When there's a conflict, generally speaking, the policy to spread nuclear technology overrides the non-proliferation policy."

GE spokesman Michael Tetuan says that the planned safeguards for the facility, such as measures to protect classified information, exceed the government's requirements. He also points to a report by an external panel, commissioned by GE but not made public,

which concluded that laser enrichment poses no greater proliferation risk than the other enrichment methods.

Donald Kerr, a former director of Los Alamos National Laboratory in New Mexico, who was a member of that panel, disagrees with the assessment that a laser facility would be smaller and more difficult to detect. The critics, he says, are relying on "marketing projects" from the 1980s that may have oversold the small footprint of the technology. "We had access to the actual information about the full-scale plant," says Kerr. The proposed plant would occupy 0.5 square kilometres. Kerr also dismisses concerns about industrial

espionage. "There's never been an American A. Q. Khan," he says, referring to the Pakistani nuclear scientist who stole industrial centrifuge secrets from the URENCO plant in the Netherlands, notoriously creating a nuclear black market.

Henry Sokolski, executive director of the Nonproliferation Policy Education Center in Washington DC, says that proliferation risks are harder to avoid than industrial espionage; the plant itself could simply spur other countries to follow suit and pursue their own research. "The most sensitive technology leak has already occurred," says Sokolski. "And it's that this stuff can work." ■ [SEE COMMENT P.30](#)

EMPLOYMENT

African researchers sue flagship programme for discrimination

Conflict at Kenya Medical Research Institute exposes widespread tensions.

BY LINDA NORDLING IN CAPE TOWN

The Kenya Medical Research Institute (KEMRI)–Wellcome Trust Research Programme is often seen as a model North–South partnership. African-run and mainly European-funded, it has trained dozens of African PhDs and done important research on malaria and other tropical diseases.

Yet in a court case that reawakens sour memories from colonial history, it now finds itself accused of exploiting African employees and holding back their careers compared with colleagues from developed countries. KEMRI denies the charges.

The case, which pits six African researchers, known as the KEMRI six, against the institute, highlights perceptions of unequal treatment that are common in joint programmes. Many prominent research institutions in Africa have evolved from field stations that once belonged to Europe, and although most are now owned locally, they remain dependent on funding and administrative support from their erstwhile masters.

"It is fair to say that this is an issue," says Marcel Tanner, director of the Swiss Tropical and Public Health Institute in Basel, which partners with health-research centres in Tanzania, Ivory Coast and Chad. Partnerships between rich and poor nations inevitably generate tensions, and those are exacerbated when the split between the haves and the have-nots runs along racial or former-colonial lines, says Kelly Chibale, a Zambia-born



Funding from Britain's Wellcome Trust is a cornerstone of the Kenya Medical Research Institute's programme in Kilifi.

biochemist who trained in Britain and the United States, and who now leads a drug-discovery centre at the University of Cape Town in South Africa. "There are tensions everywhere in science — but where the former colonial master is involved, it takes on a different dimension."

ALLEGATIONS OF BIAS

The KEMRI six — Samson Gwer, Michael Mwaniki, Nahashon Thuo, John Wagai, Moses Ndiritu and Albert Komba — were all medical officers or clinical research officers working towards PhDs, or about to start doing so, as part of the KEMRI–Wellcome Trust Research Programme in Kilifi, Kenya. The programme has a mixture of African and European staff, is run by the University of

Oxford, UK, and gets most of its funding from the Wellcome Trust, a British medical charity that has funded research in Africa for many decades. Neither body is a defendant in the case. "We are aware that allegations have been made concerning the KEMRI–Wellcome Trust research programme in Kenya," the trust said in a statement. "However, an investigation carried out by KEMRI found no evidence to support the serious allegations made by the researchers."

In their submission to Kenya's high court on 5 December 2011, the KEMRI six describe their treatment at the programme as "modern day slavery", alleging that they were passed over for promotion, training opportunities and grants while their white colleagues flourished. They also say that their work was stolen and given to researchers in the developed world, and that they were paid less than foreign colleagues with equivalent qualifications on the programme.

The six say that they raised their complaints with programme managers in 2010. Later that year they were suspended. They are suing KEMRI for compensation and demanding a court order for them to be reinstated unconditionally.

In submissions to the court, KEMRI says that the complaints from the six were dealt with in accordance with institutional employment policies. It also says that its staff are well paid in ▶

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