Enrichment Market Overview

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Agenda

I. Introduction to Nuclear Fuel

II. Enrichment 101

III. Enrichment Technologies

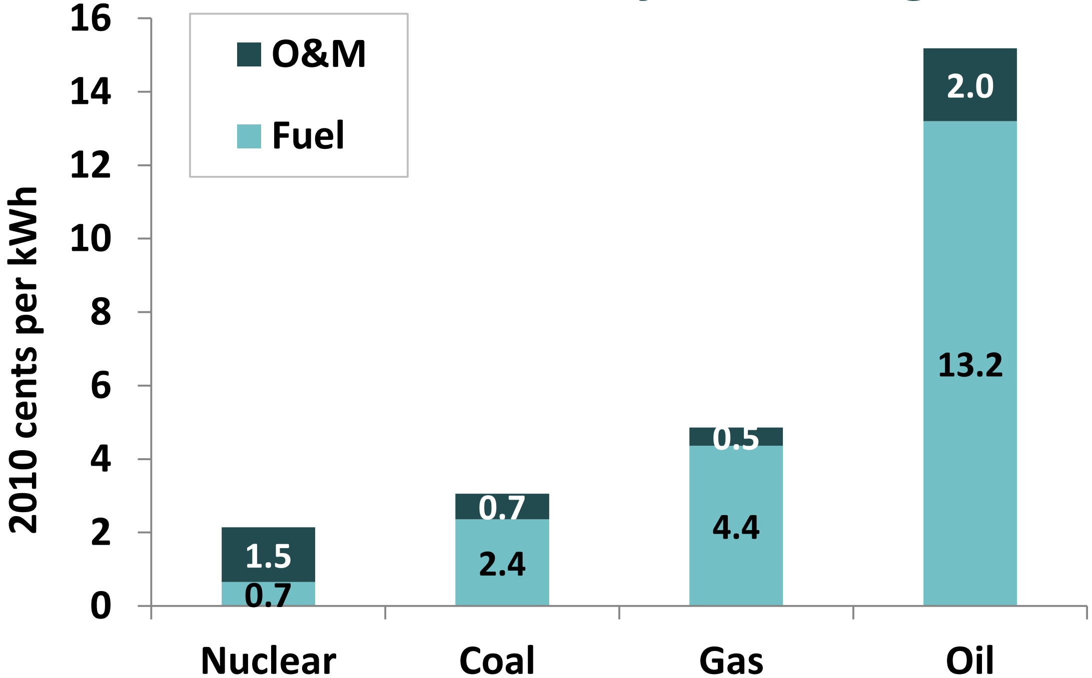
IV. Enrichment Supply

V. Centrifuge Development

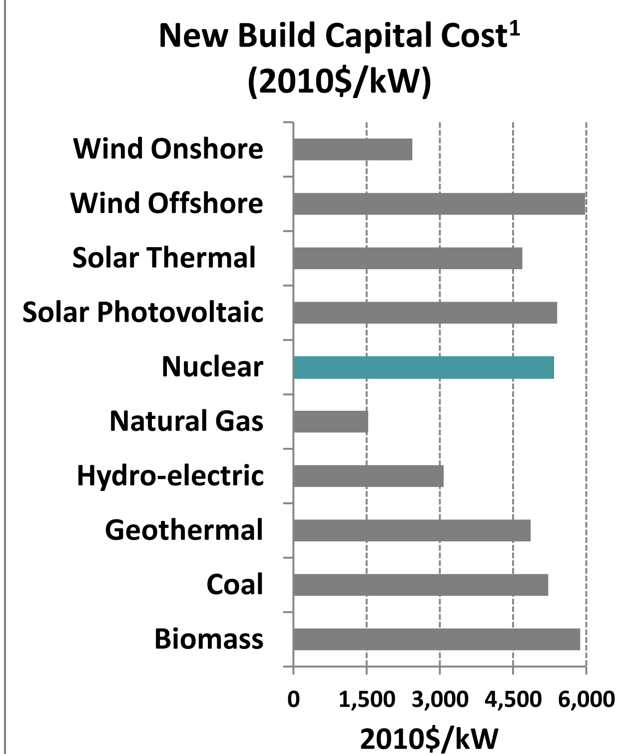
VI. Comparison of Designs

I. Nuclear's Competitive Advantage

Fuel cost is a key advantage



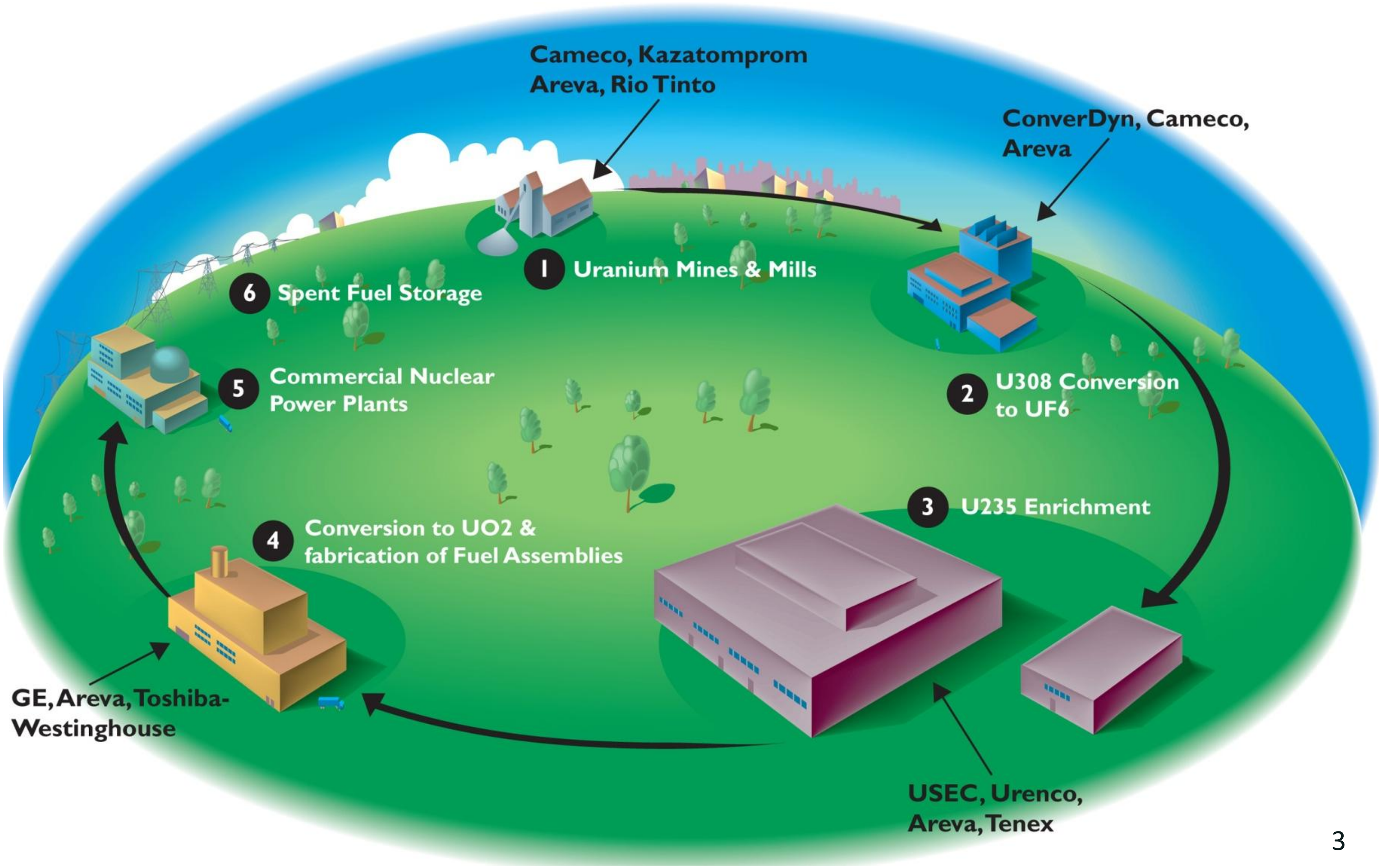
% Fuel Cost	30%	77%	90%	87%



Sources: NEI, DOE

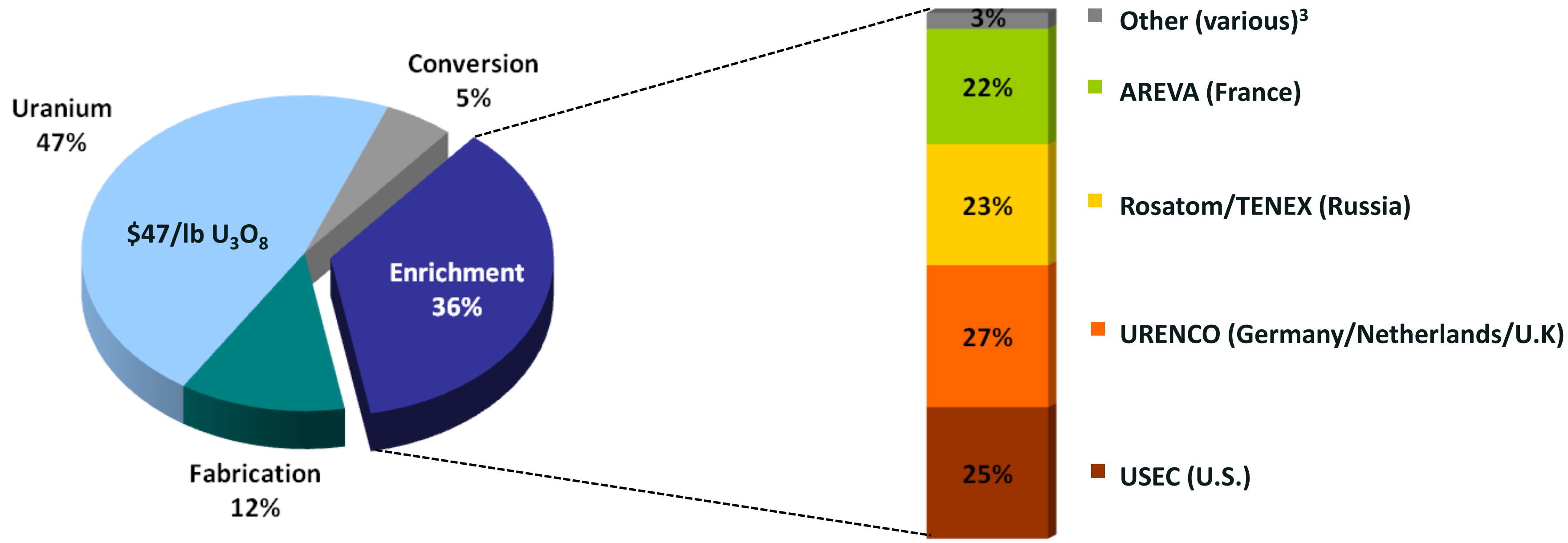
[1] Overnight capital cost (EPC plus owners' costs excluding financing, escalation due to increased material and labor costs, and inflation)

I. Nuclear Fuel Cycle Overview



I. Enrichment Is a Key Element of the Fuel Cycle

2010 Front-End Nuclear Fuel Market Costs[1] | **2010 Average Share of Worldwide Deliveries[2]**



Front-End Nuclear Fuel Industry:
$22 Billion

Enrichment Industry:
≈ 49 MMSWU[4] or $8 Billion

[1]Based on TradeTech, LLC 2010 average term market prices for SWU and conversion and average uranium price of $47/lb U3O8. Assumes 4.0% product assay, 0.30 w/o tails and 0.5% conversion losses

[2] USEC estimate

[3] Includes supply from China, Japan, and Brazil

[4] WNA Reference case 2010 worldwide demand (assumes 0.25% tails assay for Western-origin reactors and 0.15% tails assay for Russian-origin reactors)

II. Terminology

Enrichment

- Concentrating the amount of U^{235} in uranium to typically 3% to 5% (product)
- Feed: typically natural uranium ~0.7% U^{235} and 99.3% U^{238}
- Tails: what remains after the enriched product is removed, expressed as the percentage of U^{235} in the material

Uranium Form

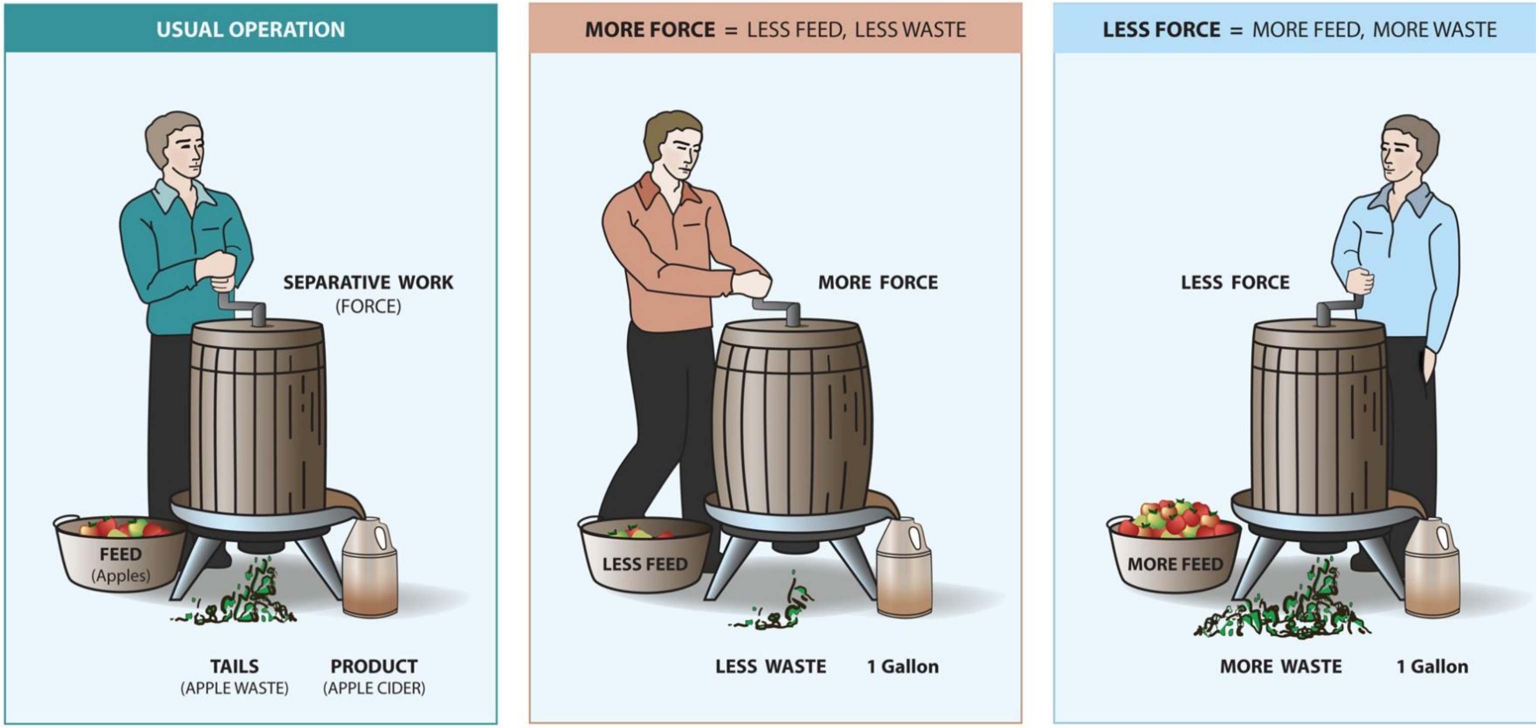
- For current technologies, enrichment plants require the uranium to be in the form of uranium hexafluoride (UF_6)
  - Solid at room temperature and a gas above ~80°C

II. What is a SWU?

Separative Work Unit (SWU)

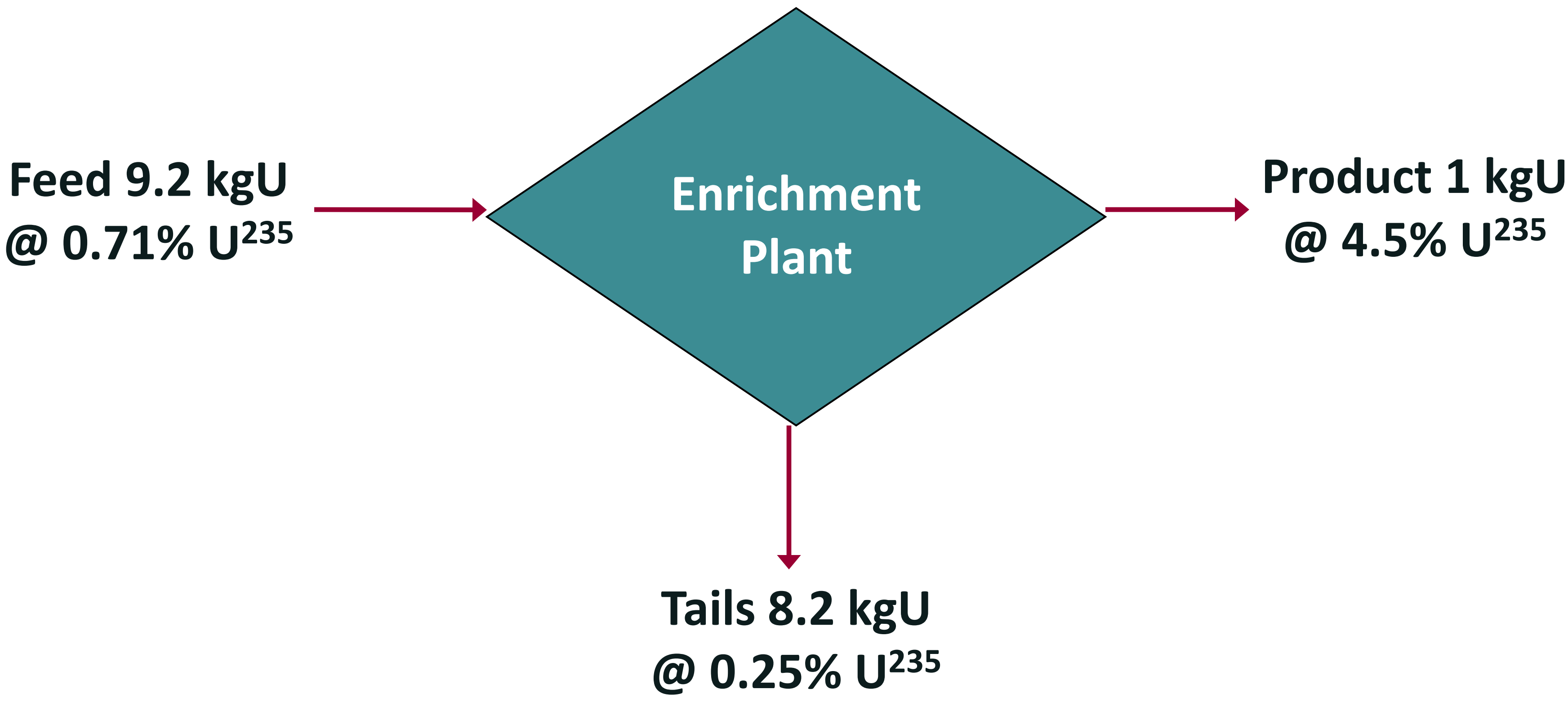
- A measure of the separation achieved in an uranium enrichment plant after uranium of a given U^{235} content is separated into two components, one having a higher percentage of U^{235} (product) and one having a lower percentage of U^{235} (tails)

Separative Work & Tails Analogy (Making 1 Gallon of Apple Cider)

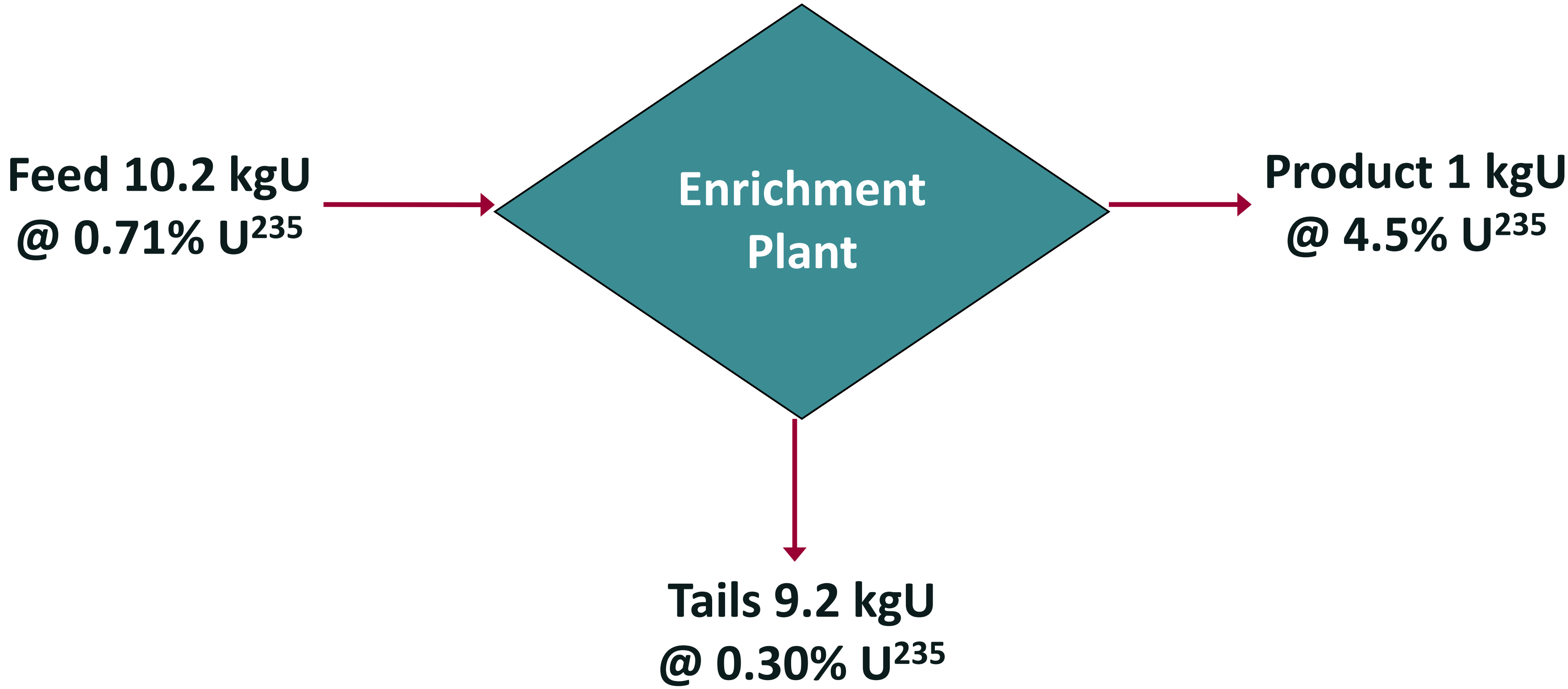


Source: USEC

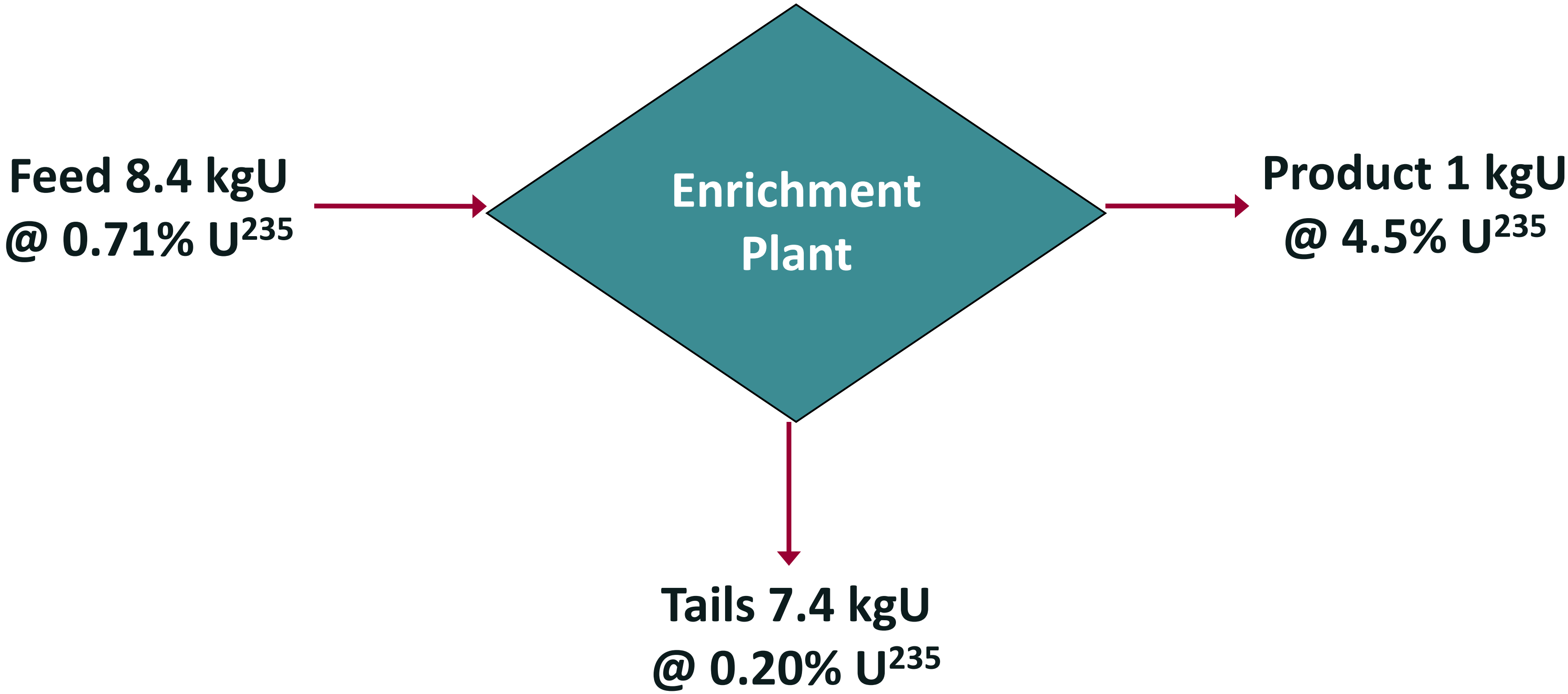
II. Enrichment Plant Material Flow @ 0.25 tails



II. Enrichment Plant Material Flow @ 0.30 tails



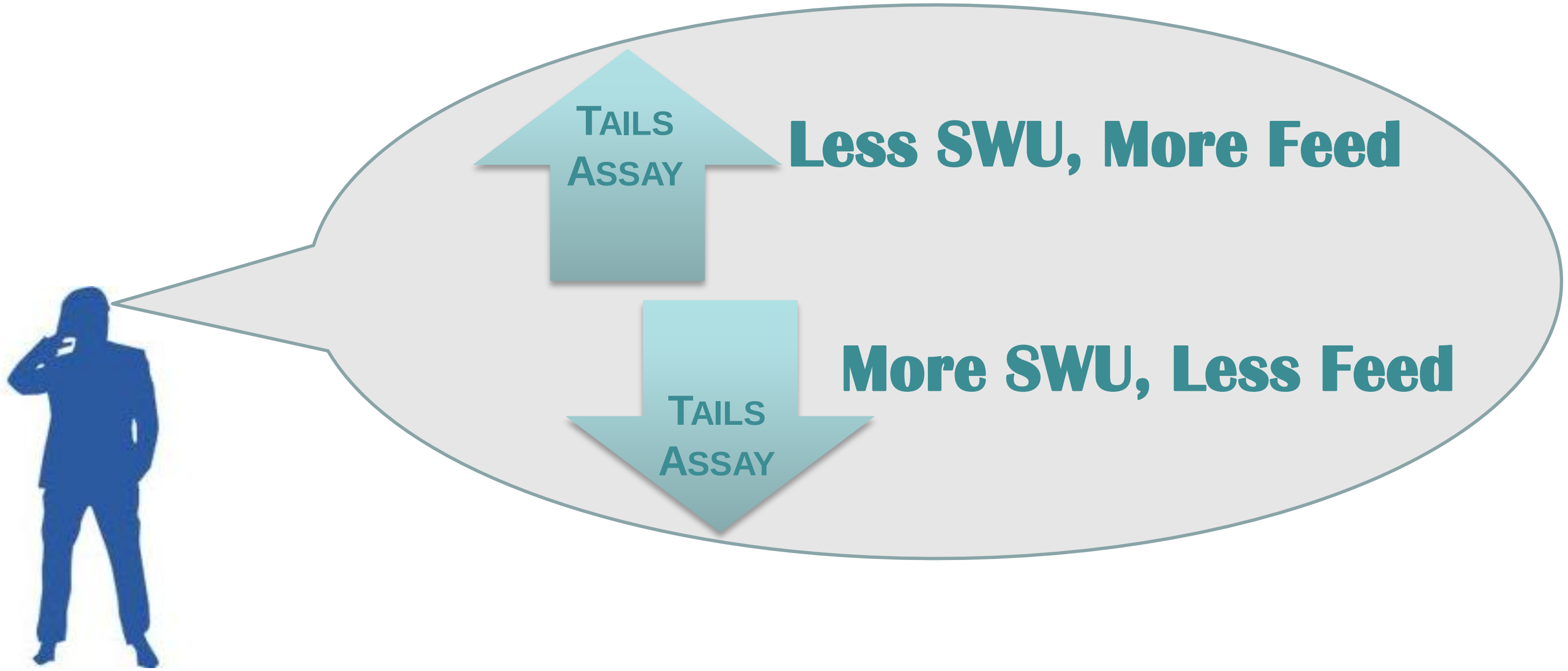
II. Enrichment Plant Material Flow @ 0.20 tails



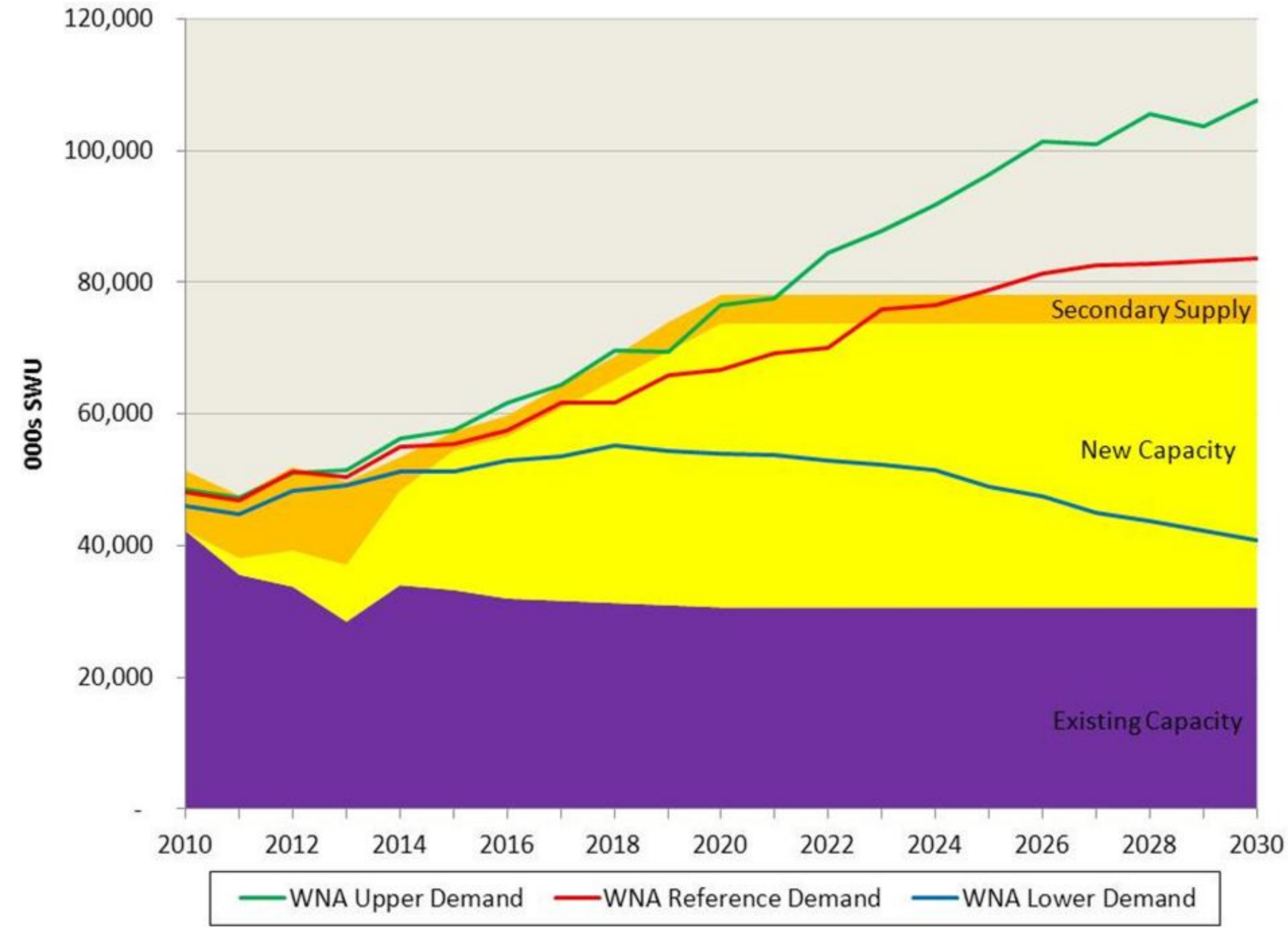
II. Economic Considerations

Product assay based on reactor operational needs

Transactional tails assay based upon relative costs of feed and SWU and contract limits (actual tails assay at enrichment plant often differs)



II. Enrichment demand: today - 2030



Source: WNA

III. Enrichment Technologies

Based upon the small differences in weight between U^{235} and U^{238}

- Gaseous Diffusion
- Gas Centrifuge

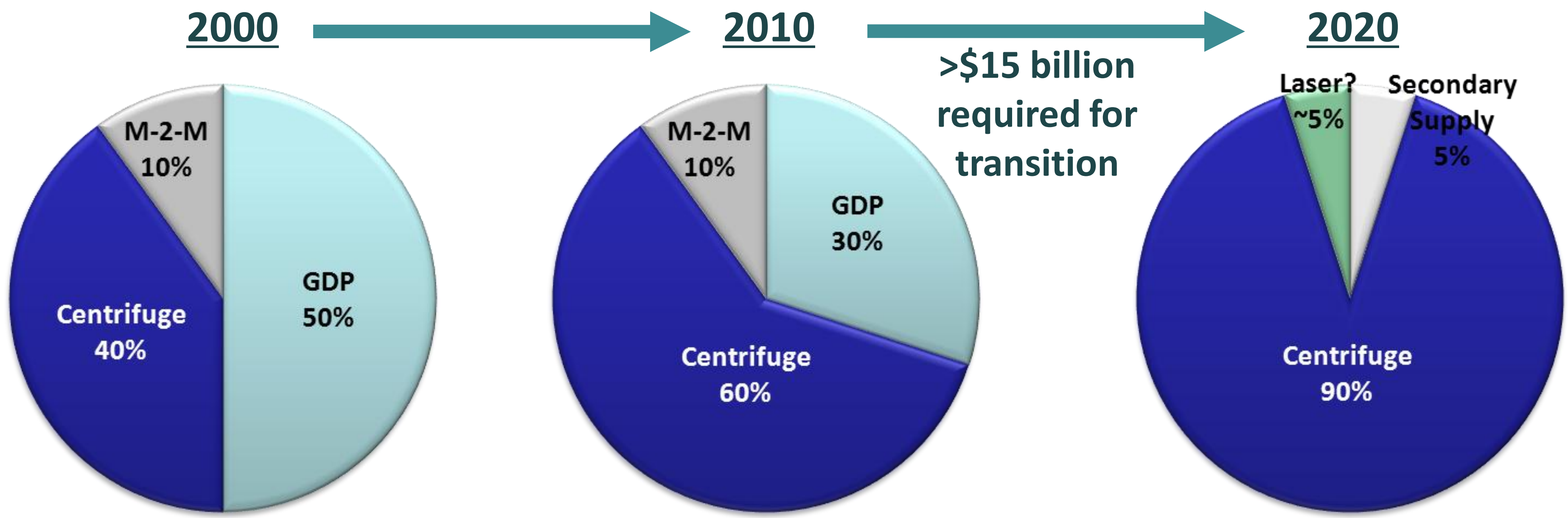
Based upon differences in atomic or molecular properties

- Atomic Vapor Laser Isotope Separation (AVLIS)
- Molecular Laser Isotope Separation (MLIS)
- Separation of Isotopes by Laser Excitation (SILEX)
- Aerodynamic Separation Process

III. Transition to Centrifuge

Industry estimates indicate a 3 million SWU plant will cost approximately $3 billion

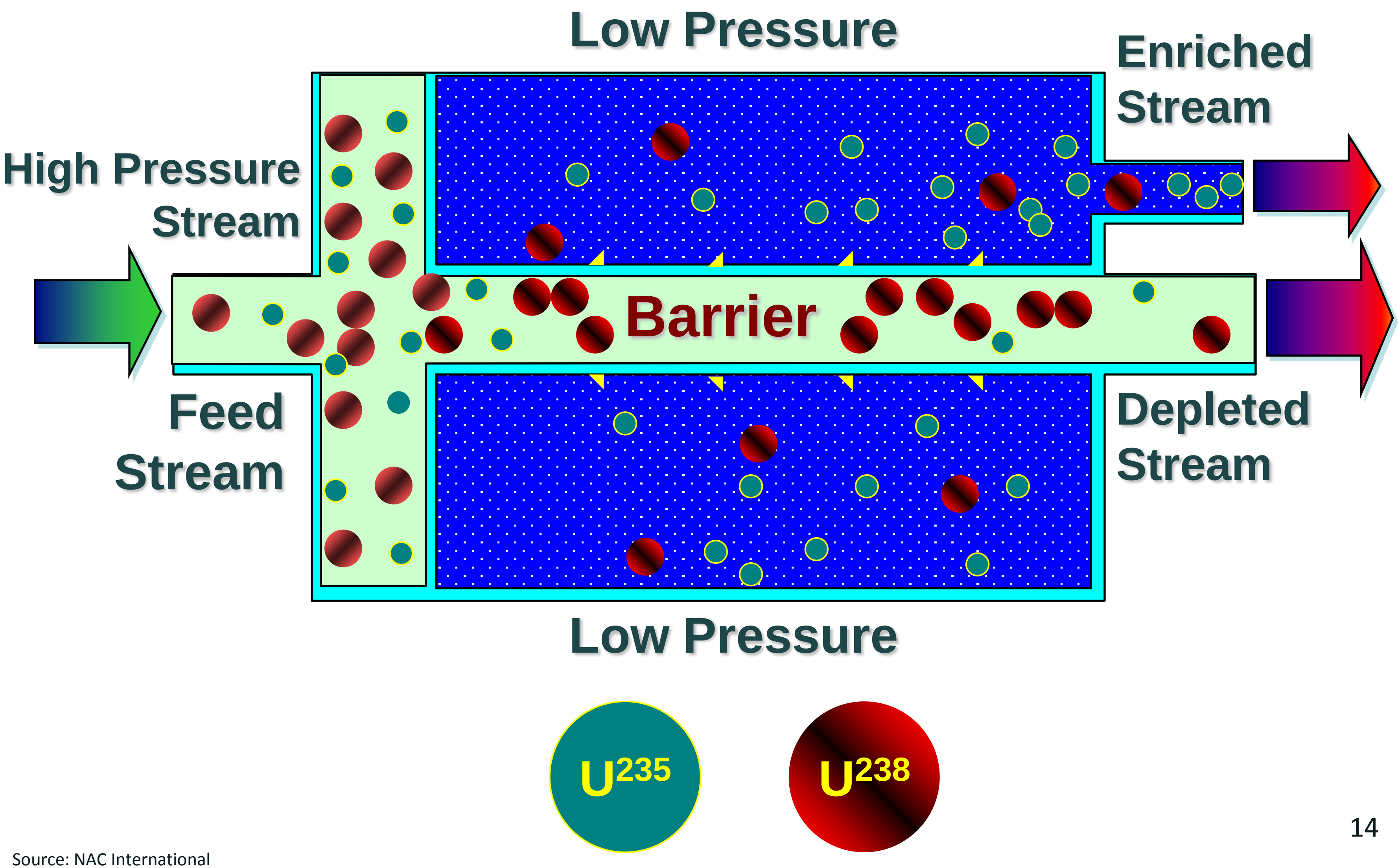
- Sufficient to fuel about 30 reactors' reload requirements per year



M2M: Megatons to Megawatts program

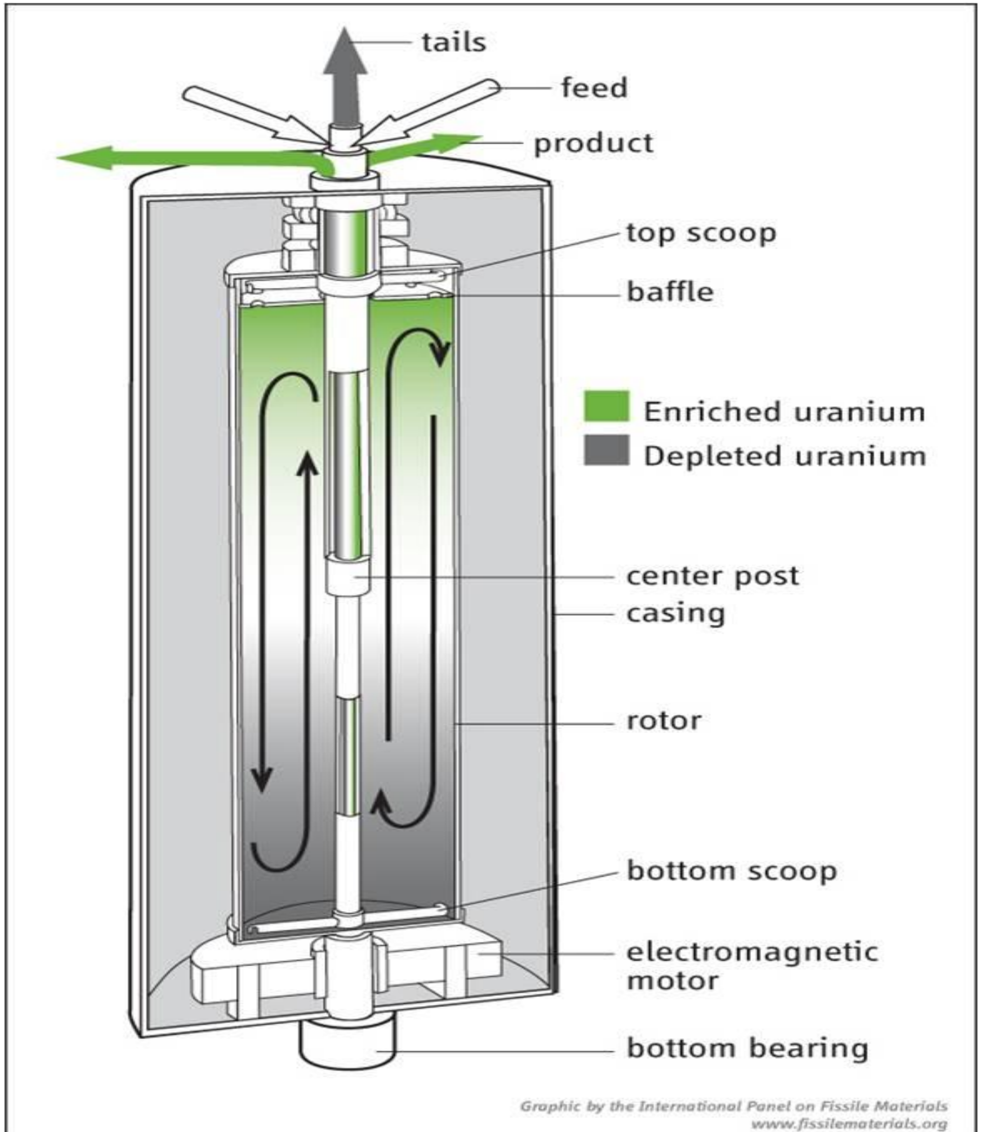
Source: USEC (assuming deployment of planned facilities)

III. Gaseous Diffusion

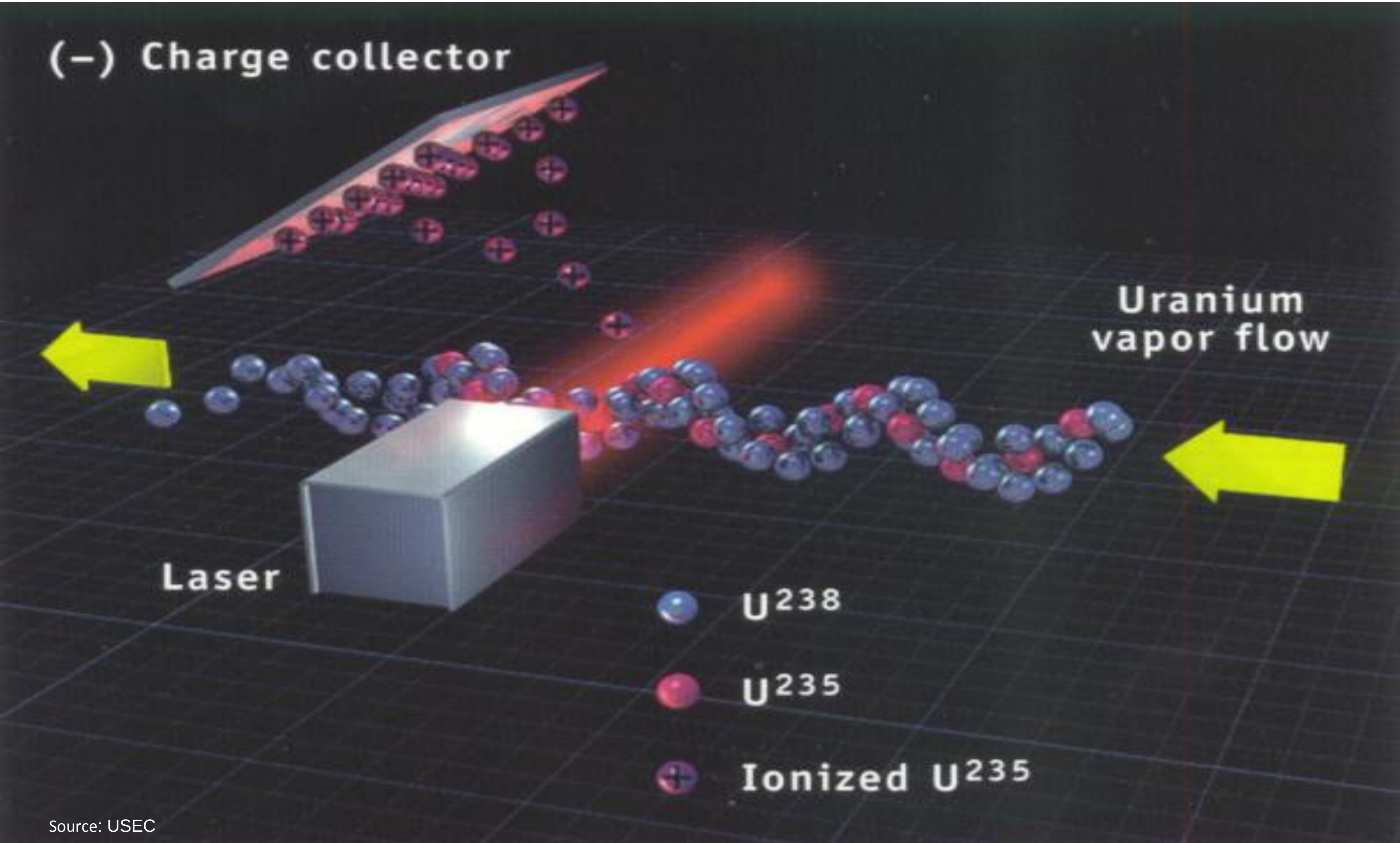


Source: NAC International

III. Gas Centrifuge

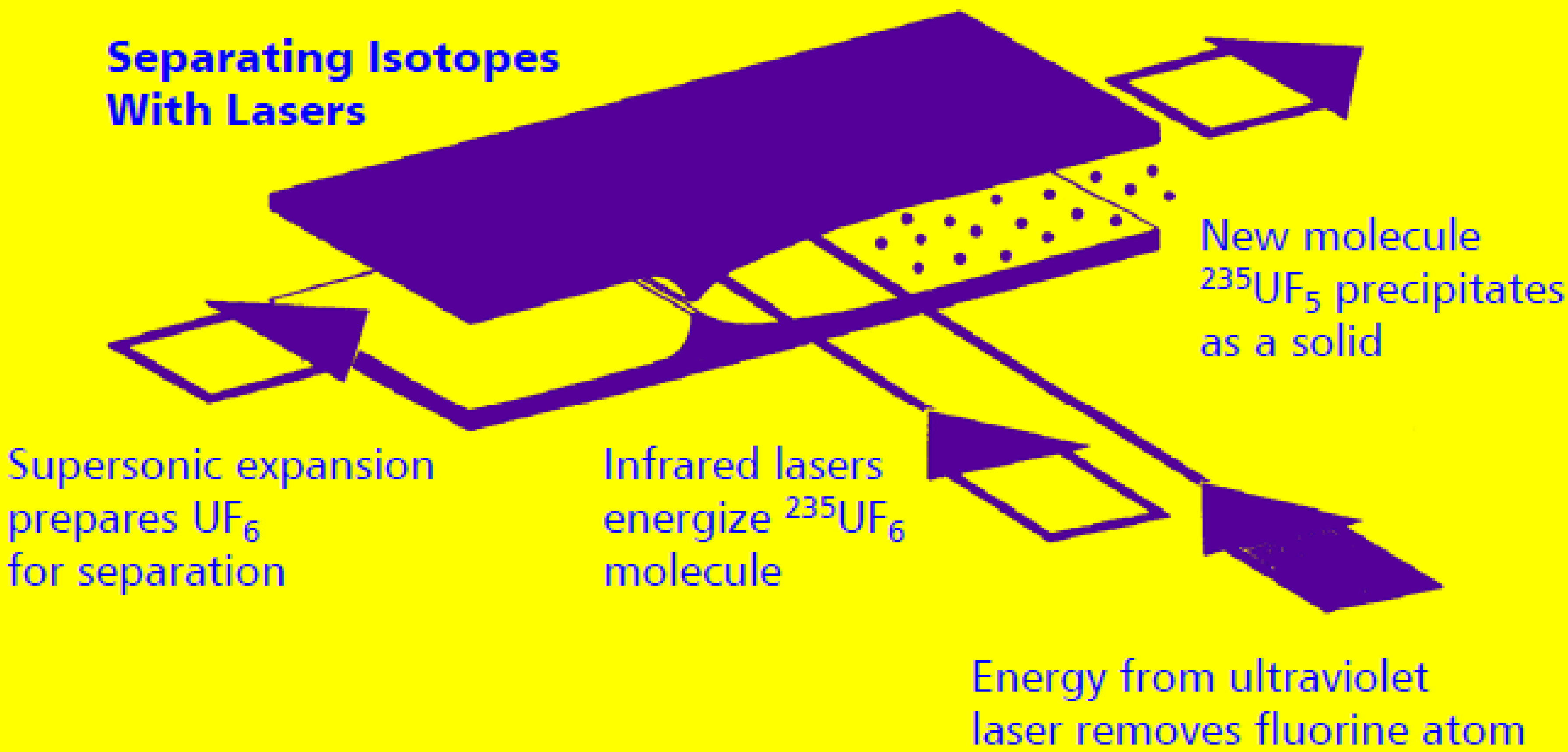


III. AVLIS



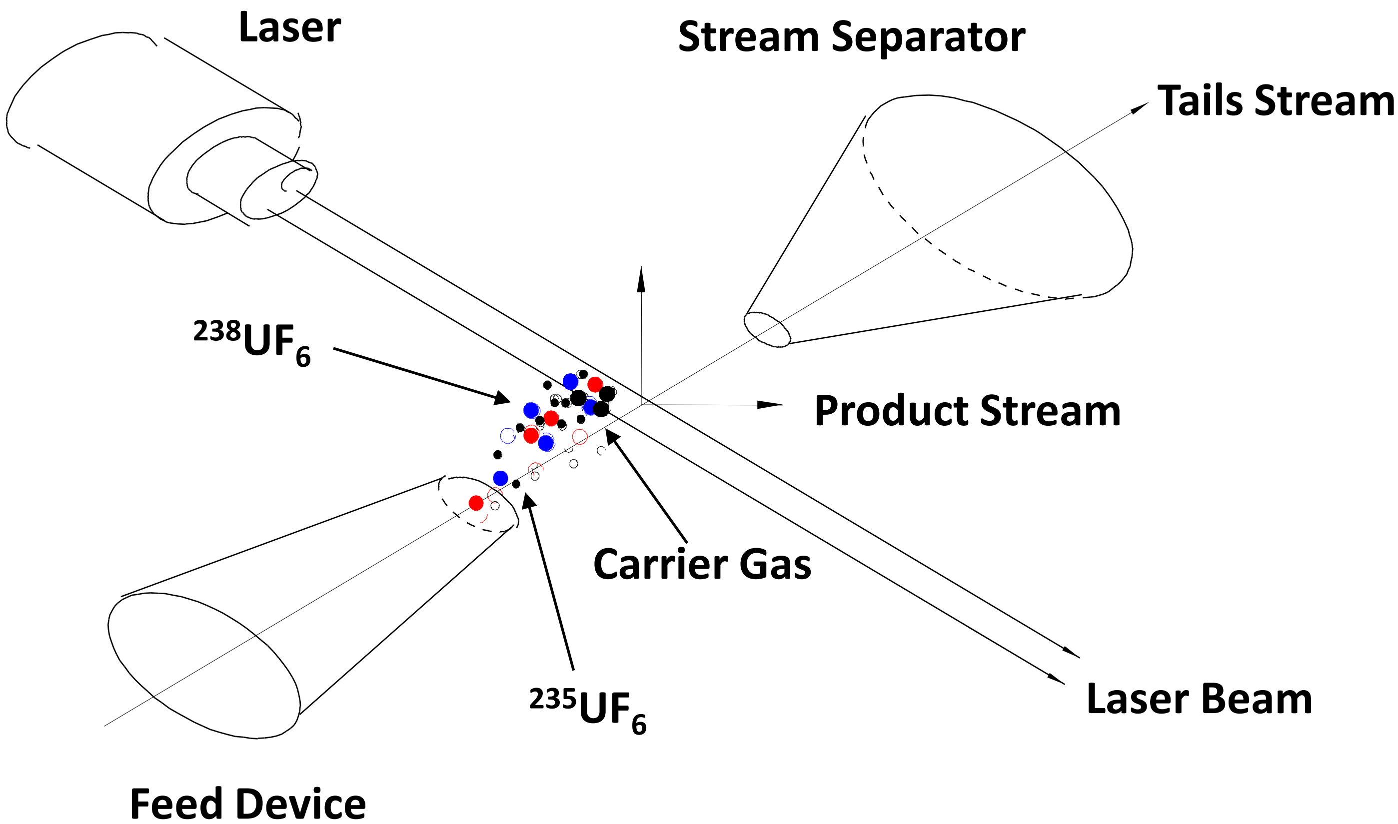
Source: USEC

III. MLIS



Source: NAC International

III. SILEX



Source: USEC

III. Aerodynamic Separation Process

Stationary walled centrifuge uses the same physical principle as a rotating centrifuge

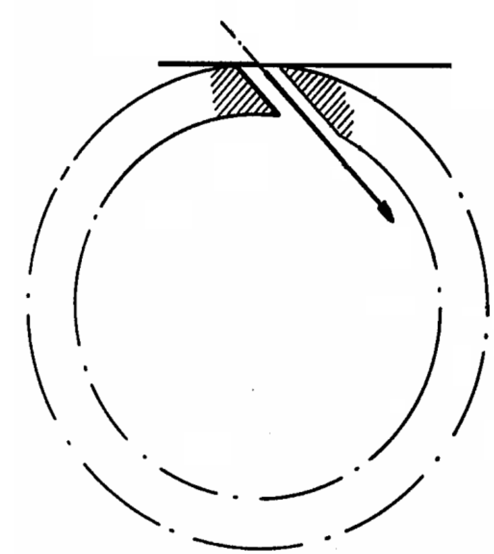
Processes have relatively high separation factors (1.025 to 1.030) over an element

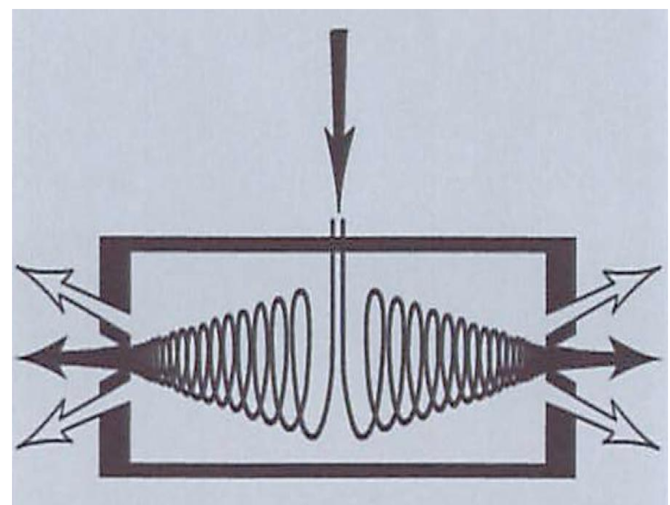
Extremely high energy requirements

Fewer stages required due to re-feeding of material

High capital, high power

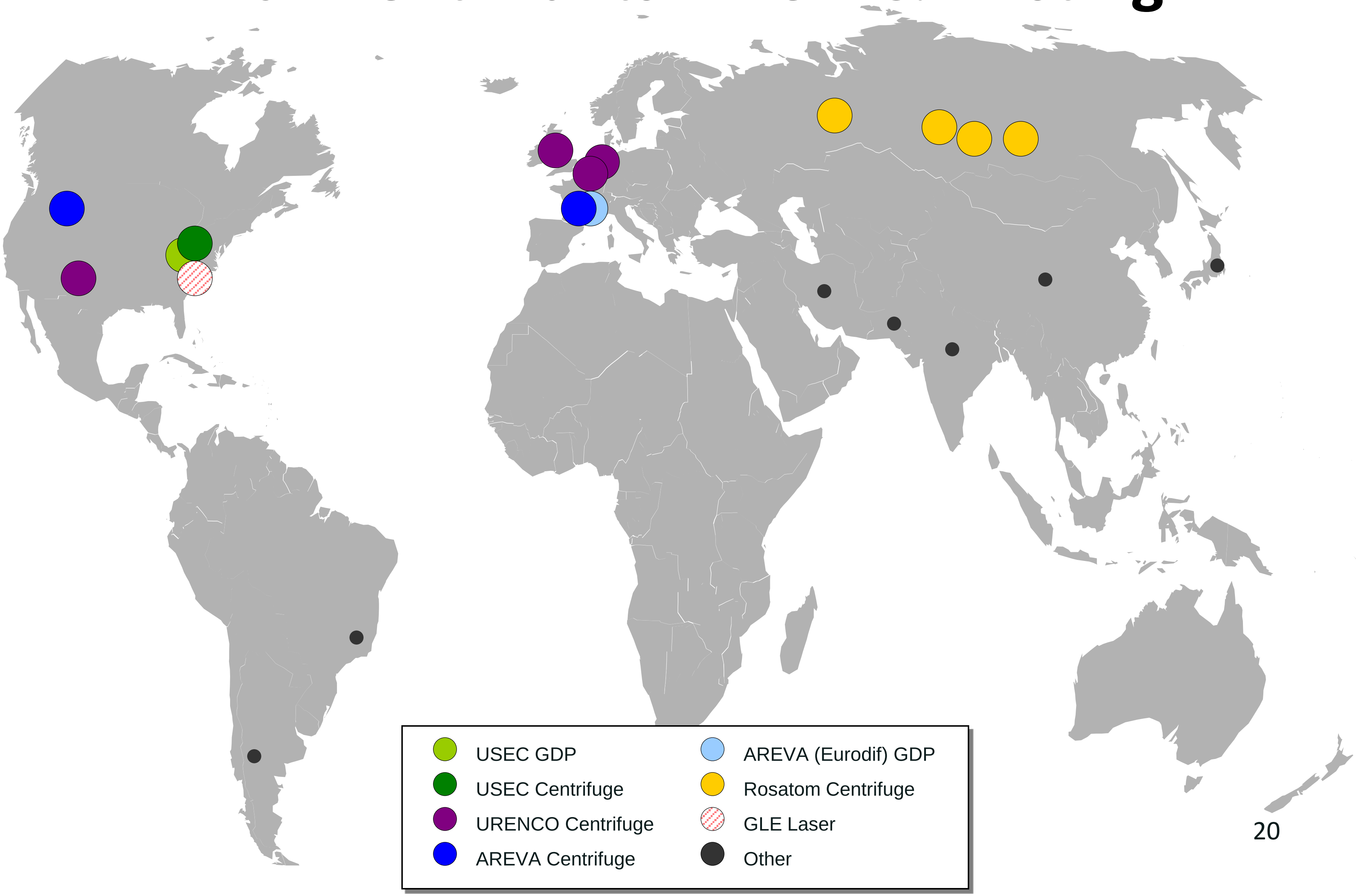
(~3,000 kWh/SWU)





Sources: NAC International; image courtesy of Klydon

IV. Enrichment Plants – New & Existing



IV. Principal Suppliers

Supplier	Market Share[1]	Enrichment Technology
USEC	25%	• Currently using gaseous diffusion • Deploying centrifuge
URENCO	27%	• ETC[2] centrifuge
Rosatom / TENEX	23%	• Centrifuge
AREVA	22%	• Currently using gaseous diffusion • Deploying ETC centrifuge
Other	~ 3%	• China (“black-box” Russian centrifuge) • Japan (JNFL centrifuge) • Brazil (INB centrifuge)

[1] USEC 2010 estimate

[2] Enrichment Technology Company (ETC) is a joint venture company owned in equal shares by URENCO and AREVA

IV. Secondary Supplies

The Megatons to Megawatts™ Program is a unique, commercially financed government-industry partnership[1] in which bomb-grade uranium from dismantled Russian nuclear warheads is recycled into LEU used to produce fuel for American nuclear power plants

20-year, $8 billion program at no cost to taxpayers

412 metric tons of bomb-grade HEU have been recycled into 11,905 metric tons of LEU, equivalent to 16,494 nuclear warheads eliminated[2]

The LEU received from Russia each year under this agreement is deemed to contain ~5.5 MMSWU

[1] USEC, as executive agent for the U.S. government, and TENEX, acting for the Russian government

[2] As of December 31, 2010

IV. Paducah, Kentucky

Source: USEC

IV. USEC: Gaseous Diffusion Enrichment Stage

Source: USEC

IV. USEC: American Centrifuge

Source: USEC

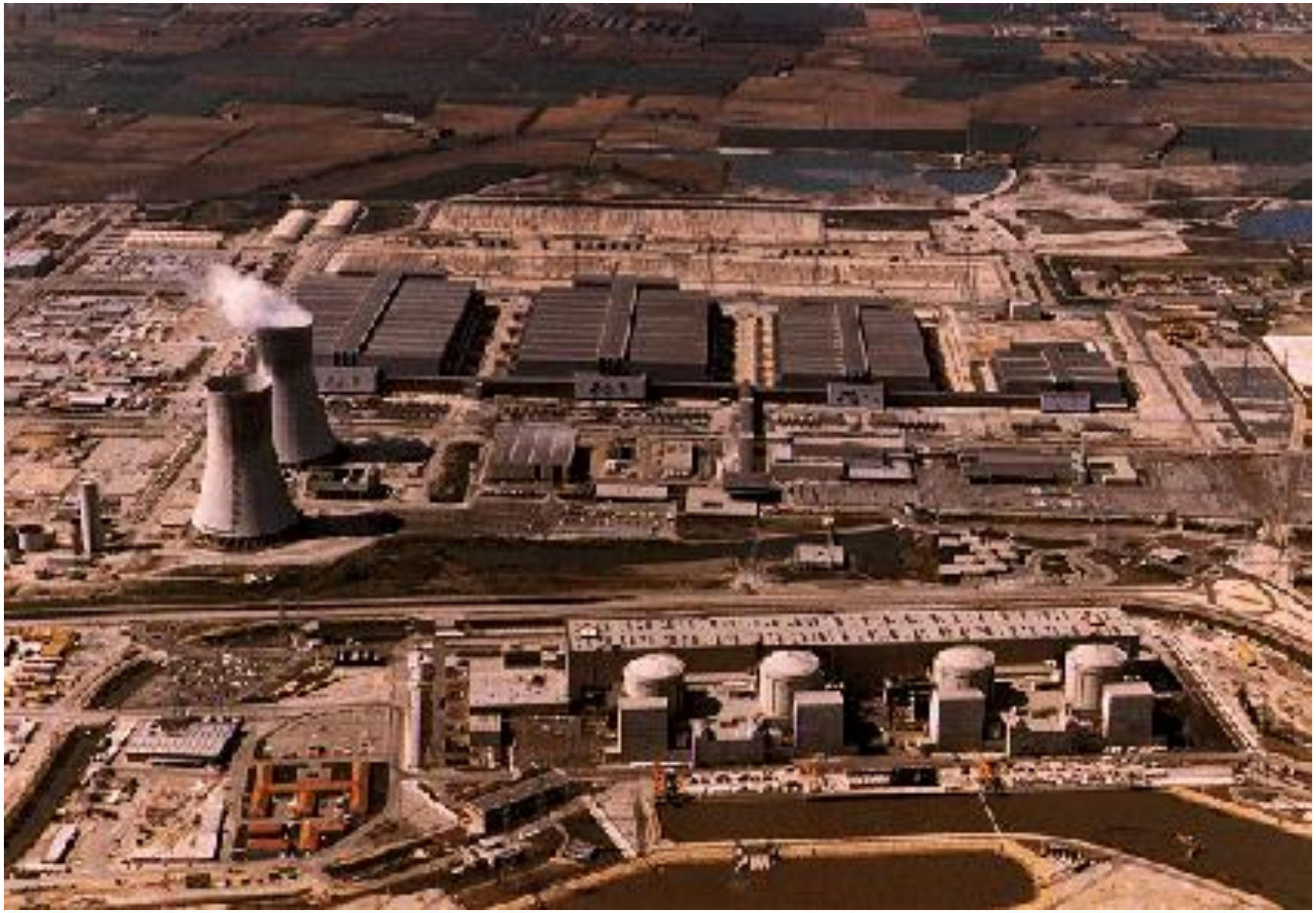
IV. Depleted Uranium

Large quantities of depleted UF_6 has accumulated at the gaseous diffusion plants in the U.S.

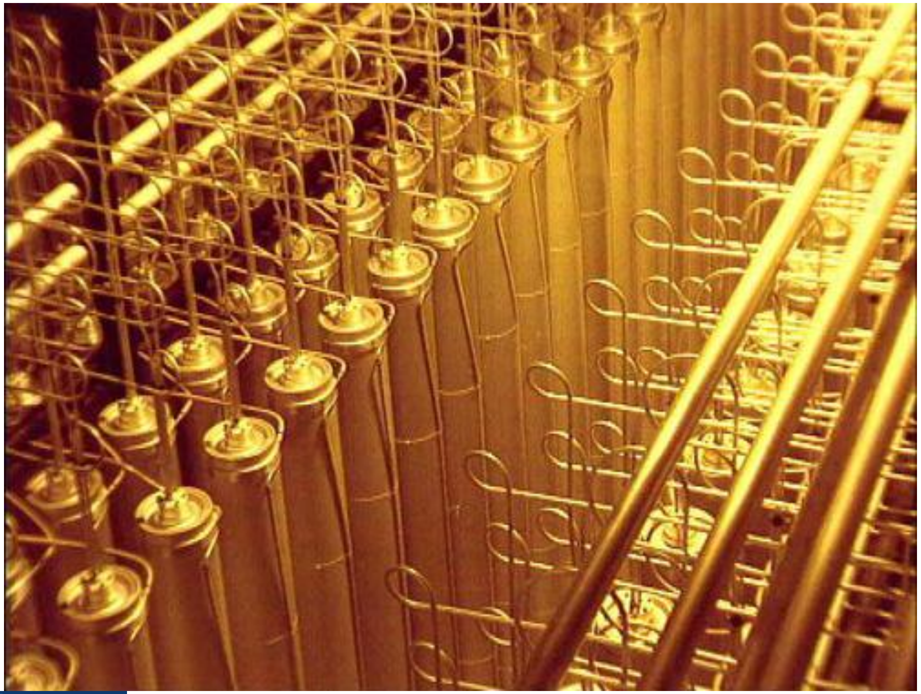
Location	Total Cylinders	Total Depleted UF_6 (metric tons)
Paducah, Kentucky	36,191	436,400
Portsmouth, Ohio	16,109	195,800
Oak Ridge, Tennessee	4,822	54,300
U.S. Total	**57,122**	**686,500**

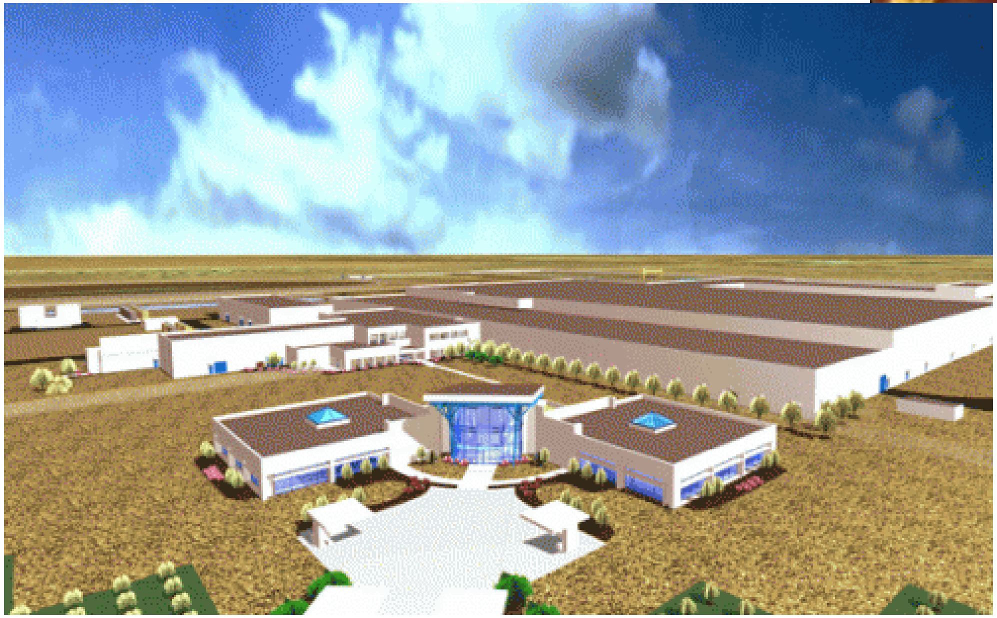
Source: Argonne National Laboratory (U.S. Department of Energy, Office of Environmental Management)

- The AREVA George Besse gaseous diffusion plant:



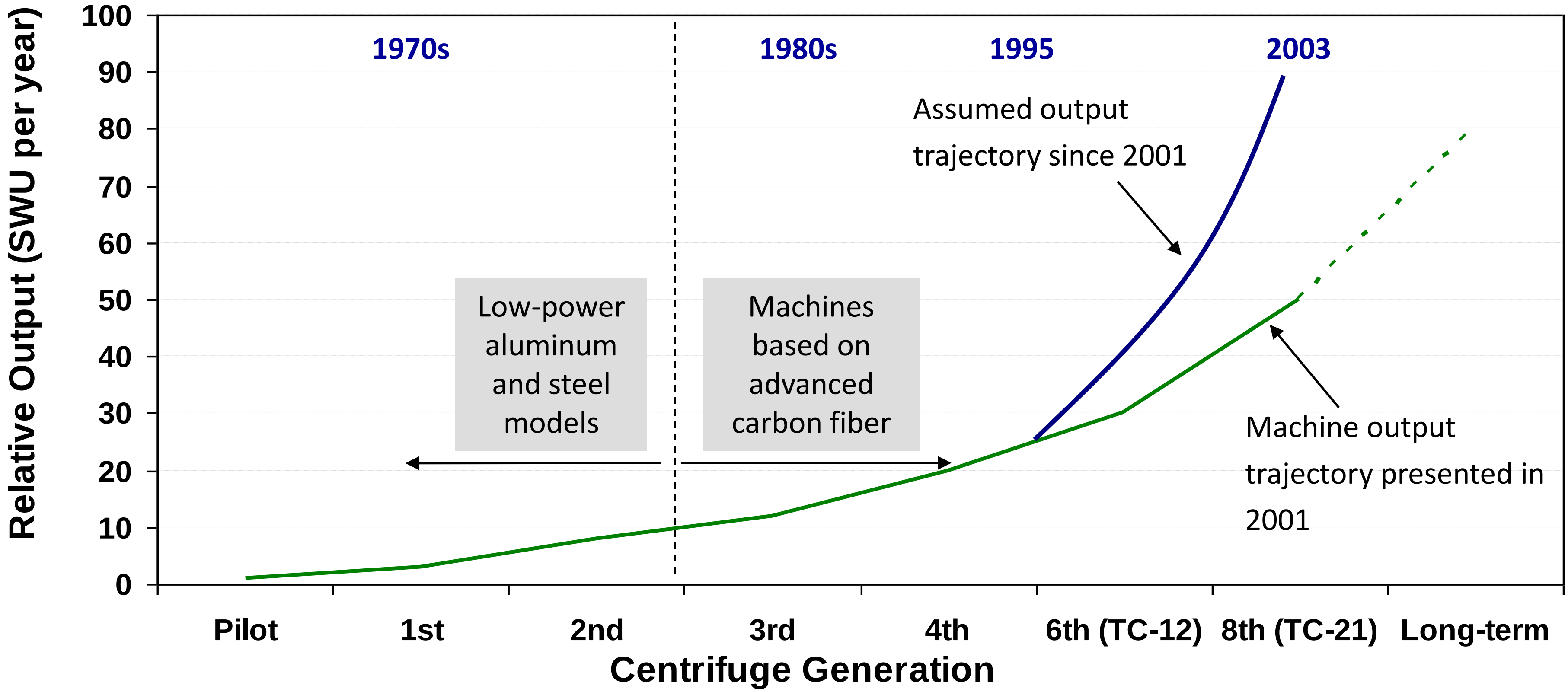
A bank of centrifuges at a URENCO plant





The URENCO Eunice plant

V. ETC Centrifuge Development

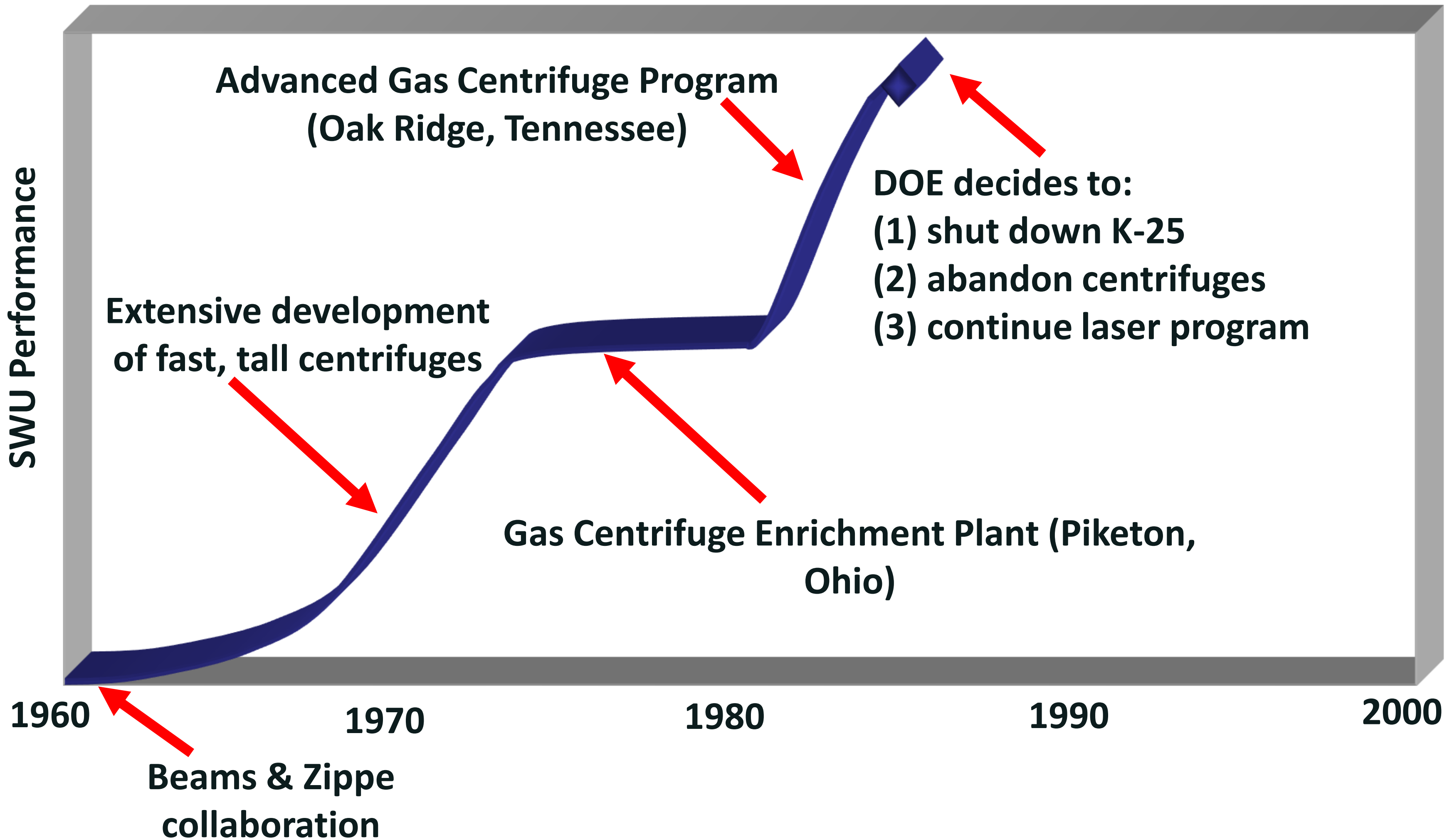


Source: UxC 4Q 2009 Enrichment Market Outlook; USEC

A URENCO centrifuge

ORNL gas cascade centrifuge

V. U.S. Centrifuge Development



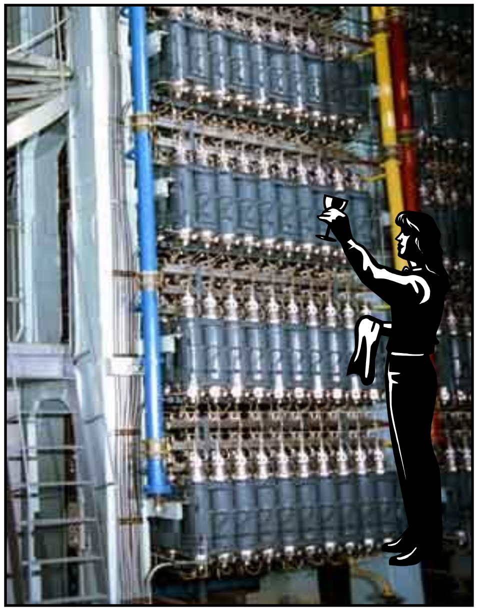
Source: USEC

VI. Comparison of Technologies

Technology	Power	Capacity	Availability/Flexibility
Gaseous Diffusion	▪ Power intensive ▪ ~2500 kWh/SWU	Economies of scale	Ability to increase power and output
Centrifuge	▪ Energy efficient ▪ 50-60 kWh/SWU	Modular expansion	Favorable lead times in comparison to new reactor builds
SILEX	▪ Low power consumption	Modular expansion	Technology can be applied for silicon & other elements
AVLIS	▪ Low energy inputs	Modular technology	High separative capacity

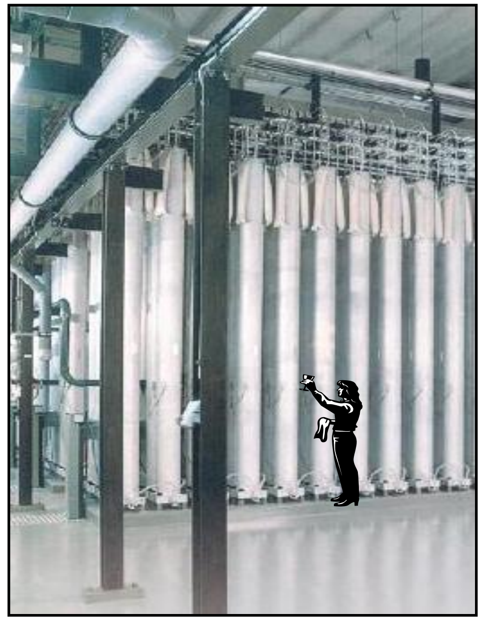
Sources: Silex; USEC; WNA

VI. Comparison of Centrifuge Designs



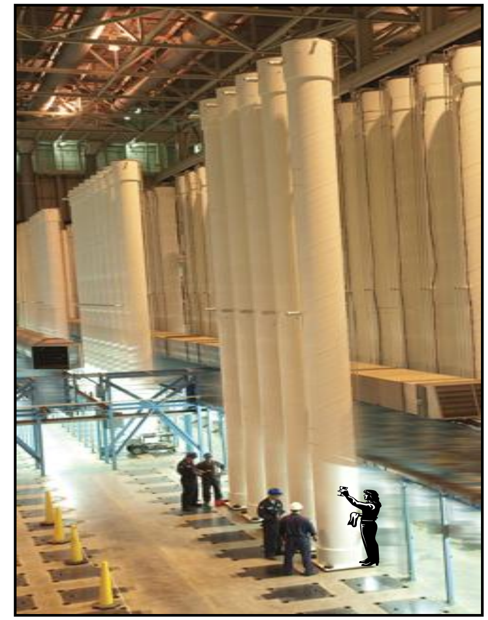
Russian

<10 SWU/year



European (TC-12)

~40-45 SWU/year



American

~350 SWU/year

Source: USEC

Questions