

# American Centrifuge overview

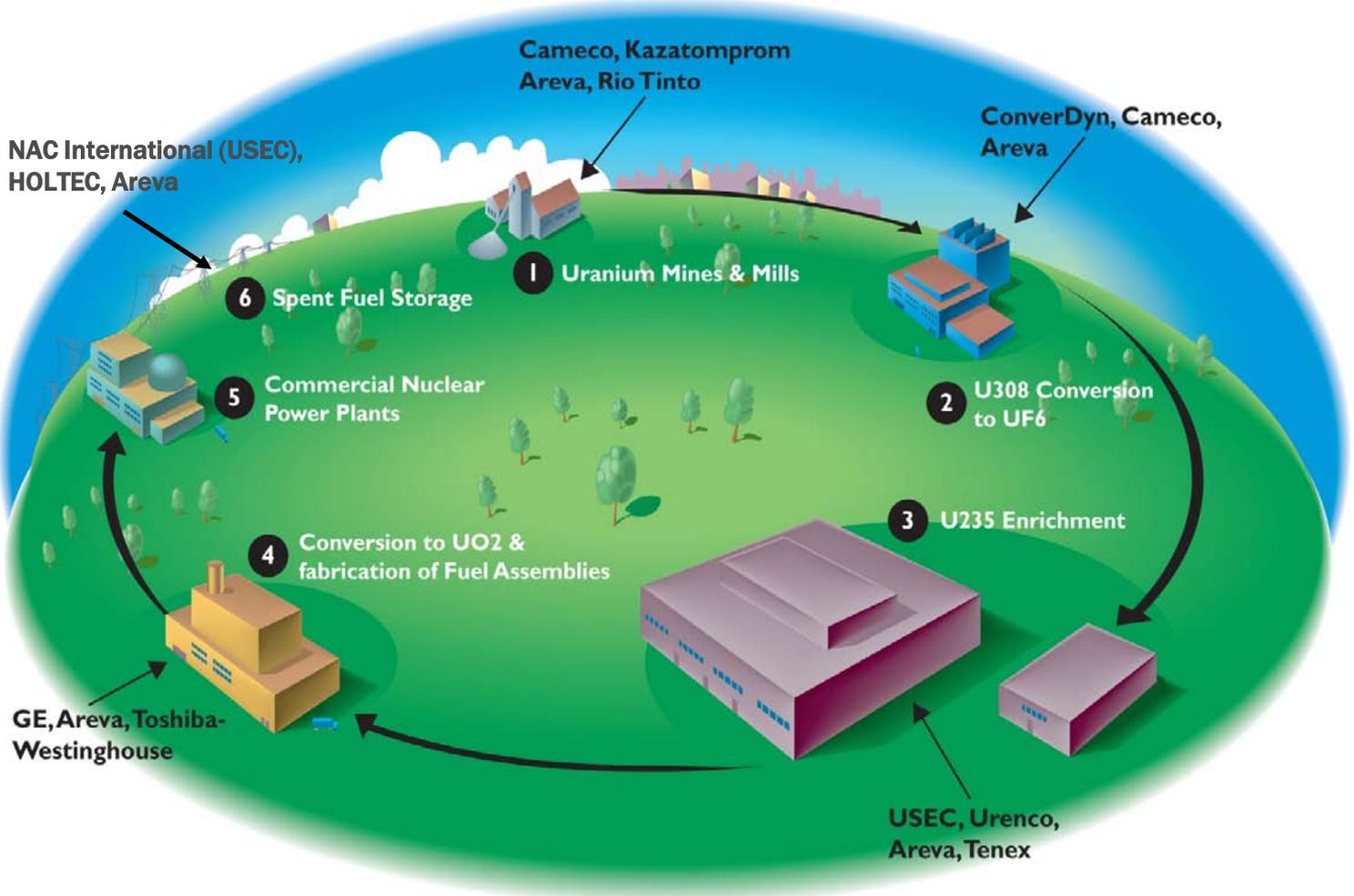


Governor's Energy Summit

December 6, 2011

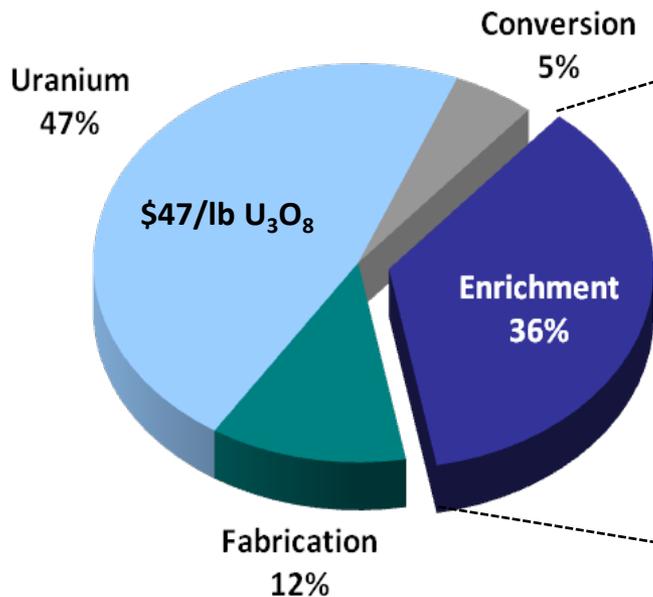


# USEC's Role in the Nuclear Fuel Cycle



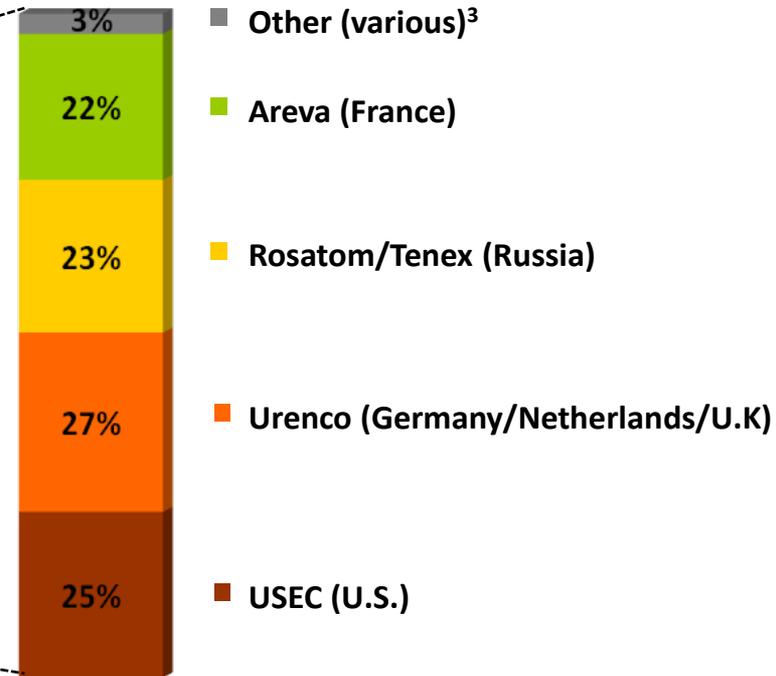
# Worldwide Enrichment Industry

2010 Front-End Nuclear Fuel Market Costs<sup>1</sup>



**Front-End Nuclear Fuel Industry:  
\$22 Billion**

2010 Average Share of Worldwide Deliveries<sup>2</sup>



**Enrichment Industry:  
≈ 49 MMSWU<sup>4</sup> or \$8 Billion**

<sup>1</sup>Based on TradeTech, LLC 2010 average term market prices for SWU and conversion and average uranium price of \$47/lb U<sub>3</sub>O<sub>8</sub>. Assumes 4.0% product assay, 0.30 w/o tails and 0.5% conversion losses

<sup>2</sup> USEC estimate

<sup>3</sup> Includes supply from China, Japan, and Brazil

<sup>4</sup> WNA Reference case 2010 worldwide demand (assumes 0.25% tails assay for Western-origin reactors and 0.15% tails assay for Russian-origin reactors)

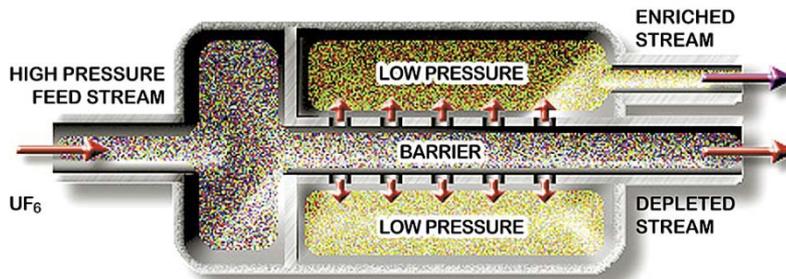
# What is enrichment?

Uranium is a naturally occurring element containing U235 and U238 isotopes. Only the U235 isotope is fissionable.

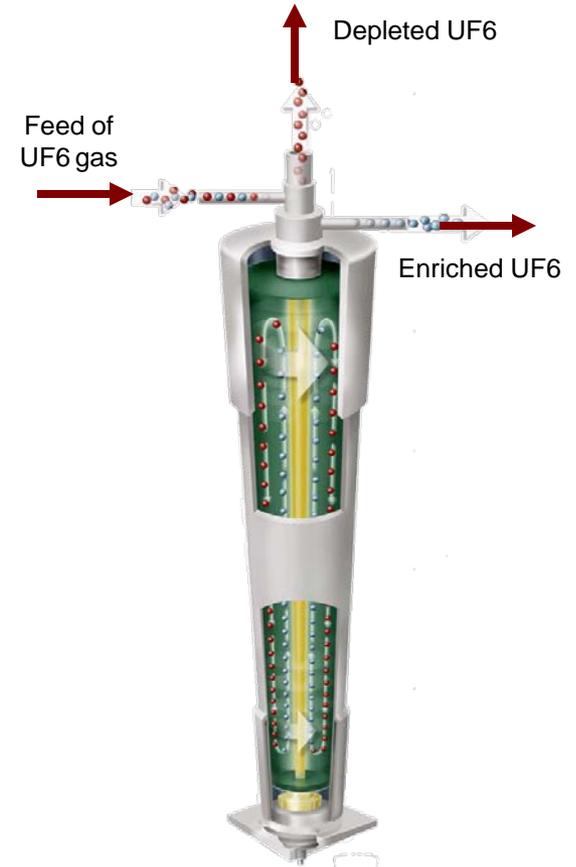
Enrichment is the process of increasing the concentration of U235 in natural uranium and decreasing the proportion of U238. Uranium hexafluoride gas (UF<sub>6</sub>) is used in this process.

Natural uranium contains about 0.7% U235. The fuel that powers a commercial nuclear reactor needs uranium with a 4% - 5% concentration of U235.

Commercial uranium enrichment currently employs one of two technologies: gaseous diffusion and gas centrifuge.



***Gaseous diffusion***



***Gas centrifuge***

# Current Enrichment Operations



*The largest commercially operating uranium enrichment facility in the United States*

**Paducah GDP is operating at its highest efficiency and capacity in decades.**

**Approximately 6.0 million Separative Work Units (SWU) produced in 2010.**

## **Gaseous Diffusion Plant – Paducah, KY**

Built in 1951-54 by the Atomic Energy Commission.

Gaseous diffusion production began in 1952.

Four enrichment process buildings with total floor area of 150 acres; total site area of 750 acres.

Leased from the DOE with limited USEC environmental and decommissioning liability.

USEC has extended its lease through June 2016, with renewal rights continuing thereafter.



***Diffusion cell arrangement***

# The Next Generation in Enrichment – American Centrifuge

USEC Inc. is deploying an advanced uranium enrichment technology called American Centrifuge.

This technology was developed by DOE from the late 1960s through 1985. DOE invested over \$3 billion, and in the past decade USEC has invested \$2 billion.

USEC improved the technology through modern materials, advanced computer design, digital controls and state-of-art manufacturing processes.

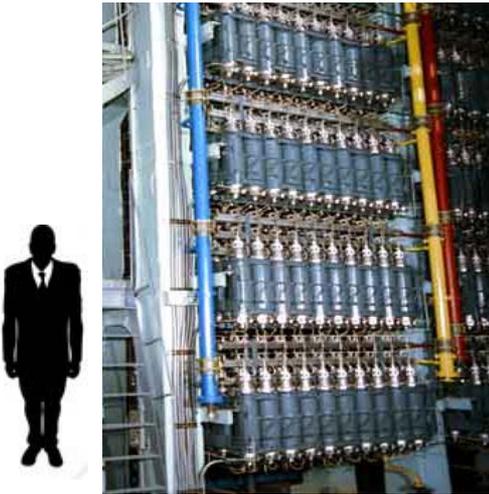


*DOE's Gas Centrifuge Enrichment Program, 1980s*



*American Centrifuge, today*

# American Centrifuge – scale



## Russian (Tenex)

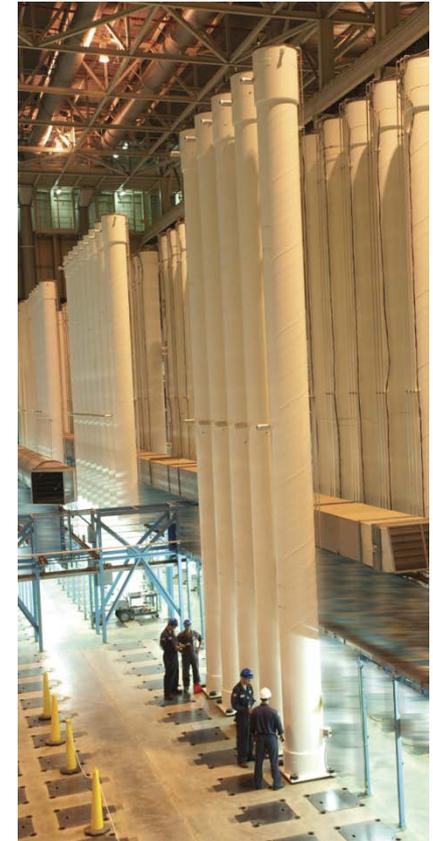
Produce approximately  
4-8 SWU per  
machine per year



## European (TC-12)

Produce approximately  
40-45 SWU

*(Note: newer TC-21  
model, in development,  
may produce up to 80  
SWU)*



## American Centrifuge

Produce approximately  
350 SWU

# Why American Centrifuge?



***Assembled machines ready for installation***

**Security of supply:** enhances long-term nuclear fuel supply; supports American energy security.

**Manufacturing:** develops an essential U.S. technology and related manufacturing capacity.

**American jobs:** will create up to 8000 manufacturing, construction, and associated jobs in a number of states, with 350+ in West Virginia

**National security interests:** supports nuclear energy nonproliferation efforts and maintenance and modernization of the nuclear arsenal.

**Modular expansion:** production can begin incrementally as machines are installed; allows for potential future expansion.

**Environmental benefits :** uses approximately 95% less electricity than current gaseous diffusion technology; will reduce greenhouse gases by 10,000,000 tons of emissions each year.

# American Centrifuge Suppliers



*Work related to the American Centrifuge Project in West Virginia occurs at ATK's facility in Rocket Center. There ATK manufactures the large carbon-fiber rotors for the American Centrifuge machines. Additionally, Northwest Pipe in Parkersburg will manufacture steel tubing for the external casings of the centrifuges. More that 11,500 centrifuges are planned to be built.*

American Centrifuge Project Jobs*		
State	Current	Peak
Ohio	725	3,500 – 4,000
Tennessee	851	~1,900
South Carolina	19	~750
Utah	0	~480
Alabama	28	~380
Pennsylvania	73	~380
West Virginia	86	~350
Indiana	17	~120
<b>Total</b>	<b>1,800</b>	<b>7,500-8,000</b>

\* Reflects direct and indirect jobs for first tier suppliers and contractors only. Numbers are rounded and Department of Commerce multipliers used to calculate indirect jobs vary by community and with time

# American Centrifuge – Status

Lead Cascade operations using prototype machines commenced on August 29, 2007.

More than eighteen months of demonstrated AC100 cascade operations and over 800,000 total hours of AC100 and prototype machine operations since 2007.

Performance of the Lead Cascade has been confirmed under a variety of operating conditions with product assays consistent with industry standards.

USEC submitted a loan guarantee application to DOE in 2008, seeking \$2 billion to finance the project; the application was updated in 2010.

**DOE is seeking a cooperative Research, Development, and Demonstration project to further commercialize the technology prior to issuing a loan guarantee.**



*AC100 Lead Cascade*

# The American Centrifuge Plant



Piketon, Ohio



# Interior of Process Building Where Machines Will Be Installed

