URANIUM SUPPLY AND DEMAND

Summary

Sufficiency of the uranium supply depends upon three factors: nuclear power production; uranium resources and reserves; and uranium processing. Nuclear power production, stable for decades, is rising with the construction of new plants. Substantial natural uranium resources exist in the U.S. and globally, and market prices control uranium extraction and processing.

Nuclear power provides one-fifth of U.S. electricity. Utilities in the U.S. and throughout the world are pursuing development of new nuclear reactors, but estimates of the number of reactors that will be built in the coming decades and beyond are highly uncertain. Although some growth is likely, scenarios that vastly increase nuclear power production in the 21st century are highly uncertain.

Uranium is abundant in nature. Because uranium resources and uranium demand are distributed around the globe, adequacy of supplies for U.S. nuclear power plants must be assessed in the context of worldwide supply and demand.[a] At the current rate of worldwide use, identified resources are sufficient to meet demand for approximately 90 years [1], but may be sufficient for 230 years when undiscovered resources are included in the reckoning [2].

URANIUM RESOURCES (MTU)[†]

	Annual Requirements	Identified Resources
U.S.	16,400	207,000
Worldwide	59,100	5,400,000

[†]Requirements data are for 2008. Identified resources data are for 2009 at <$130/Kg. [1]

Identified resources, supplies held in reserve stocks, operational flexibility in enrichment, conversion of highly-enriched uranium and unconventional sources such as uranium in seawater—all enhance the capacity for uranium suppliers to meet future uranium demand. In sum, these factors indicate that the supply of uranium is unlikely to be exceeded by demand for at least 50 years.

Nuclear Power Production and Uranium Demand

The U.S. is the world's largest generator and consumer of nuclear power. The collective generating capacity of 104 operating nuclear power plants exceeds 100 billion watts of electric power (GWe). Nuclear power has supplied about 20 percent of U.S. electricity since 1987 [3]. From 1981 to 2003, each million watts of electric power (MWe) capacity in U.S. nuclear power plants required on average about 0.18 metric tons of uranium metal (MTU) per year [4].

After a long hiatus, there is renewed interest in developing new nuclear power reactors in the U.S. To date the U.S. Nuclear Regulatory Commission (NRC) has received applications for constructing and operating 28 new reactors [5]. However, NRC construction authorization does not ensure that new reactors will be built. Since 2000 the NRC has issued 20-year license extensions to 59 existing reactors with a collective generating capacity of approximately 55 GWe, and it is currently reviewing license extension applications for an additional 18 reactors [6].

Worldwide, 438 reactors were operational at the end of 2008 [1]. Global nuclear energy production capacity was about 373 GWe [1]. An additional 52 reactors (including 16 in China) with a total capacity of 46 GWe are under construction [7]. Nuclear industry estimates of future world capacity range from 602 GWe to 1339 GWe by 2030 and from 2062 GWe to 11046 GWe in 2100 [8]. A 2003 scenario of 1000 GWe world nuclear capacity by 2050 is now thought unlikely [9, 10]. Estimates of future reactor capacity are subject to significant uncertainty.

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[a]In 2008, 86 percent of the 20,400 MTU of uranium purchased by U.S. utilities was from foreign sources. Utilities paid an average of $119/Kg. [11]

Uranium Resources

Uranium is about 100 times more common than silver [12] and occurs in a variety of geologic deposits and locations. Natural uranium contains U-235, the fissile isotope used to fuel the overwhelming majority of nuclear power plants. Uranium is produced by open pit mining, underground mining or by a chemical extraction process known as in situ leaching. U.S. uranium resources are largely located in the western and southwestern states, with some on Native American lands. U.S. uranium extraction is subject to state, federal and Indian Nation regulations. Some waste from old uranium mining and milling operations can be exploited as secondary supplies. Australia, with 1.67 million MTU identified at a market cost of <$130/Kg, has over 30 percent of the world's uranium resources [1]. Canada has the largest resources in North America (and the third largest in the world behind Kazakhstan), with 485,000 MTU identified at <$130/Kg [1]. Unconventional resources include an estimated 4.5 billion MTU in the world's oceans [2], which could be extracted for approximately $700/Kg [1].

> ***URANIUM RESOURCE CLASSIFICATION***
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> Uranium resources are classified based on geological certainty and production cost. Reasonably assured resources (RAR) have high confidence estimates of grade and tonnage. Inferred resources estimates have less confidence and require further characterization. The sum of RAR and inferred resources is known as **identified resources**. Prognosticated resources are expected to occur in known uranium provinces, and usually have supporting evidence. Speculative resources are also expected to occur, but lack supporting evidence. The sum of prognosticated and speculative resources is known as **undiscovered resources**.
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> SOURCE: *Uranium 2009: Resources, Production and Demand*

Uranium Reserves

Uranium stocks in the form of concentrates, low-enriched uranium (LEU) and highly-enriched uranium (HEU) from nuclear weapons programs are held in reserve by producers, utilities and governments. In 2008, U.S. utilities held 22,600 MTU as concentrates and 8,920 MTU as LEU, while the U.S. government held 17,600 MTU as concentrates and 12,500 MTU as LEU [1]. The U.S. government is supporting downblending of HEU to make LEU suitable for use in commercial reactors. To date, 64 (of 174) MTU of excess domestic HEU has been downblended to 1,050 MTU LEU and 391 (of 500) MTU of Russian HEU has been downblended to 11,300 MTU LEU [12].

Uranium Processing

Light-water reactors, the most common type of power reactor, typically use enriched fuel containing about 4 to 5 percent U-235. Natural uranium has a concentration of about 0.7 percent U-235. Uranium is extracted from ore by chemical processes and subsequently enriched using physical processes. In an enrichment facility, the operation can be adjusted to vary the U-235 enrichment in the uranium product, providing flexibility for meeting demand in response to market conditions [13].

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