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A Detailed Review of the Need for Future Enrichment Capability -Response to ASLB Topic 5A-

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1. Introduction

This report presents an analysis of the market for uranium enrichment services and a detailed review of the need for additional enrichment capability during the period 2012 through 2035. It considers scenarios with and without the introduction of several of the new uranium enrichment facilities that are presently being considered for potential construction and operation in the United States (U.S.). It is important to recognize that the market for uranium enrichment services is international in nature. At the present time, the owners and operators of the primary commercial uranium enrichment facilities, which are located in six countries, actively market uranium enrichment services worldwide. In addition, entities in several other countries enrich uranium to supply largely indigenous requirements.

Nuclear energy currently provides about 14% of world electric generation. In the 30 countries with nuclear generating capacity, the nuclear share represents about 17% of total electric generation. The interest in nuclear power continues to benefit from concern over the future impacts of global warming, the primary contributor to which is the use of fossil fuels. However, the March 2011 accident at the Fukushima Daiichi Nuclear Power Plant in Japan, which was initiated by a massive earthquake and tsunami off the East coast of Honshu, Japan, has led to a reconsideration of nuclear power in some countries.

Following very thorough, independent and cooperative evaluations by national regulatory agencies and nuclear power plant operators, most countries with established nuclear power programs have decided to maintain or expand their respective base of nuclear power plants. Some smaller countries that had shown an early interest in developing nuclear power may now abandon or postpone those plans for a decade or more. The reduced prospects for nuclear power worldwide, as compared to the prospects two years ago, are due to more than just the direct impact of Fukushima on Japan and its indirect effects on other countries, such as Germany. Other contributing factors include the low natural gas prices in some areas, slow growth in electric power demand due to the economic downturn in some countries, and high capital costs associated with building new nuclear power plants.

Requirements for uranium enrichment services associated with the operation of the predominant commercial nuclear power plant type – the light water reactor (LWR), presently exist in 28 countries, with more countries committed to adding nuclear power plants to their electric power grid during the years ahead. Market-related changes that occur in one part of the world impact the supply and requirements situation throughout the world. Accordingly, to understand the uranium enrichment services market in the U.S., it is necessary to examine the world market.

As of the end of 2011, world commercial nuclear power generation capacity stood at 367.3 Gigawatt electric (GWe) net at 430 operating units in 30 countries around the world, providing 14% of total world electric generation and 17% of electric generation in those countries with operating nuclear power plants.

The adverse political reaction to nuclear power in Germany following Fukushima was very strong, and the seven oldest nuclear units were shut down permanently, along with another unit that had been in a long-term outage. If the six units at the Fukushima Daiichi station are included, then 14 units totaling approximately 13 GWe (equivalent to 3.5% of existing world capacity) were effectively retired as a result of the accident. The 0.2 GWe Oldbury-2 in the U.K. also retired as scheduled. Overall, net generation capacity decreased by 8.6 GWe during 2011. This is due largely to the permanent shutdown of certain units as a direct result of the Fukushima Daiichi accident. The long-term impact is estimated by ERI to be a 4.6% reduction in installed nuclear generation by 2020, growing to a 7.9% reduction by 2030. This is equivalent to a two to three-year slippage in the projected installed nuclear generation capacity from pre-Fukushima numbers in 2020, and as much as a four-year slippage by 2030.[1]

Despite the Fukushima accident, five units, totaling 3.1 GWe, entered commercial operation during 2011 in China, India, Korea and Pakistan. Uprates at existing units added 1.2 GWe in 2011.

Seven units totaling 6.9 GWe in China, India, Iran, South Korea, and Russia are scheduled to enter commercial operation during 2012, although ERI expects two of the units to be delayed into 2013 in its Reference Nuclear Power Growth forecast (discussed further below). In addition, Bruce-1 and 2 in Canada are expected to return to service in 2012 following extended shut downs, adding 1.5 GWe.

A total of 74 units (74 GWe) are engaged in active construction activities in 15 countries around the world at this time. Another 79 units (99 GWe) are firmly planned in 14 countries. Four units (4 GWe) in Slovakia and the Ukraine have had construction activities suspended, but ERI expects three of the four units eventually to be completed.

2. Forecast of Installed Nuclear Power Generating Capacity

2.1 Overview

ERI has prepared Reference, High and Low Nuclear Power Growth forecasts of installed nuclear power generating capacity by country. The generating capacity in each forecast is categorized according to the following five world regions: (i) U.S., (ii) Western Europe, (iii) Commonwealth of Independent States (C.I.S.)[2] and Eastern Europe, (iv) East Asia, and (v) remaining countries, which are grouped as Other.[3]

[1] Schwartz, M., "An Updated Assessment of the Adequacy of Nuclear Fuel Supply", presented at the Nuclear Energy Institute's Nuclear Fuel Supply Forum, Washington, DC, January 24, 2012.

[2] The C.I.S. is an association of former Soviet republics that was established in December 1991 by Russia, Ukraine, and Belarus following the dissolution of the Soviet Union. Other members include Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan.

[3] Energy Resources International, Inc., "2012 Nuclear Fuel Cycle Supply and Price Report", ERI-2006-1201, Section 3, June 2012.

Countries in Western Europe with active nuclear power programs include: Belgium, Finland, France, Germany, the Netherlands, Slovenia, Spain, Sweden, Switzerland and the United Kingdom (U.K.). Italy has expressed interest in reestablishing its program, but, if so, not for many years.

Of the C.I.S. countries that were part of the former Soviet Union, the three with nuclear power plants still operating are Armenia, Russia and Ukraine. In addition, Belarus and Kazakhstan, which previously had operating nuclear power plants, may revive their nuclear programs in the future. The countries categorized as Eastern Europe that have operating nuclear power plants are Bulgaria, the Czech Republic, Hungary, Romania and Slovakia. Within this category, Lithuania has expressed interest in reviving its program and Poland has initiated efforts to establish a nuclear power program.

East Asia includes Japan, the People's Republic of China (China), the Republic of Korea (South Korea), and Taiwan, each of which has an active commercial nuclear power program; and Vietnam, which is in the early stages of developing a program.

Among the countries categorized as Other, those with ongoing nuclear power programs include: Argentina, Brazil, Canada, India, Mexico, Pakistan, and South Africa. In addition, a number of other countries have expressed interest in developing commercial programs in the future; among them are: Bangladesh, Chile, Egypt, Iran, Indonesia, Jordan, Malaysia, Saudi Arabia, Thailand, Turkey and the United Arab Emirates (U.A.E.)

These forecasts are based on ERI's country-by-country and unit-by-unit review of current nuclear power programs and plans for the future. The resulting ERI forecasts of future world nuclear generation capacity are dependent to a large extent upon existing plants and what happens to them over time, as well as new plants. Figure 1 illustrates the changing contribution to world nuclear generation capacity between now and 2035, as envisioned in the Reference forecast. The categories of nuclear generation that are included are identified in Figure 1.

- Nuclear generating units currently in operation as of January 2012 and retirements among these units that occur during the forecast period (assuming no license renewal);
- Capacity which is created by uprates or by restarting units that have been placed in extended outages of several years or more;
- Capacity which is created by extending the operating lifetimes of units currently in operation beyond initial expectations through license renewal;
- Units under construction, already ordered, or firmly planned with likely near-term site approval as of May 2012; and
- Additional new capacity that will require site approval and which is expected to be ordered in the future.

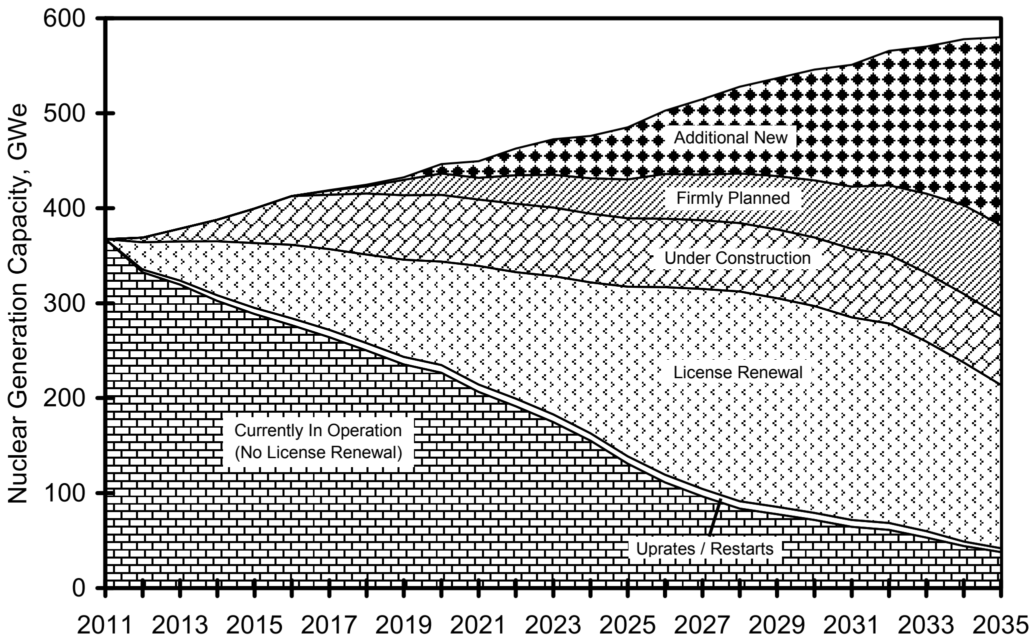

Figure 1 Composition of World Nuclear Capacity for the Reference Forecast

2.2 Reference Nuclear Power Growth Forecast

In the Reference Nuclear Power Growth forecast, world nuclear capacity will be dominated by plants currently in operation and license renewals for those units whose licenses otherwise would expire during the forecast period. The contribution of plants currently in operation, but with no license renewal, steadily decreases from 72% of the total in 2015 to just 7% by 2035. A small contribution (1.5% between 2015 and 2035) is obtained from capacity uprates of these units and plant restarts. The contribution of license renewal of existing units rises from 17% in 2015 to 42% of total capacity by 2028, before gradually declining to 30% in 2035. As a result, plants currently in operation still account for 65% of total operating capacity in 2025 and 38% in 2035.

Plants currently under construction or firmly planned will account for 9% of total operable capacity in 2015 and will average 23% between 2020 and 2035. Additional new capacity first appears in 2017 (0.2%) and steadily rises to 38% in 2035. Cumulative retirements of currently operating units will amount to 3% of total operable capacity in the year 2015, slowly rising to 14% by 2030 and then doubling to 28% by 2035

On a world basis, the Reference Nuclear Power Growth forecast is consistent with a steady average annual nuclear generating capacity growth rate of 1.9% through the year 2035. The Reference forecast is consistent with present trends and is considered by ERI to be the most likely at the present time. Aggressive expansion plans in Asia, particularly in China, are assumed to translate into real growth. Worldwide, plant operating lifetimes extending beyond 40 years are expected to be the rule rather than the exception. Almost all U.S.

plants are expected to undergo license renewal; and several Gigawatts in capacity additions are being made in the form of plant power uprates. Russia is making progress on an ambitious expansion of its nuclear power program. Several other countries in the C.I.S./Eastern Europe category also plan to add nuclear power plants.

According to the ERI Reference forecast, all world regions demonstrate sustained growth, with the exception of Western Europe. New builds do take place in France and the U.K., but only to offset the retirement of existing capacity. Other European countries maintain their nuclear commitment by extending plant lifetimes. Only Finland increases capacity through new builds. It is assumed that, as announced, Germany completes its phase out of nuclear power by 2022. Long term capacity declines in Belgium and Switzerland also take place as unit lifetimes are limited to 40 to 50 years with no replacements.

In the U.S., the prospects for new nuclear power plant construction remain strong, even though they have diminished to some degree over the last several years. The U.S. Nuclear Regulatory Commission (NRC) has received combined construction and operating license (COL) application submittals for 28 new units. Two new units at the Vogtle site and two new units at the Summer site have received their COLs and construction of those new units has commenced. Another 11 units are undergoing NRC licensing review. The NRC review schedules for 6 units have been suspended and additional review schedules are being revised by the NRC. Projected growth in the U.S. is modest but steady, as a total of 11 new units are projected under the Reference forecast to be added by 2030. Although an additional 17 units are expected to added by 2035, they do not result in net capacity expansion since a number of existing units will reach the end of their extended operating lives between 2030 and 2035.

Growth is strong in East Asia, C.I.S./Eastern Europe and Other regions. Many new units are added in China and India. Significant additions also are made in Russia and South Korea. Several new entrants (e.g., Iran, Poland, Saudi Arabia, the U.A.E. and Vietnam) are expected to join the ranks of countries with nuclear generation, but their impact on total world nuclear generating capacity is small. Of course, not all of the expectations are positive. In Japan, the last operating unit went into a refueling outage in May 2012; and, as of yet, no units have been authorized to return to operation. Twelve units, including the six at Fukushima Daiichi, are expected by ERI to retire without restarting. The restart of other units is projected to be spread out over the next 30 months, with just four restarts expected in the second half of 2012. Only the two Japanese units currently under construction, for which construction is presently suspended, are completed. All of the projects firmly planned, but not initiated prior to Fukushima, are expected to be abandoned.

2.3 High Nuclear Power Growth Forecast

ERI's High Nuclear Power Growth forecast is generally consistent with announced owner/operator schedules for identified nuclear power plants in the mid-term, to the extent that those schedules are not regarded by ERI as unduly optimistic. Persistent high coal and natural gas prices, broad agreement regarding the need for new base load generation capacity, and more stringent environmental controls and costs imposed on fossil fired capacity (including limits on carbon emissions) will support the level of nuclear plant orders after the year 2012 that is assumed in the High forecast. Nuclear construction capability, including the capacity for key heavy forgings, is assumed to continue to ramp up without difficulty to prevent any construction bottlenecks. Universal recognition of nuclear power's economic and environmental benefits, a decline in the political clout wielded by opponents to nuclear power, and widespread recognition of the inability to lower global carbon emissions without increased reliance on nuclear power would enable nuclear power to enhance its market share. The financial markets are assumed to moderate their assumptions pertaining to nuclear risk so that necessary capital for new nuclear construction is readily available. The cost increases observed for all types of major construction during the past few years are contained, and the first wave of new nuclear power plants are built on schedule and within budget. In the ERI High Nuclear Power Growth forecast, most countries decide to extend the operating licenses of existing nuclear power plants to 50 years or more or to replace units retiring in order to maintain their portfolio of nuclear plants. The High forecast is considered to be an upper bound scenario, with a comparatively low probability of occurrence.

2.4 Low Nuclear Power Growth Forecast

ERI's Low Nuclear Power Growth forecast represents a lack of support for the nuclear option in most countries, resulting in minimal growth in nuclear generating capacity on a world basis. In this forecast, the addition of new nuclear power generation capability beyond those units already under construction is dominated by China (83 additional units). India (13 additional units), Russia (8 additional units), South Korea (7 additional units) and the U.K. (5 additional units) also continue to add plants, but at a reduced pace. The rest of the world is limited to the 6 units that are already in advanced stages of planning. Persistent low natural gas prices, the lack of any carbon-based taxes on fossil fueled generation or other incentives for non-carbon emitting technology, difficulties raising capital for new construction, persistently high construction costs, lower than expected growth in electric power demand, declining market prices for electricity, difficulties in plant site selection, and growing anti-nuclear sentiments – as exacerbated by the Fukushima Daiichi accident – would be consistent with the Low forecast throughout the world. The Low forecast is considered to be a lower bound scenario, with a comparatively low probability of occurrence.

2.5 Summary and Comparison

A summary comparison of ERI’s Reference, High and Low Nuclear Power Growth forecasts is provided in Table 1. World installed nuclear power capacity is forecast to rise 32% to 485 GWe by 2025, and to rise an additional 19% to 580 GWe by 2035 for a total increase of 58% during the Reference forecast period.

Year	Forecast	Nuclear Generation Capacity (GWe)					
		U.S.	Western Europe	C.I.S. & E. Europe	East Asia	Other	World
2011	Actual	101.8	116.1	47.2	78.1	24.1	367.3
2015	Low	99.4	114.6	48.3	86.5	29.1	377.9
	Reference	104.4	117.2	51.9	96.1	30.1	399.8
	High	105.0	118.5	53.8	114.7	33.3	425.4
2020	Low	101.8	100.7	50.9	111.5	24.6	389.4
	Reference	107.7	115.8	57.8	132.3	32.8	446.4
	High	109.4	125.8	66.5	165.9	50.6	518.3
2025	Low	99.6	85.8	49.4	130.9	25.6	391.3
	Reference	107.2	102.6	64.2	167.8	43.4	485.3
	High	116.5	143.5	78.4	223.9	87.8	650.1
2030	Low	95.5	72.7	38.9	151.5	31.0	389.7
	Reference	109.1	102.7	70.2	203.2	60.8	546.0
	High	125.7	147.5	95.3	282.5	133.3	784.2
2035	Low	70.1	48.1	30.3	165.1	32.4	346.0
	Reference	111.1	94.4	71.7	232.6	70.2	580.1
	High	130.6	144.0	102.7	341.0	146.3	864.7

Table 1 Summary of World Nuclear Power Installed Generating Capacity Forecasts

ERI's forecast of installed nuclear generation capacity is generally consistent with those published by other organizations, as discussed below.

On a world basis, the full range of these forecasts indicates a variation of ±16% (i.e., ±76 GWe) in 2020. The variation in forecasts then expands noticeably and is ±41% (i.e., ±241 GWe) by 2030. The Low forecasts that are made by WEO[4], UXC[5] and IAEA[6] are significantly higher than the Low forecasts made by the WNA[7] and ERI by 2030. The High forecasts of world nuclear capacity made by all the organizations are in general agreement.

The Mid/Reference forecasts for installed world nuclear generation capacity by the various organizations are shown in Figure 2. The differences among the published "Mid/Reference" forecasts are small at ±4% (i.e., ±18 GWe) in the year 2015, and increase slowly with time to ±7% (i.e., ±37 GWe) in the year 2025, and to ±9% (i.e., ±55 GWe) by

[4] International Energy Agency, "World Energy Outlook 2011", November 2011. Note: Only Reference and 450 Scenarios provided; midpoint calculated by ERI.

[5] Ux Consulting Company, as referenced in Platts Nuclear News Flashes, May 10, 2011 and presented at NEI Nuclear Fuel Supply Forum, July 12, 2011.

[6] International Atomic Energy Agency, "Energy, Electricity and Nuclear Power Estimates for the Period up to 2050", July 2011. Note: Only Low and High generation scenarios provided; midpoint calculated by ERI.

[7] World Nuclear Association, "The Global Nuclear Fuel Market Supply and Demand 2011-2030", Tables I.1, I.2 and I.3, September 2011.

the year 2035. Between 2020 and 2030, the EIA[8], IAEA, UXC and WNA forecasts are grouped in a range that is between 2% and 4% above the group average. The WEO Mid forecast is 4% below the group average, while the ERI Reference forecast is almost 9% below the group average during the period between 2020 and 2030. The other forecasts assume accelerating growth of installed nuclear generation capacity after 2020, while the ERI forecast assumes a growth rate that is more consistent with that assumed prior to 2020. The other forecasts also appear to assume a much stronger recovery for nuclear power in Japan, while ERI has assumed that Japan will gradually reduce its commitment to nuclear power as a result of the Fukushima accident.

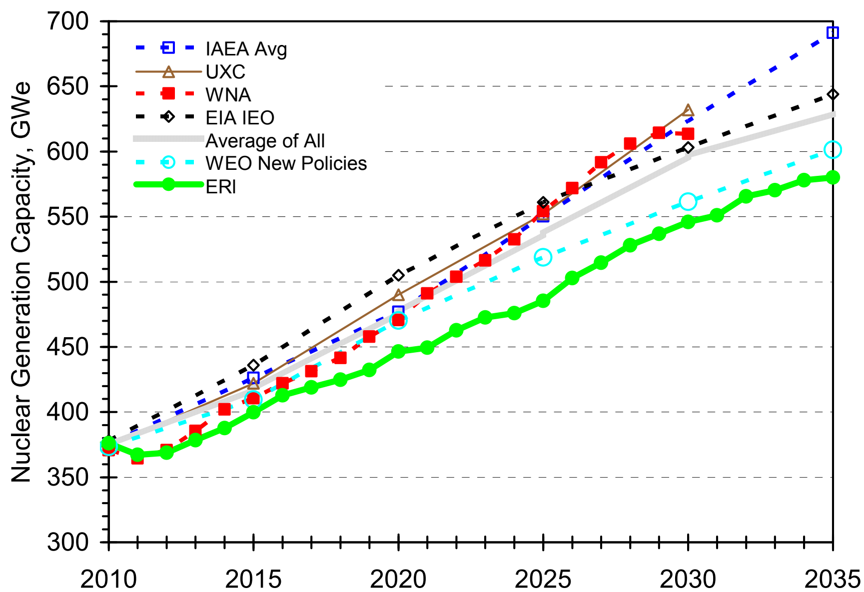

Figure 2 Comparison of World Nuclear Generation Capacity Reference Forecasts

With regard to the U.S., only ERI, EIA and WNA publish separate forecasts of U.S. installed nuclear generation capacity. The ERI and EIA forecasts extend through 2035 and the WNA forecast extends through 2030. Overall, these three forecasts are in very close agreement. The differences among the forecasts are only ±3% to 5% (i.e., ±3 to 5 GWe) during the period 2020 through 2030. In 2035 the ERI and EIA forecasts are identical.

3. Uranium Enrichment Requirements Forecast

Forecasts of uranium enrichment services requirements prepared by ERI[9] are consistent with ERI's nuclear power generation capacity forecasts, as presented in Section 2.

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[8] U.S. Department of Energy (DOE) Energy Information Administration (EIA), "International Energy Outlook 2011", September 2011. Reference Case nuclear capacity projection. [EIA]

[9] Energy Resources International, Inc., "2012 Nuclear Fuel Cycle Supply and Price Report", ERI-2006-1201, Section 6.2, June 2012.

Assumptions regarding nuclear fuel design and management parameters that were used in developing the forecast of uranium enrichment requirements are summarized below.

- Country-by-country average capacity factors rise with time from a world average of 77.8% in 2011. A further reduction in capacity factor is expected for 2012, as no Japanese units were in operation as of May 2012. World capacity factor will then gradually recover as Japanese units are restarted; although some may be retired. Worldwide, performance expectations for the future remain high and capacity factors are forecast to gradually increase, reaching 85% for the long term. The average capacity factor for the U.S. remains at 90%.

- Long term Western world average enrichment tails assay[10] is projected to decline from 0.25 w/o U^{235} at present to approximately 0.23 w/o for the long term. The projected 0.23 w/o tails assay is used for all world regions for the purposes of the nuclear fuel requirements projection.

- Individual plant enriched product assays are based on plant design, energy production, design discharge burnup, and fuel type. Actual operating company practices outside the U.S. make use of higher enriched product assays in some Western countries, where a 0.1 to 0.2 w/o U^{235} design margin is typical. For fuel used in Russian designed LWRs, enriched product assays are typically 0.3 w/o U^{235} higher than for otherwise comparable Western fuel designs.

- Current plant-specific fuel discharge burnups for the U.S., and country and power plant type-specific burnups abroad will continue to increase. The average design discharge burnup for Western world LWRs is forecast to gradually increase to 50 GWD/MTU in the year 2015, 51 GWD/MTU in 2025 and 53 GWE/MTU in 2035. The increase in later years is driven by the higher discharge burnups expected for new power plant designs (e.g., 60 GWD/MTU for AP1000s and EPRs).

- Plant-specific (for the U.S. and other selected countries) and country-specific (for other countries) fuel cycle lengths are used. For example, cycle lengths collectively average

[10] Various uranium enrichment processes can be used to enrich natural uranium hexafluoride (UF_6) to obtain the desired concentration or assay of the fissile Uranium-235 isotope (U^{235}) for light water reactor (LWR) fuel (i.e., "product assay"), usually in the range of 3.0 to 5.0 weight percent (w/o) U^{235} from the 0.711 w/o U^{235} that exists naturally. The enrichment process also generates a waste stream in which the concentration of U^{235} is reduced that is known as the enrichment tails. The concentration (assay) of U^{235} in the tails (i.e., "tails assay") generally falls in a range between 0.2 w/o and 0.3 w/o, although Russian enrichment tails may have assays as low as 0.11 w/o. The most economic tails assay, known as the "optimum tails", is the tails assay that yields the minimum cost for the resulting enriched uranium product (EUP), given the costs of uranium concentrates, conversion services and enrichment services. The EUP is occasionally referred to as low enriched uranium (LEU). The enrichment process is measured in kilograms or tonnes of separative work units (SWU).

approximately 20 months in the U.S., and 16 months for the world average for LWRs (including those in the U.S.).

- Typical delivery lead times for enrichment services (calculated from the start of the refueling outage) of 24 to 36 months for first cores and 6 to 12 months for reloads are assumed. Lead times in the U.S. and Europe are at the lower end of the range, while lead times in East Asia are at the higher end of the range.

It should be recognized that on a year to year basis, there can be both upward and downward fluctuations in requirements for enrichment services. This reflects the various combinations of nominal 12-month, 18-month and 24-month operating/refueling cycles that occur at nuclear power plants throughout the world, as well as the timing of first cores for new nuclear power plants. Therefore, multiyear interval averages are used as the basis for subsequent discussion.

Figure 3 presents the world annual enrichment services requirements for the Reference, High and Low Nuclear Power Growth forecast.

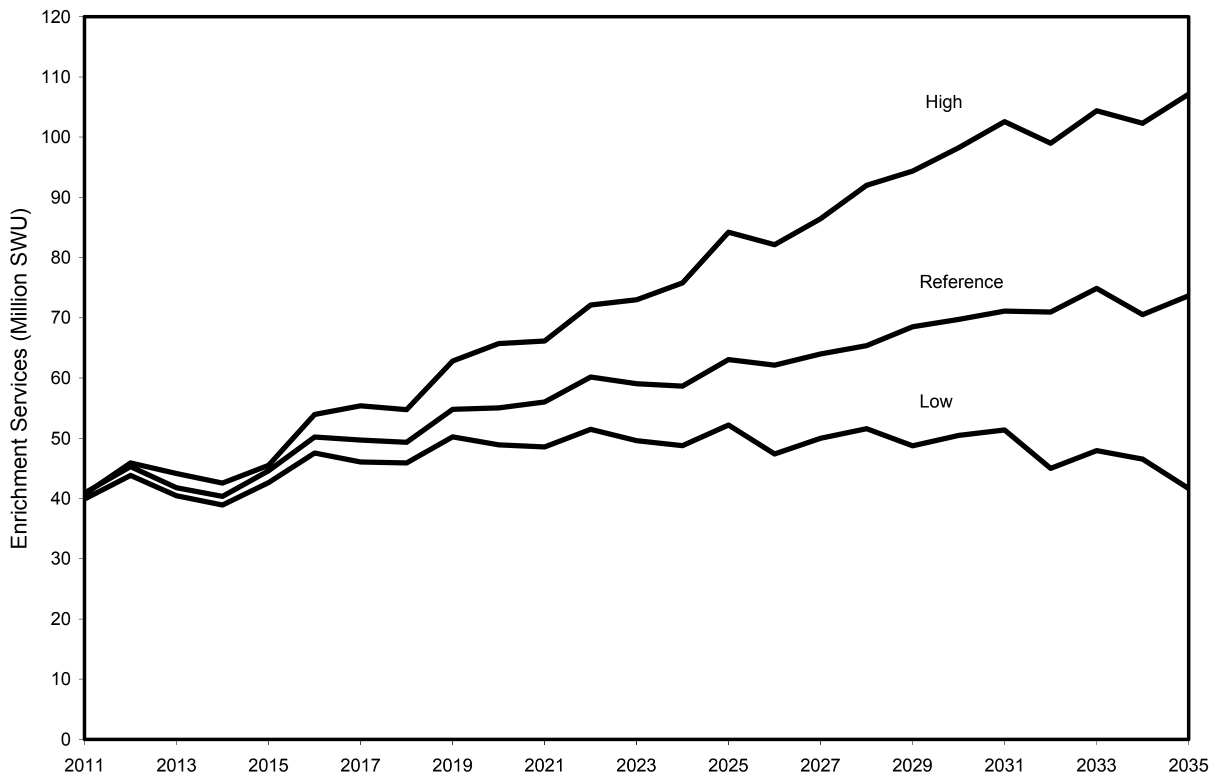

Figure 3 ERI Forecasts of World Annual Enrichment Services Requirements

Under the ERI Reference Nuclear Power Growth forecast, U.S. annual requirements for enrichment services are expected to grow from 14 million SWU in 2012 to 18.1 million SWU per year by 2030, an increase of 29%.[11]

Table 2 provides ERI forecasts of average annual enrichment services requirements by world region over successive five-year periods for the Reference, High and Low Nuclear Power Growth forecasts.

Period	Forecast	Average Annual Enrichment Requirements (Million SWU)					
		U.S.	Western Europe	C.I.S. & E. Europe	East Asia	Other	World
2011	Actual	12.2	12.1	5.8	10.0	0.8	40.9
2016-2020	Low	14.8	12.5	6.6	12.7	1.1	47.7
	Reference	15.6	13.0	7.0	14.7	1.5	51.8
	High	15.8	13.8	7.8	18.5	2.7	58.6
2021-2025	Low	14.6	11.2	6.5	16.4	1.4	50.1
	Reference	16.0	13.2	7.8	19.6	2.7	59.3
	High	17.3	16.1	9.2	25.5	6.1	74.2
2026-2030	Low	14.2	9.4	5.9	18.4	1.8	49.7
	Reference	16.8	12.2	8.4	24.3	4.2	65.9
	High	19.2	17.0	10.8	33.1	10.6	90.7
2031-2035	Low	11.4	7.4	4.6	21.0	2.1	46.5
	Reference	16.7	12.1	9.0	28.5	5.8	72.1
	High	19.4	17.3	12.2	40.7	13.6	103.2

Table 2 World Average Annual Enrichment Requirements Forecasts

As shown in Table 2, during the 2021 to 2025 period, world annual enrichment services requirements are forecast to average 59.3, 74.2 and 50.1 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. The world requirements forecast for this period reflects a 45%, 81% and 22% increase over the estimated 2011 value of 40.9 million SWU for the Reference, High and Low forecasts, respectively. During the 2031 to 2035 period, world annual enrichment services requirements are forecast to average 72.1, 103.2 and 46.5 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. The world requirements forecast for this period reflect a 76%, 152% and 14% increase over the estimated 2011 value for the Reference, High and Low forecasts, respectively.

Also as shown in Table 2, during the 2021 to 2025 period, U.S. annual enrichment services requirements are forecast to average 16.0, 17.3 and 14.6 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. The world requirements forecast for this period reflect a 31%, 42% and 20% increase over the estimated 2011 value of 12.2 million SWU for the Reference, High and Low forecasts, respectively. During the 2031 to 2035 period, world annual enrichment services requirements are forecast to

[11] Energy Resources International, Inc., "2012 Nuclear Fuel Cycle Supply and Price Report", ERI-2006-1201, Section 6.2, June 2012.

average 16.7, 19.4 and 11.4 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. The world requirements forecast for this period reflect a 37% increase, 59% increase, and a 7% decrease over the estimated 2011 value for the Reference, High and Low forecasts, respectively.

As presented in Section 2, there are several organizations that publish forecasts of installed nuclear generation. However, the only publicly available forecasts of enrichment requirements that were available for comparison are those published by WNA.[12] Figures 4 and 5 provide comparisons of the ERI forecasts with those published by WNA for world and U.S. requirements, respectively, for the Reference, High and Low Nuclear Power Growth forecasts.

As illustrated in Figure 4, over the period 2016 through 2030, the ERI Reference forecast for the world is 16% lower than the WNA Reference World Nuclear Power Growth forecast. For the High forecasts, the ERI forecast is 7.7% lower than the WNA High Nuclear Power Growth forecast; and for the Low forecasts, the ERI forecast is 1% lower than the WNA Low Nuclear Power Growth forecast. However, by 2030 the WNA Low forecast is lower than the ERI Low forecast.

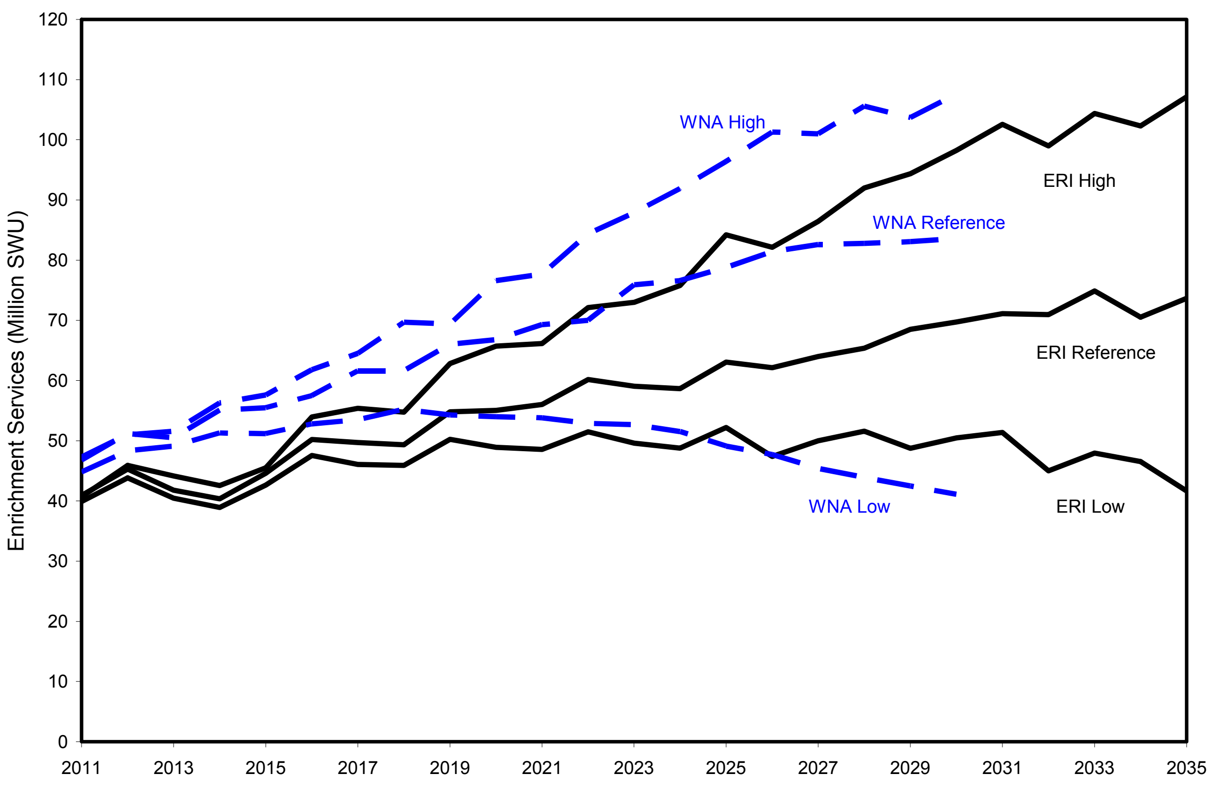

Figure 4 Comparison of World Annual Enrichment Requirements Forecasts

[12] The World Nuclear Association, "The Global Nuclear Fuel Market Supply and Demand 2011-2030", Tables IV.1, IV.2 and IV.3, September 2011.

As illustrated in Figure 5, over the period 2016 through 2030, the ERI Reference forecast for the U.S. is 11% lower than the WNA Reference U.S. Nuclear Power Growth forecast. For the High forecasts, the ERI forecast is 10.3% lower than the WNA High U.S. Nuclear Power Growth forecast; and for the Low forecasts, the ERI forecast is 8.2% greater than the WNA Low U.S. Nuclear Power Growth forecast.

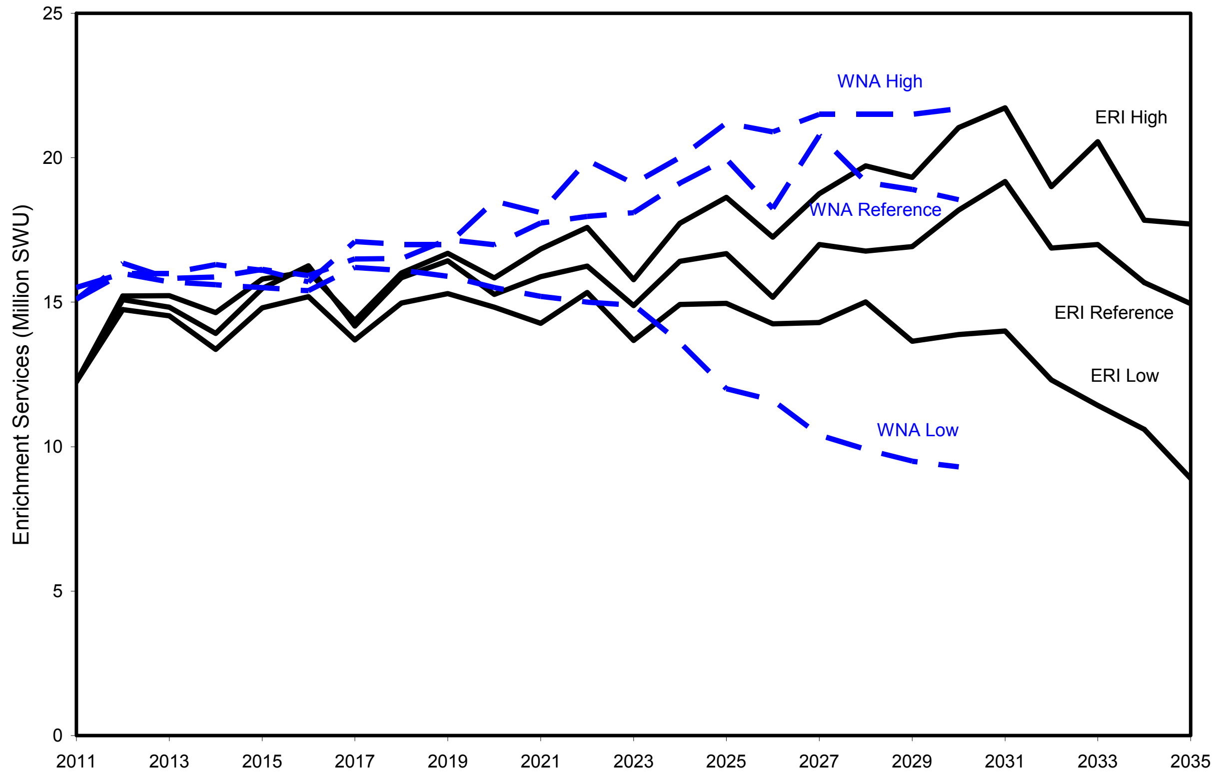

Figure 5 Comparison of U.S. Annual Enrichment Requirements Forecasts

The difference in enrichment requirements forecasts between WNA and ERI is due to several factors, including WNA's higher forecasts of installed nuclear generation capacity (which includes the requirements for more first cores for new nuclear power plants); WNA's higher long-term average plant capacity factors; WNA's use of slightly lower tails assays; and WNA's nuclear fuel assumptions for operating cycles in current nuclear power plants. If the higher WNA forecasts for uranium enrichment requirements were used by ERI in its analysis of supply adequacy, then the forecast need for new uranium enrichment capability would be even greater, as shown in Section 5.

4. Current and Proposed Future Sources of Uranium Enrichment Services

4.1 Overview

The Georges Besse gaseous diffusion plant (GDP) which had been operated by AREVA in France was permanently shutdown on June 7, 2012[13]; and the Paducah GDP operated by USEC in the U.S. is expected to be removed from service during the next year.[14]

Uncertainty also has grown during the past year regarding which of the newly licensed U.S. enrichment facilities will be built, and if so, on what schedule.

Even though USEC received a license from the NRC in 2007 to build and operate the American Centrifuge Plant (ACP), USEC continues to experience delays in obtaining financing and USEC has acknowledged that it cannot continue to independently fund the project.[15] DOE raised additional concerns about a number of aspects of the project that USEC was not able to overcome to DOE's satisfaction. As a result, instead of issuing the conditional loan guarantee that USEC had sought from DOE, DOE proposed a two year cost share research, development and demonstration (RD&D) program for the project "to enhance the technical and financial readiness of the centrifuge technology for commercialization". However, the source of the full funding for this RD&D program remains uncertain.

Marking progress in this regard, on June 13, 2012, USEC and the DOE executed an agreement to move forward on a cooperative RD&D program with a total investment of up to $350 million to confirm the technical readiness of the American Centrifuge. The agreement calls for DOE to provide 80% ($280 million) and USEC to provide 20% ($70 million) of the total. This RD&D program will support building, installing, operating and testing commercial plant support systems and a 120 machine cascade that would be incorporated in the full commercial ACP. According to USEC's announcement, USEC and DOE will initially provide $110 million in cost-shared funding that is intended to last through the end of November 2012. DOE's portion of the funding will come from its assumption of the disposal obligation for a quantity of depleted uranium tails from USEC, releasing $87.7 million in cash for use in the RD&D program. DOE and USEC used a similar approach in March 2012 to provide $44 million in interim funding. USEC will continue to work with Congress and DOE to pursue opportunities for funding the balance of the RD&D program. Appropriation bills providing Fiscal Year 2013 funding have been approved by the House of Representatives and the Senate Appropriations Committee, but have not yet been finalized.[16]

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[13] AREVA, "EURODIF's uranium enrichment plant ceases production permanently", June 7, 2012.

[14] USEC Inc., "USEC Inc., 8-K Current Report", Item 1.01, May 15, 2012.

[15] USEC Inc., "USEC Inc., 10-K Annual Report for the Period Ending December 31, 2011", page 5, March 14, 2012.

[16] USEC Inc., "USEC Inc., Form 8-K, June 13, 2012.

On December 13, 2011, AREVA announced that it was cutting jobs and suspending projects around the world, including the Eagle Rock Enrichment Facility in the U.S., as part of a five-year strategic action plan developed in response to massive fiscal losses in 2011 to allow it to return to profit.[17] It was reported in January 2012 that AREVA was planning to begin construction of the EREF in 2013, instead of 2012 as had originally been planned; or possibly as late as 2014 if it could not secure an investment partner for the project.[18] However, in February 2012, URS Nuclear LLC, the Procurement and Construction Manager for the EREF notified all of its subcontractors that the "project has been placed on indefinite suspension until further notice".[19]

With regard to other sources of enrichment supply, in January 2012, Urenco reported that it had increased its annual worldwide enrichment capacity during 2011 by 12.3% to 14.6 million SWU, and that it was on track to achieve enrichment capacity of 18 million SWU by 2015.[20] In January 2012, Urenco reported that its enrichment facility in New Mexico, Urenco USA (previously known as the National Enrichment Facility), had reached an annual enrichment capacity of 400,000 SWU as of the end of 2011, following a slower than expected start up process.[21] During the first five months of 2012, the NRC has approved 12 additional cascades (i.e., approximately 800,000 SWU) for introduction of uranium hexafluoride (UF_6) gas.

It is not clear whether and to what extent other operating facilities, such as Urenco's three operating enrichment facilities in Europe, and Rosatom's four operating enrichment plants in Russia, may be expanded in the future to meet projected, but, as yet, uncertain requirements. In addition, the smaller enrichment plants that are located in countries such as China, Japan, and Brazil also must be considered. Additionally, while they are not expected to be a significant source of supply in the long term, government high-enriched uranium (HEU) inventories currently play a role in meeting commercial requirements.

In addition to the physical supply capacity that may or may not be available, one must be mindful of the extent to which any of the international trade constraints that are presently being imposed, and which may continue to be imposed on selected sources of supply in the future, could impede the market's ability to most effectively utilize physically available increments of supply to meet growing requirements.

Finally, Global Laser Enrichment (GLE), a business venture of General Electric-Hitachi Nuclear Energy (GEH) and Cameco Corporation, could decide to build an enrichment plant

[17] "AREVA Strategic Action Plan – 2012-2016", page 45, December 13, 2011.

[18] Associated Press, Idaho Business Review, January 31, 2012, http://idahobusinessreview.com/2012/01/31/areva-could-begin-work-on-eagle-rock-plant-in-2013/

[19] URS Nuclear LLC Letter to Subcontractors, February 27, 2012.

[20] Urenco, "Urenco Trading Update for 2011", January 26, 2012, http://www.urenco.com/print/content/448/urenco-trading-update-for-2011.aspx

[21] Chaffee, Phil., "Urenco USA Production a Year Behind Schedule", Nuclear Intelligence Weekly, page 3, January 30, 2012.

that is now being licensed and which is based on Silex laser enrichment technology. The planned maximum target annual production for the GLE plant is six million SWU.[22]

4.2 Base Supply of Enrichment Services

Table 3 summarizes current and potential future Base sources and quantities of uranium enrichment services. As available, these Base sources include: (1) existing inventories of low enriched uranium (LEU), (2) production from existing uranium enrichment plants, (3) enrichment services obtained by blending down Russian weapons-grade HEU, (4) the base capacity for enrichment plants under active construction, (5) capacity expansions at existing facilities, and (6) enrichment services that are presently being obtained by blending down U.S. HEU. ERI notes that, with respect to the GDPs, the current annual "economically competitive and physically usable capability" is less than the facility's "nameplate rating". In the case of facilities that are in the process of expanding their capacities, the annual production that is available to fill customer requirements during the year is listed, not the end-of-year capability.

The economically competitive and physically usable capability refers to that portion of the enrichment facility nameplate rating that is capable of producing enrichment services that can be competitively priced and delivered to end users. For instance, the cost of firm power during summer (peak demand) months can be several times higher than the cost of non-firm power that may be purchased under contract during the remainder of the year. In practice this limits the annual enrichment capability of electricity intensive gas diffusion enrichment plants. However, it should be noted that by mid-2013 there will no longer be any GDPs in operation.

From the perspective of an operator of a nuclear power plant in the U.S., physically usable capability requires that the enriched uranium product be obtained from an enrichment plant that is not subject to international trade restrictions that preclude the product's use in commercial nuclear power plants in the U.S. In this context the Base supply in this analysis includes the annual amount of Rosatom enrichment services that are included in the 2008 Amendment to the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation that may be exported to the U.S.[23,24] For all of the above reasons, it is not appropriate to simply

[22] U.S. Nuclear Regulatory Commission, "Environmental Impact Statement for the Proposed GE-Hitachi Global Laser Enrichment, LLC Facility in Wilmington, North Carolina", NUREG-1938, page iii, February 2012.

[23] U.S. Department of Commerce International Trade Administration, February 1, 2008, "Amendment to the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation", Federal Register Volume 73, Number 28, February 11, 2008.

[24] Imports of LEU produced in the Russian Federation became subject to restrictions imposed under a 1992 agreement suspending an antidumping investigation of imports of all forms of Russian uranium, i.e., "Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation" (Suspension Agreement) that was initiated by the U.S. Department of Commerce (DOC) at the request of the U.S. producers of natural uranium and uranium workers. The Suspension Agreement prohibited all imports of LEU from Russia into the U.S. other than LEU derived from the HEU imported under the HEU

add together the nameplate capacities of all presently operating and proposed new enrichment facilities, if the objective is to obtain a meaningful forecast of total useable world enrichment capability. Based upon current practices, a portion of an enrichment facility's production capacity may be dedicated to "underfeeding" [25] to produce uranium. Where appropriate, some of the numbers in this table have been adjusted to reflect this practice.

As a further point of clarification, USEC executed an agreement with TENEX on March 23, 2011, which became effective in December 2011, for a 10 year supply of Russian low enriched uranium (LEU), extending from 2013 through 2022. However, as noted in the agreement[26], its implementation must be carried out in a manner that is consistent with the limitations under the previously referred to Russian Uranium Suspension Agreement and the Domenici Amendment.[27] The implication of this limitation is that the total amount of Russian origin SWU entering the U.S. annually between 2014 and 2020 is set at an amount equal to about 20% of projected U.S. annual requirements. Any SWU purchased by USEC from TENEX under the March 2011 agreement for use in U.S. nuclear power plants during the period 2014 through 2020 must fall within this 20% limit. Therefore, any enrichment services that are purchased by USEC under this March 2011 agreement with TENEX that are in excess of the portion of the quota that TENEX is making available to USEC under their agreement must be sold by USEC under contracts with its foreign customers.

Agreement. A number of amendments to the Suspension Agreement have been implemented since 1992. Following years of discussions between the U.S. and Russian governments, an amendment to the Suspension Agreement was executed on February 1, 2008, allowing Russia limited direct access to the U.S. market (i.e., the owners and/or operators of nuclear power plants in the U.S.) between 2011 and 2013, 20% of the U.S. market between 2014 and 2020, and unlimited access beginning in 2021. While still a member of the U.S. Senate, Senator Pete Domenici submitted language regarding Russian exports of enriched uranium to the U.S., which was included in the Consolidated Security, Disaster Assistance, and Continuing Appropriations Act of 2009. This Act amends Sections 3112 and 3112A of the USEC Privatization Act, as amended, and effectively codified into U.S. law terms of the above mentioned February 2008 Amendment to the Suspension Agreement. This language links the amount of Russian EUP that could be imported into the U.S. each year beginning in 2011 to Russia's willingness to down blend an additional 300 MT HEU. If Russia continues to down blend HEU to an assay of less than 20 w/o U235, then it could potentially increase its exports to the U.S. from approximately 20% of U.S. requirements to as much as 25% of U.S. requirements. At the present time, it is not anticipated that Russia will down blend additional HEU beyond the amount to which it is currently committed under the HEU Agreement.

[25] Suppliers of enrichment services may choose to operate their enrichment plants at an operating tails assay that is lower or higher than the average tails assay specified in their contracts with customers for deliveries actually made. The tails assay specified in the contract is referred to as the "transaction tails assay". If the operating tails are lower than customer transaction tails, then the supplier must use more enrichment capacity to meet its delivery commitments, but ends up with excess UF_6 feed, which it may sell on the market. This mode of operation is referred to as "underfeeding".

[26] USEC Inc., 10-Q Quarterly Report for the Period Ending March 31, 2011, Exhibit 10.3, "Enriched Product Transitional Supply Contract", dated March 23, 2011.

[27] Provisions of U.S. law added by Section 8118 of the Consolidated Security, Disaster Assistance and Continuing Appropriations Act, 2009.

As shown in Table 3, current Base annual supply capability that is economically competitive and not constrained by international trade restrictions amounts to 43.4 million SWU for the Reference Nuclear Power Growth forecast. This is similar to the estimated 2012 total world requirement of 41.5 million SWU. Base annual supply capability is forecast to increase to 61.3 million SWU per year by 2025 and 69.4 million SWU per year by 2035. However, as explained in Section 5, given growing requirements for enrichment services, current forecasts of future supply do not offer any greater sense of security (with respect to adequacy of supply) than the present-day supply situation.

Item		Technology	Base Economically Competitive and Usable Supply Capability (Million SWU)					
			2012	2015	2020	2025	2030	2035
1	Inventory (a)	Misc.	1.5	1.3	0.0	0.0	0.0	0.0
2	Urenco (Existing and Planned Expansions)	Centrifuge	13.5	13.7	13.6	13.6	13.6	13.6
3	AREVA GB I (Existing)	Diffusion	1.3	0.0	0.0	0.0	0.0	0.0
4	AREVA GB II (New)	Centrifuge	1.6	6.3	7.0	7.0	7.0	7.0
5	USEC Paducah (Existing)	Diffusion	2.3	0.5	0.3	0.0	0.0	0.0
6	Rosatom (Internal - C.I.S. & Eastern Europe - Ref. Case)	Centrifuge	5.8	6.5	7.2	7.4	8.5	8.0
7	Rosatom (Exports, excluding for U.S.)	Centrifuge	4.9	8.3	9.3	9.2	10.3	10.7
8	Russian HEU-derived LEU	Inventory, down blending required	6.7	0.4	0.2	0.0	0.0	0.0
9	U.S. HEU	Inventory, down blending required	1.0	0.6	0.2	0.2	0.2	0.2
10	China and Other (Existing/New)	Centrifuge	2.4	4.8	8.7	12.0	15.2	18.3
11	Urenco USA (Exisitng and Expansion)	Centrifuge	0.9	4.6	5.3	5.3	5.3	5.3
12	Rosatom (Exports to U.S.)	Centrifuge	0.2	2.6	3.0	4.5	4.8	4.2
13	Recycle	Commercial Reprocessing; Weapons Pu Inv.	1.4	1.5	2.1	2.1	2.1	2.1
	Total		43.4	51.2	56.8	61.3	67.0	69.4

(a) Includes preproduction by an enrichment facility prior to its being shut down.

(b) A portion of an enrichment facility's production capacity may be dedicated to underfeeding to produce uranium. Where appropriate, some of the numbers in this table have been adjusted to reflect this.

Table 3 Base Sources of Uranium Enrichment Services

Each of the sources of supply identified in Table 3 is discussed in more detail below.

ERI believes that, with the exception of enrichment services that result from GDP preproduction prior to their shutdown, and some **inventory** being held by EdF, there are virtually no excess LEU inventories (i.e., enrichment services component of the LEU) beyond pipeline and strategic reserve that are available for release. Certainly, no long-term contribution to world supply can be expected from LEU inventories.

AREVA enrichment capability from the Georges Besse I (**GB I**) GDP that is located near Pierrelatte, France, which shut down permanently on June 7, 2012.

AREVA is presently building a new enrichment plant near Pierrelatte, France that will result in the replacement of its existing GDP with a new 7.5 million SWU per year enrichment plant that utilizes Enrichment Technology Company (ETC) centrifuge technology. The new plant, Georges Besse II (**GB II**), became operational in 2011 and is continuing to ramp up to its nameplate capacity by 2017.

In all figures that display projections of enrichment services supply and requirements, the **Urenco existing and planned expansions** refers to capability from machines that are presently in operation or expected to be installed at Urenco's three European enrichment plants, which are located in Gronau, Germany, Almelo, Netherlands and Capenhurst, United Kingdom. These plants had a combined annual production capability of 14.2 million SWU at the end of 2011, which is scheduled to increase to about 14.7 million SWU per year by the end of 2012.

The Urenco USA enrichment facility in Lea County, New Mexico, which is owned and operated by Urenco, began operating in 2010. At the end of 2011 it had an annual enrichment capacity of 0.4 million SWU. Urenco continues to add enrichment cascades as it ramps up to its present annual licensed capacity of 3.0 million SWU. Urenco previously has indicated that it expects to request to increase licensed annual production to 5.9 million SWU.

USEC Paducah enrichment capability refers to capability from the GDP, which is located in Paducah, Kentucky. Following negotiation of a multiparty agreement that included USEC, the DOE, Energy Northwest and the Tennessee Valley Authority, the Paducah GDP is now expected to operate through the middle of 2013 as it enriches DOE high assay tails that will be transferred to Energy Northwest under the agreement[28].

[28] U.S. Department of Energy, "Background Fact Sheet Transfer of Depleted Uranium and Subsequent Transactions", May 15, 2012. Under the agreement, in May 2012, DOE will transfer 9,075 metric tons uranium (MTU) of high-assay depleted tails to Energy Northwest (ENW). ENW is expected to contract with USEC to enrich these depleted tails, which would be done at the Paducah gaseous diffusion plant (GDP) over a period of about one year. This will create 482 MTU of low enriched uranium (LEU). ENW will sell a portion of this LEU to TVA. ENW and TVA would use this resulting LEU in their respective nuclear power plants to produce electricity during the period 2015 through 2021.

Rosatom is the state-owned corporation overseeing both commercial and military nuclear activities in Russia. Rosatom's utilization of its substantial enrichment capacity and how it interacts in the world market is much more complex than is the case for any of the other enrichers, warranting a more detailed discussion. The Rosatom uranium enrichment plant production capability refers to the production at four plants in Russia operating at close to a 100% capacity factor. Production is reduced approximately 7% from nameplate capacity due to the low operating tails assay employed. Production during 2011 is estimated to have been 26.2 million SWU. For 2011, approximately 5.7 million SWU was devoted to C.I.S. and Eastern European requirements, which will be referred to as **Rosatom Internal**. Current U.S. and European trade policies effectively limited the quantity of Russian enrichment services that were sold directly and indirectly to Western customers during 2011 – referred to as **Rosatom Export,** which is further divided between exports excluding to the U.S. and exports to the U.S. – totaling approximately 5.4 million SWU. Rosatom exports are expected to increase substantially in 2014 to 10.3 million SWU and grow thereafter. The direct sale of almost 3 million SWU to the U.S. market begins in 2014, consistent with the terms of the 2008 Amendment to the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation.[29] Since Russian enrichment capacity is constrained due to U.S. and European trade policies, a substantial amount will be used to underfeed in meeting its commercial enrichment contracts and to re-enrich depleted uranium tails, creating natural uranium equivalent material (i.e., "normal" uranium) for internal use by Russia. An operating tails assay of 0.13 w/o U^{235} tails has been assumed. It should be noted that the Rosatom Internal and Export capacities are increased to respond to the greater requirements for enrichment services arising under the High Nuclear Power Growth forecast. Rosatom is assumed to maintain its long-term shares of approximately 100% and 25% for internal and export markets, respectively. As older centrifuges reach their design lifetimes, Rosatom is replacing them with newer designs that have higher outputs. As a result, total Russian enrichment production is expected to increase to 32.3 million SWU by 2025. Not all of this enrichment capacity may be needed, particularly if Russia's aggressive nuclear power expansion plans are moderated, as is assumed for the Reference Nuclear Power Growth forecast.

The **Russian HEU-derived LEU** is expected to remain at 5.5 million SWU per year through 2012, dropping to 5.3 million SWU in 2013 when the term of the current U.S.-Russian agreement for 500 MT HEU concludes. The 5.5 million SWU figure is based on the contractually agreed tails assay of 0.30 w/o U^{235}. However, it is equivalent to nearly 6.0 million SWU when evaluated at a 0.25 w/o U^{235} tails assay. USEC expects that this arrangement will end in 2013 as scheduled. In order to create and utilize the 5.5 million SWU contained in the LEU that is derived from the Russian HEU, approximately 5.4 million SWU contained in blend stock[30] is required. When the blending of Russian HEU ends, this capacity will become

[29] U.S. Department of Commerce International Trade Administration, February 1, 2008, "Amendment to the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation", Federal Register Volume 73, Number 28, February 11, 2008.

[30] Down blending of high enriched uranium (HEU) with assays greater than 90 w/o U^{235} to produce the low enriched uranium (LEU) for use in commercial nuclear power plants with assays of 4 to 5 w/o U^{235} and

available to Rosatom for use in commercial sales, subject to any trade constraints that may still exist. Note that an additional small quantity of SWU is derived from Russian HEU directly blended with European utility reprocessed uranium (RepU). The program has gradually expanded and now provides an estimated 0.6 million SWU per year, but will decline in the future, as supplies of the non-weapons grade HEU are limited.

At present, **U.S. HEU** includes material that is being used by TVA in the so-called BLEU program that began in 2005 as well as LEU derived from other HEU downblending operations, a portion of which is used to compensate the blending contractors. A detailed presentation of DOE's expected transfers of uranium and enrichment services into the commercial market from these sources is provided in a report that documents a comprehensive analysis of DOE's uranium sales and transfers that was prepared for the DOE[31] The contribution to supply is expected to gradually decline from 1.0 million SWU in 2012 to 0.2 million SWU per year in 2020 and beyond.

China and Other Existing and New capability is presently dominated by approximately 1.8 million SWU of annual centrifuge enrichment capability in China, with smaller amounts in other countries. The majority of this capability is used internally, although China exports modest amounts to the U.S. and Europe. The Chinese enrichment capability primarily uses centrifuges that are imported from Russia, although a small demonstration facility using indigenous centrifuge technology is believed to be in operation. The Chinese centrifuge enrichment capacity is expected to expand to seven million SWU by 2020, as China endeavors to continue to service a substantial portion of its own requirements. China is expected to make use of a combination and indigenous and Russian centrifuge technology for the expansion, but details remain closely held by the Chinese government.

Recycle materials contributed about 1.4 million SWU-equivalent to supply in 2011 and is expected to continue to supply the equivalent of as much as 2.1 million SWU per year for the long-term.

4.3 Proposed Supply of Enrichment Services

There are three proposed sources of enrichment services that have each made a substantial financial commitment to establishing U.S. based capability to provide enrichment services on a commercial basis. Two out of the three facilities already have received NRC construction and operating licenses; and a third may receive its construction and operating license later this year. Proposed Supply includes the following sources:

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associated enrichment services for sale to the U.S. requires production of 1.5 w/o U^{235} blend stock from enrichment tails material, which is accomplished by enriching the tails material.

[31] Energy Resources International, Inc., "Quantification of the Potential Impact on Commercial Markets of Introduction of DOE Excess Uranium Inventory in Various Forms and Quantities During Calendar Years 2012 through 2033", ERI-2142.12-1201, April 23, 2012.

AREVA has received a license from the NRC that will allow it to build and operate a 6.6 million SWU per year centrifuge enrichment plant – the Eagle Rock Enrichment Facility (EREF), in Idaho – using the same technology being deployed in GB II. Initial production had originally been expected to occur in 2014 with full capacity to be reached in 2019. However, as previously noted, on December 13, 2011, AREVA announced that it was cutting jobs and suspending projects around the world, including the Eagle Rock Enrichment Facility in the U.S., as part of a five year strategic action plan that would allow it to recover from massive losses in 2011 and allow it to return to profit.[32] It was reported in January 2012 that AREVA was planning to begin construction on the EREF in 2013, instead of 2012 as had originally been planned; or possibly as late as 2014 if it could not secure an investment partner for the project.[33] However, in February 2012, URS Nuclear LLC, the Procurement and Construction Manager for the EREF notified all of its subcontractors that the "project has been placed on indefinite suspension until further notice".[34]

Global Laser Enrichment (GLE), a business venture of General Electric-Hitachi Nuclear Energy (GEH) and Cameco Corporation, could decide to build a commercial enrichment plant that is now being licensed and which is based on laser enrichment technology. The planned maximum target annual production for the GLE plant is six million SWU.[35] If the decision is made to proceed with construction of a commercial plant, the earliest that such facility might be expected to begin operation according to GLE is 2014[36]. GLE expects that by the end of the first year it would reach an enrichment capacity of one million SWU. GLE then expects that its annual production would increase by one million SWU per year, reaching the planned maximum target of six million SWU per year in 2020.

USEC plans to replace the Paducah GDP with a new 3.8 million SWU per year centrifuge enrichment plant known as the **American Centrifuge Plant (ACP)**. As previously noted, USEC has received a license from the NRC to build and operate the ACP, but continues to experience delays in obtaining financing and USEC acknowledged that it is in a period of significant uncertainty since it cannot continue to fund the project on its own.[37] DOE raised additional concerns about a number of aspects of the project that USEC was not able to overcome to DOE's satisfaction. As a result, instead of issuing the conditional loan guarantee that USEC had sought from DOE, DOE proposed a two year cost share research, development and demonstration program for the project "to enhance the technical and financial readiness of the centrifuge technology for commercialization". In a statement

[32] "AREVA Strategic Action Plan – 2012-2016", page 45, December 13, 2011.

[33] Associated Press, Idaho Business Review, January 31, 2012, http://idahobusinessreview.com/2012/01/31/areva-could-begin-work-on-eagle-rock-plant-in-2013/

[34] URS Nuclear LLC Letter to Subcontractors, February 27, 2012.

[35] U.S. Nuclear Regulatory Commission, "Environmental Impact Statement for the Proposed GE-Hitachi Global Laser Enrichment, LLC Facility in Wilmington, North Carolina", NUREG-1938, page iii, February 2012.

[36] Olivier, J. GLE, Licensing and Regulatory Affairs Manager, Personal Communication, June 7, 2012.

[37] USEC Inc., "USEC Inc., 10-K Annual Report for the Period Ending December 31, 2011", page 5, March 14, 2012.

made May 1, USEC CEO John Welch said USEC is "quickly running out of time to obtain the necessary fiscal 2012 funding" for the project. "Our credit facility severely limits spending on the American Centrifuge project after May 31 unless we have federal RD&D funding in place. That means we need action this month, or we will be forced to demobilize the project."[38] During an earnings conference call May 2, Welch told analysts, "Obtaining the 2013 funding beginning October would be of limited value if the company had to shut down the ACP project in June because of a lack of fiscal 2012 funding."[39] Based on progress reportedly made to date, and the "expected near-term completion" of the agreements needed to provide such cost-shared funding, USEC stated on June 1, 2012 that it had completed work with the administrative agent and the lenders for the company's credit facility that would allow it to be extended for 15 days, supporting USEC's ability to continue with work on the project until the agreements are finalized. However, USEC and DOE have not announced a specific time frame for completing the agreements.[40]

The enrichment services that might be expected from these proposed sources are summarized in Table 4.

Item		Technology	Potential Economically Competitive and Usable Capability (Million SWU)					
			2012	2015	2020	2025	2030	2035
14	GLE	Laser	0.0	1.5	6.0	6.0	6.0	6.0
15	USEC ACP	Centrifuge	0.0	0.0	3.8	3.8	3.8	3.8
16	AREVA EREF	Centrifuge	0.0	0.0	1.9	4.5	6.0	6.0
	Total		0.0	1.5	11.7	14.3	15.8	15.8

(a) A portion of an enrichment facility's production capacity may be dedicated to underfeeding to produce uranium. Where appropriate, some of the numbers in this table have been adjusted to reflect this.

Table 4 Proposed Sources of Uranium Enrichment Services

Recognizing that there are national security implications attendant to the United States' nuclear fuel supply, it is important to consider supply of uranium enrichment services in the context of the current and expected future requirements that are described in Section 3.

5. Market Analysis of Supply and Requirements

Operators of many nuclear power plants in the U.S. – the end users of uranium enrichment services in the U.S. – monitor the future supply situation to ensure that adequacy of supply

[38] USEC Inc., Press Release, "USEC Reports First Quarter 2012 Results", May 1, 2012.
[39] Platts, Nuclear News Flashes, May 2, 2012.
[40] USEC Inc., "USEC Inc., Form 8-K, June 1, 2012.

is maintained. They see a world supply and requirements situation for economical uranium enrichment services that is presently in reasonable balance, but one that has a potential for significant shortfall if plans that have been announced for new enrichment facilities are not successfully executed.

To better understand the industry's expectation and concerns regarding the future, it is useful to consider both the world and U.S. markets and the potential impact that the three proposed sources of enrichment services (i.e., AREVA/EREF, GEH/GLE and USEC/ACP), which are discussed in Section 4.2, could have on these markets and the adequacy of enrichment services to meet future operating requirements of nuclear power plants.

5.1 Reference Nuclear Power Growth Forecast

Figure 6 presents the Base Supply identified in Section 4.1, together with the ERI Reference Nuclear Power Growth forecast that is presented in Section 3. Given the growing uncertainty with regard to the AREVA/EREF and USEC/ACP projects, and the fact that the GEH/GLE project must still receive a construction and operating license from the NRC, these three proposed sources of enrichment services have not been included in this figure to illustrate the impact of their potential absence on the adequacy of supply in the world market.

In the absence of the enrichment services that would be produced by these three U.S.-based plants, supply is shown not to be adequate to meet world requirements beginning as early as 2017.

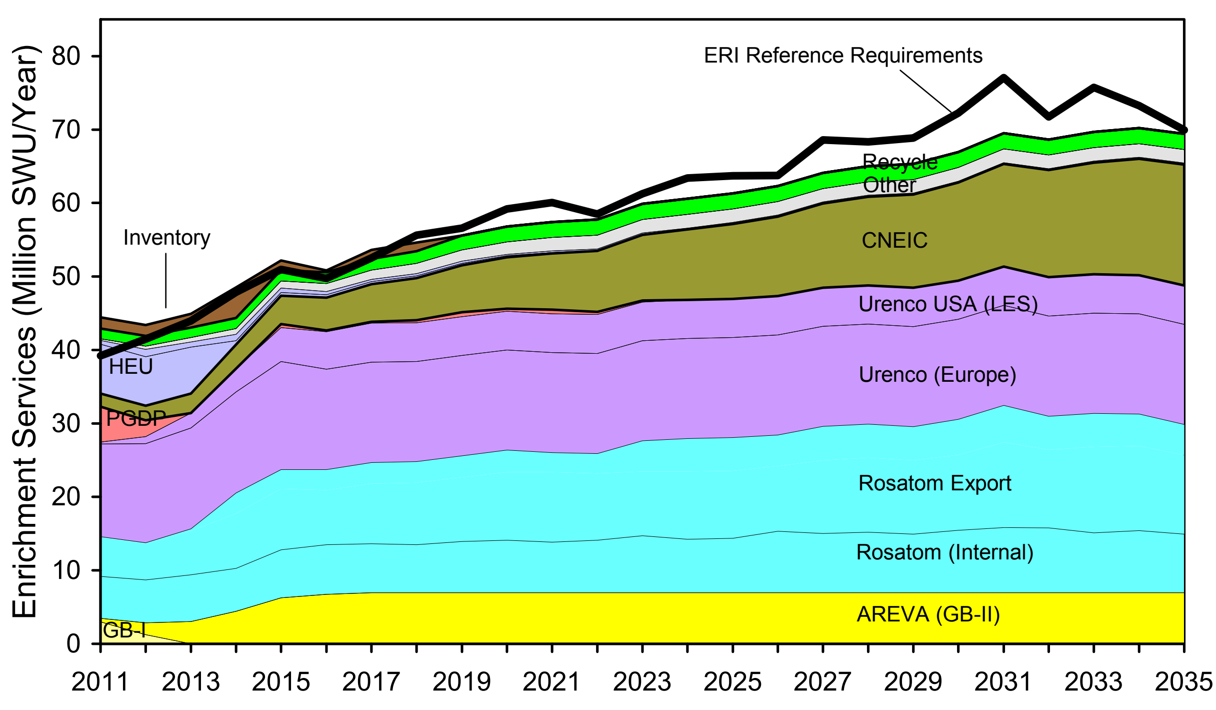

Figure 6 Base Supply and ERI Reference Nuclear Power Growth Requirements

During the 10 year period 2016 through 2025, without these three proposed sources of enrichment supply under the Reference Nuclear Power Growth forecast, world supply is an average of 1.3 million SWU per year (2.2%) short of meeting world average annual requirements. During the subsequent 10 year period 2026 through 2035, supply is an average of 3.8 million SWU per year (5.4%) short of meeting world average annual requirements. However, if one of these three proposed sources of enrichment supply are assumed to be operating, then it is estimated that there will be adequate world supply, but with an average annual supply margin that, depending upon which one of the proposed sources of enrichment supply is assumed to be operating, is between 0.8 and 3.9 million SWU per year (between 1.4% and 6.7% of average annual requirements) during the period 2016 through 2025; and not more than 2.2 million SWU per year (not more than 3.1% of average annual requirements) during the period 2026 through 2035.

From the perspective of U.S. self sufficiency with respect to enrichment services, it is important to note that all three of these enrichment plants must be operating to avoid there being a shortage of U.S. based enrichment supply relative to U.S. requirements at some point during the period 2016 through 2035 under the Reference Nuclear Power Growth forecast. With only two of the three proposed sources of enrichment supply operating, the average shortage in supply during the period 2016 through 2025 is between 1.6 and 4.7 million SWU per year (between 10.1% and 29.7% of average annual requirements). During the period 2026 through 2035, without both the EREF and GLE plant operating there is a shortage of about 1.7 million SWU per year (about 10.1% of average annual requirements). If the smaller ACP is not operating, but both the EREF and GLE plant are operating, then average annual supply exceeds U.S. average annual requirements by 0.5 million SWU per year (3.0% of average annual requirements). The Reference Nuclear Power Growth forecast indicates there a clear need for all three of these proposed sources of enrichment supply.

5.2 High Nuclear Power Growth Forecast

Figure 7 presents the Base and Proposed Supply identified in Sections 4.1 and 4.2 together with the ERI High Nuclear Power Growth forecast. In this figure the AREVA/EREF, GEH/GLE and USEC/ACP projects are all assumed to have been successfully built and operational (under the High Requirements Scenario). Therefore, all three sources are included in the figure.

Even with the enrichment services that would be produced by these three U.S. based plants, supply is shown not to be adequate to meet world requirements by about 2026, at which time a supply gap occurs.

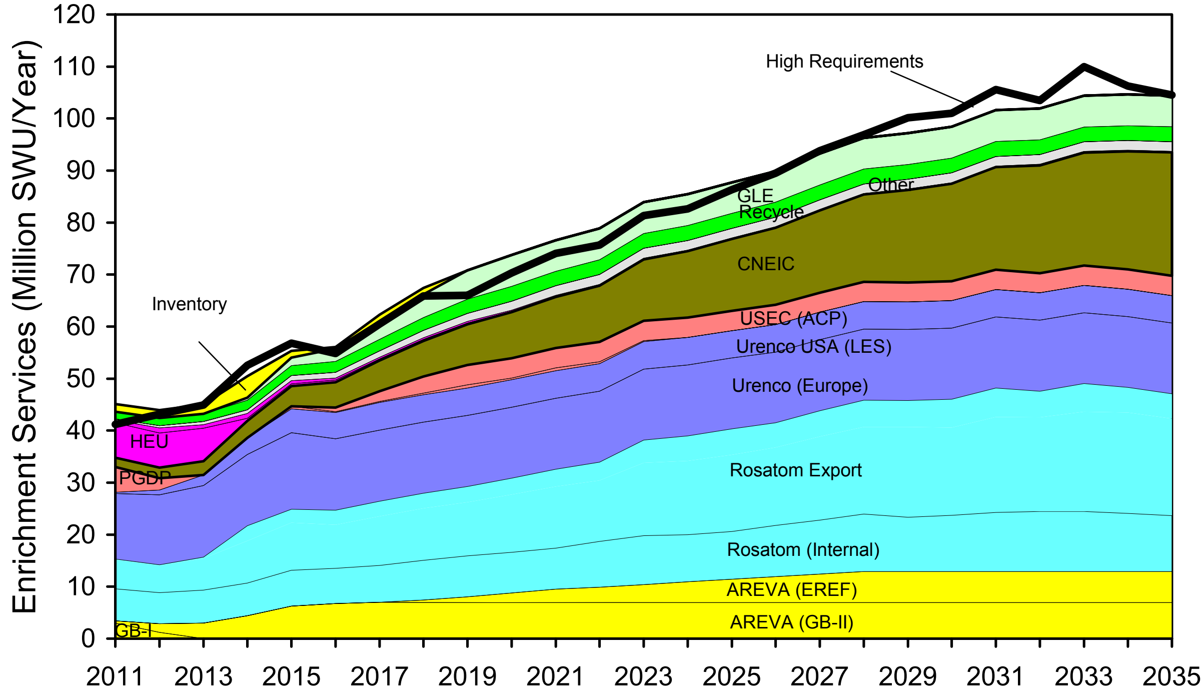

Figure 7 Base and Proposed Supply and ERI High Nuclear Power Growth Requirements

During the 10-year period 2016 through 2025, with all three proposed sources of supply assumed to be operational, the world average annual supply margin is only 2.5 million SWU per year (3.5% of average annual requirements). During the subsequent 10- year period 2026 through 2035, there is an average annual supply shortage of 1.9 million SWU per year (1.9% of average annual requirements).

Even with all three of these proposed sources of enrichment supply available, there are shortages of U.S.-based enrichment supply relative to U.S. requirements during the period 2016 through 2035 under the High Nuclear Power Growth forecast. With only two of these three proposed sources of supply assumed to be operating, the average shortage in supply during the ten-year period 2016 through 2025 is between 2.4 and 5.5 million SWU per year (between 14.5% and 33.1% of average annual requirements). During the period 2026 through 2035, with only two of these three proposed sources of supply operating, the average shortage in supply during the ten year period 2026 through 2035 is between 2.0 and 4.2 million SWU per year (between 10.4% and 21.8% of average annual requirements). Under the High Nuclear Power Growth forecast, there is clearly a need for all three of these proposed sources of enrichment supply if the U.S. is to achieve self-sufficiency with respect to uranium enrichment services.

5.3 Low Nuclear Power Growth Forecast

Figure 8 presents the Base Supply identified in Section 4.1 together with the ERI Low Nuclear Power Growth forecast. In this figure the proposed sources of enrichment supply – the AREVA/EREF, GEH/GLE and USEC/ACP projects – are not assumed to be operating

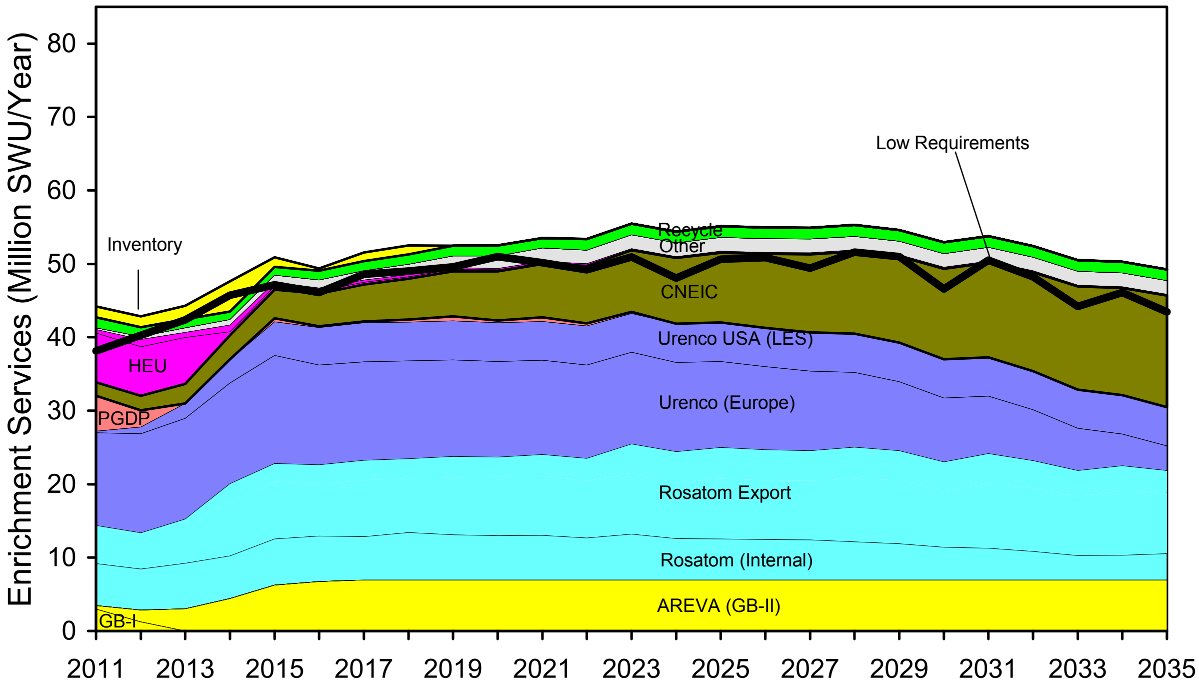

Figure 8 Base Supply and ERI Low Nuclear Power Growth Requirements

As shown in the figure, without the three proposed sources of supply operating there is adequate enrichment supply to cover world requirements throughout the entire study period. However, during the 10 year period 2016 through 2025, average supply exceeds average requirements by only 3.7 million SWU per year (7.5% of average annual requirements). During the 10 year period 2026 through 2035, average supply exceeds average requirements by only 4.7 million SWU per year (9.8% of average annual requirements).

Even under the Low Nuclear Power Growth forecast, all three of the proposed sources of enrichment supply must be operating to avoid a shortage of U.S.-based enrichment supply relative to U.S. enrichment requirements during the period 2016 through 2035. If only two of these proposed sources of enrichment supply are operating, then the average annual shortage in the U.S. during the period 2016 through 2025 is between 0.5 and 3.6 million SWU per year (between 3.4% and 24.5% of average annual requirements). During the period 2026 through 2035, if only one of these proposed sources of enrichment supply are operating, then depending upon which of the plants are assumed to be operational, the situation ranges from an average supply shortage in the U.S. of as much as 1.3 million SWU per year (10.2% of average annual requirements) to an average supply excess of 0.8 million SWU per year (6.2% of average annual requirements). Thus, it is apparent that even in the Low Nuclear Power Growth forecast, there is need for these three units to assure U.S. self-sufficiency in meeting domestic enrichment supply requirements.

5.4 Summary and Comparison

Table 5 provides a summary of supply and requirements scenarios for the world and U.S. under each of the three nuclear power growth forecasts previously described. Results are presented as average annual values for each of two 10 year periods – 2016 through 2025 and 2026 through 2035. The highlighted scenarios in Table 5 are those for which the average annual supply of enrichment services is not adequate to meet requirements.

	Reference Nuclear Power Growth		High Nuclear Power Growth Forecast		Low Nuclear Power Growth Forecast	
	Million SWU per Year (Percent of Requirements)		Million SWU per Year (Percent of Requirements)		Million SWU per Year (Percent of Requirements)	
Time Period	2016-2025	2026-2035	2016-2025	2026-2035	2016-2025	2026-2035
World						
Potential Supply - None	-1.3 (-2.2%)	-3.8 (-5.4%)	-8.1 (-11.3%)	-17.5 (-17.3%)	+3.7 (+7.5%)	+4.7 (+9.8%)
Potential Supply - 1 of 3	+0.8 to +3.9 (+1.4% to +6.7%)	+0.0 to +2.2 (+0.0% to +3.1%)	-6.0 to -2.9 (-8.4% to -4.0%)	-13.7 to -11.5 (-13.6% to 11.4%)	+5.8 to +8.9 (+11.8% to +18.1%)	+8.5 to +10.7 (+17.6% to +22.2%)
Potential Supply - 2 of 3	+4.1 to +7.2 (+7.1% to +12.4%)	+5.8 to +8.0 (+8.2% to 11.3%)	-2.7 to +0.4 (-3.8% to +0.6%)	-7.9 to -5.7 (-7.8% to -5.6%)	+9.1 to 12.2 (+18.5% to 24.7%)	+14.3 to +16.5 (+29.7% to 34.2%)
Potential Supply - All	+9.3 (+16.0%)	+11.8 (16.6%)	+2.5 (+3.5%)	-1.9 (-1.9%)	+14.2 (+29.0%)	+20.3 (+42.1%)
U.S.						
Potential Supply - None	-10.0 (-63.3%)	-11.3 (-67.3%)	-10.8 (-65.1%)	-13.8 (-71.5%)	-8.9 (-60.5%)	-7.3 (-57.0%)
Potential Supply - 1 of 3	-6.1 to -4.8 (-38.6% to -30.4%)	-5.3 to -2.5 (-31.5% to -14.9%)	-6.6 to -5.5 (-39.8% to -33.1%)	-7.8 to -4.4 (-40.4% to -22.8%)	-5.1 to -3.7 (-34.7% to -25.2%)	-1.3 to +0.8 (-10.2% to +6.2%)
Potential Supply - 2 of 3	-4.7 to -1.6 (-29.7% to -10.1%)	-1.7 to +0.5 (-10.1% to +3.0%)	-5.5 to -2.4 (-33.1% to -14.5%)	-4.2 to -2.0 (-21.8% to -10.4%)	-3.6 to -0.5 (-24.5% to -3.4%)	+2.3 to +4.5 (+18.0% to +35.2%)
Potential Supply - All	+0.5 (+3.2%)	+4.3 (+25.6%)	-0.3 (-1.8%)	+1.8 (+9.3%)	+1.6 (+10.9%)	+8.3 (+64.8%)
Base Supply is included in all cases.						
Potential Supply includes AREVA/EREF, GEH/GLE, USEC/ACP.						

Table 5 Summary of Supply and Requirements for Representative Scenarios

As shown in Table 5 for the world, only under the Low Nuclear Power Growth forecast is Base supply sufficient by itself to meet world requirements through 2035. Under the Reference Nuclear Power Growth forecast, Base supply plus at least one of the three proposed sources of enrichment services will be necessary to meet world requirement during each of the 10 year periods. Under the High Nuclear Power Growth forecast, all three proposed sources of enrichment services are necessary to meet world requirements during the first 10 year period. However, even with all three proposed sources of enrichment services operational, supply is not adequate to meet forecast requirements during the second 10 year period.

With regard to the U.S., it is apparent from Table 5 together with the previous discussion that with the exception of the 2026 through 2035 period under the Low Nuclear Power Growth forecast, when only two of the three proposed sources of enrichment services is necessary to meet forecast U.S. requirements that U.S.-based supply is not adequate to meet U.S. requirements. Thus, it is apparent that there is need for these three units to assure U.S. self-sufficiency in meeting domestic enrichment supply requirements.

Furthermore, as stated at the end of Section 3, if the WNA Reference forecast for uranium enrichment requirements – which is higher than the ERI Reference forecast, as illustrated in Figures 4 and 5, was used by ERI in its analysis of supply adequacy, then the need for new uranium enrichment capability would be even greater. This can be best summarized by noting that if the WNA Reference forecast is taken as the basis for future world requirements for enrichment services, then all three of the proposed sources of enrichment services would have to be operational to avoid a shortage of supply during the 2016 through 2030 time period. However, if any one of the three proposed sources of enrichment services is not built and operated as currently planned, then there would be a shortage of enrichment services during the 2016 through 2030 time period that averages between 0.9 and 3.0 million SWU per year (between -1.2% and -4.1% of average annual requirements). These results are similar to those associated with the ERI High Reference Nuclear Power Growth requirements forecast over the same period (between -2.5% and -5.3% of average annual requirements). In the U.S., assuming the WNA Reference forecast of requirements for enrichment services, even with two out of three of the proposed sources of enrichment supply available, there would still be a shortage of U.S.-based enrichment supply relative to U.S. requirements during the 2016 through 2030 time period of between 3.5 and 5.7 million SWU per year (between -19.3% and -31.5% of average annual requirements).

6. Other Considerations

It also is important to recognize that the owners and operators of nuclear power plants have two primary objectives in purchasing nuclear fuel, including uranium enrichment services.[41,42,43,44] The first objective is security of supply – i.e., adequacy of supply in the market that is sufficient to (1) mitigate against unanticipated disruptions from one or more sources; and (2) the ability of the purchaser to rely on its suppliers to deliver nuclear fuel materials and services on schedule and within technical specifications, according to the terms of the contract and for the contract's entire term. The second objective is to ensure a competitive procurement process – i.e., the availability of qualified suppliers in the market and the ability of the purchaser to select from among multiple suppliers through a process

[41] Rives, F.B., Entergy Services, Inc., "Fuel Security – What is it and Can it Really be Achieved?", presented at Nuclear Energy Institute Fuel Cycle 2002, April 2002.

[42] Culp, D., Duke Energy Corporation, "Security of Supply-Fact or Fiction", presented at Nuclear Energy Institute International Uranium Fuel Seminar 2002, October 1, 2002.

[43] Malone, J., Exelon Generation Company, LLC, "Fuel Cycle Influencing Factors – Setting the Stage…", presented at World Nuclear Fuel Market Annual Meeting, June 5, 2006.

[44] Malone, J., Exelon Generation Company, LLC, "Testimony Before the Committee on Energy and Natural Resources Untied States Senate", March 5, 2008.

that is conducive to fostering reasonable prices for the nuclear fuel materials and services that are purchased.

While one can postulate alternative supply scenarios, there are commercial considerations and other implications associated with each such scenario, many of which can have a significant impact on the purchasers' ability to achieve the two primary purchasing objectives identified above.

Nuclear power plants are a significant component of the U.S. electric power supply system, providing about 20% of the electricity that is consumed in the U.S. each year. The current U.S. market for uranium enrichment services is characterized by annual requirements of approximately 15 million SWU.

The need for a new enrichment plant, such as the one proposed by GLE (which, with a enrichment capacity of 6 million SWU per year when fully operational, would represent approximately 8% of world requirements during the period 2026 through 2035), becomes even more apparent in light of the increased uncertainty associated with the two other proposed sources of enrichment supply – AREVA/EREF and USEC/ACP.

The NRC Staff in its FEIS appropriately acknowledges that even though operation of the GLE plant potentially could result in enrichment capacity that exceeds projected annual requirements, there are significant uncertainties in other proposed projects, and that "extra capacity would provide needed assurance that enriched uranium would be reliably available when needed for domestic nuclear power production."[45]

[45] U.S. Nuclear Regulatory Commission, "Environmental Impact Statement for the Proposed GE-Hitachi Global Laser Enrichment, LLC Facility in Wilmington, North Carolina", Final Report, page 1-8, NUREG-1938, February 2012.