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The Global Nuclear Fuel Market: Supply and Demand, 2007-2030

Rapid growth in world demand for electricity has provided a strong market for the development of nuclear power over the past 30 years, and it now contributes 16% of world electricity supply. Today, electricity demand growth is relatively low in most of the countries where nuclear power is well established, but remains rapid in many developing countries. In both established and potential markets, nuclear power faces a competitive challenge from other modes of generation, while continuing to face regulatory and political hurdles.

The forecasts of nuclear generating capacity in individual countries and areas have been revised and continue to extend to 2030. Forecasts are by country to 2020, but only by region to 2030.

It remains the case that the fortunes of nuclear power in a relatively small number of countries, notably the United States, China, India and Russia, will be particularly crucial in determining nuclear power's overall contribution to world electricity supply.

As was generally expected, the outlook for nuclear power around the world has continued to improve since the previous Market Report was issued in 2005. This is despite the continuation of unhelpful political interference in some countries, which is blighting the medium term prospects to 2020. The operating performance of existing reactors continues to improve, ensuring their economic competitiveness in liberalized electricity markets. The prospects for new reactor build continue to get better in the United States, the United Kingdom and some other countries.

Three scenarios for world nuclear generating capacity up to 2030 have been prepared, referred to as the reference, upper and lower scenarios. These range from a substantial revival of nuclear power to a slow decline over the forecast period. At the end of 2006, world nuclear capacity was 368 GWe. In the reference scenario this is expected to be 377 GWe by 2010, and then to grow to 454 GWe by 2020 and to 529 GWe by 2030. The annual average rate of growth over the whole period is 1.5%. Given expected world electricity demand growth substantially in excess of this (expected to double by 2030), the nuclear share of total generation is likely to decrease substantially. In the upper scenario, the equivalent figures are 382 GWe in 2010, 520 GWe in 2020, and 730 GWe in 2030. This would maintain the nuclear share of world electricity at close to the current 16% level in the medium term, but then lead to a small rise to 18% by 2030. In the lower scenario, nuclear generating capacity still rises slightly to 373 GWe in 2010, but then stagnates at that level until 2020, before falling away to 285 GWe in 2030.

Compared with the forecasts in the 2005 Market Report, the overall world generating capacity scenarios are little changed. This does, however, mask some changes in the country breakdowns. It may seem surprising that the scenarios are not higher than in 2005, given the mainly good news about nuclear since then, but this was largely anticipated and included in the 2005 report. What has changed is the relative likelihood of the scenarios - the upper case is probably more likely now than two years ago and the lower scenario less so.

Generating capacity is directly related to reactor requirements, the key demand indicator for nuclear fuel. The reactor requirements model has been extensively updated, with a reassessment of the various factors affecting nuclear fuel demand, such as enrichment levels, cycle lengths and fuel burnups. Questionnaires sent to nuclear utilities throughout the world provided useful information to both inform and supplement the model.

The three scenarios for nuclear generating capacity were used to produce reference, upper and lower scenarios for reactor uranium requirements. World reactor requirements in 2006 are estimated at 64,200 tU equivalent. In the reference scenario, these are expected to be 64,700 tU in 2010, rising to 81,000 tU in 2020 and 109,100 tU in 2030. The annual rate of growth 2006-2030 is 2%, slightly ahead of the equivalent growth in generating capacity. This can mainly be explained by a subtle mixture of anticipated higher reactor load factors and other fuel management strategies. In the upper scenario, uranium requirements are expected to be 67,400 tU in 2010, 92,200 in 2020, and 149,000 tU in 2030. The lower case figures are 64,500 tU in 2010, 66,300 tU in 2020, and 52,400 tU in 2030.

By comparison with the 2005 Market Report, the uranium requirements scenarios are generally lower, and substantially so in the period to 2010. The major explanation for this is that the sharp increase in world uranium prices has prompted utilities to find ways of saving uranium. This has mainly been accomplished by a lower tails assay at enrichment plants, but fuel enrichment levels have also not risen as much as previously expected.

World known reserves of uranium are more than adequate to satisfy reactor requirements to well beyond 2030. World uranium production has stagnated at around 40,000 tU over the period 2004-6, despite uranium prices rising to exceptional levels over this time. A variety of factors are

responsible for this but the price increases have greatly encouraged exploration and future production plans.

Three scenarios for uranium production have been developed by evaluating anticipated mine production capabilities. Assumptions have been made to generate three scenarios for likely uranium production in the period to 2030. It is anticipated that production should now rise strongly in all scenarios. In the reference case, world uranium production is expected to reach 60,000 tU in 2010 and 68,000 tU in 2015. In the upper case, the equivalent figures are 65,000 tU and 82,000 tU, respectively. And in the lower case, production should be 51,000 tU in 2010 and 64,000 in 2015. Beyond 2015, it gets increasingly difficult to forecast production, as there are a lot of mines in the "prospective" category, where start-up dates are unpredictable. It is clear, however, that there are sufficient reserves and identified projects to take world production well ahead of these levels in the post 2020 period.

Secondary supplies are now playing a diminishing role in the world market, but will continue to be important over the entire period to 2030. There remain uncertainties about the magnitude and character of Russian inventories and stockpiles, and it is still unclear where they will be consumed and how long they will last. However, it is known that substantial spare Russian enrichment capacity has been used to re-enrich depleted uranium; this is likely to remain an important source of secondary supply to both Eastern and Western markets, in the short-term at least. Ex-military highly enriched uranium (HEU) from Russia and, potentially, the United States will continue to be an important element in the market in the period beyond the termination of the US-Russia deal at the end of 2013. Ex-military plutonium will have only a minor impact.

There are discrete markets for conversion, enrichment and fuel fabrication services. Demand for each service is clearly linked to that for uranium and for the other services, but each market has to be considered individually. Most of the secondary sources which will have an impact on the uranium market will also affect the conversion and enrichment markets. The fuel fabrication market differs from the others in that it supplies a highly differentiated product, rather than a commodity or simple service.

Combining all primary and secondary uranium supply sources suggests that the nuclear fuel market should be more than adequately supplied in the period to 2020. Indeed, there are expected to be supply surpluses in the period 2010-15, assuming primary uranium production rises as anticipated. Lower uranium requirements than predicted in 2005 are also an important factor in this.

There have always been significant risks for the nuclear power industry in over-reliance on supplies from secondary sources, as additional primary supplies can only be brought on line with some delay. This is now, at last, beginning to happen, but projects continue to face many challenges in entering production. Interest in uranium exploration and mine development has been greatly stimulated by the recent price increases and this should eventually spur production in the period beyond 2020, when both reference and upper demand scenarios require further uranium production increases.