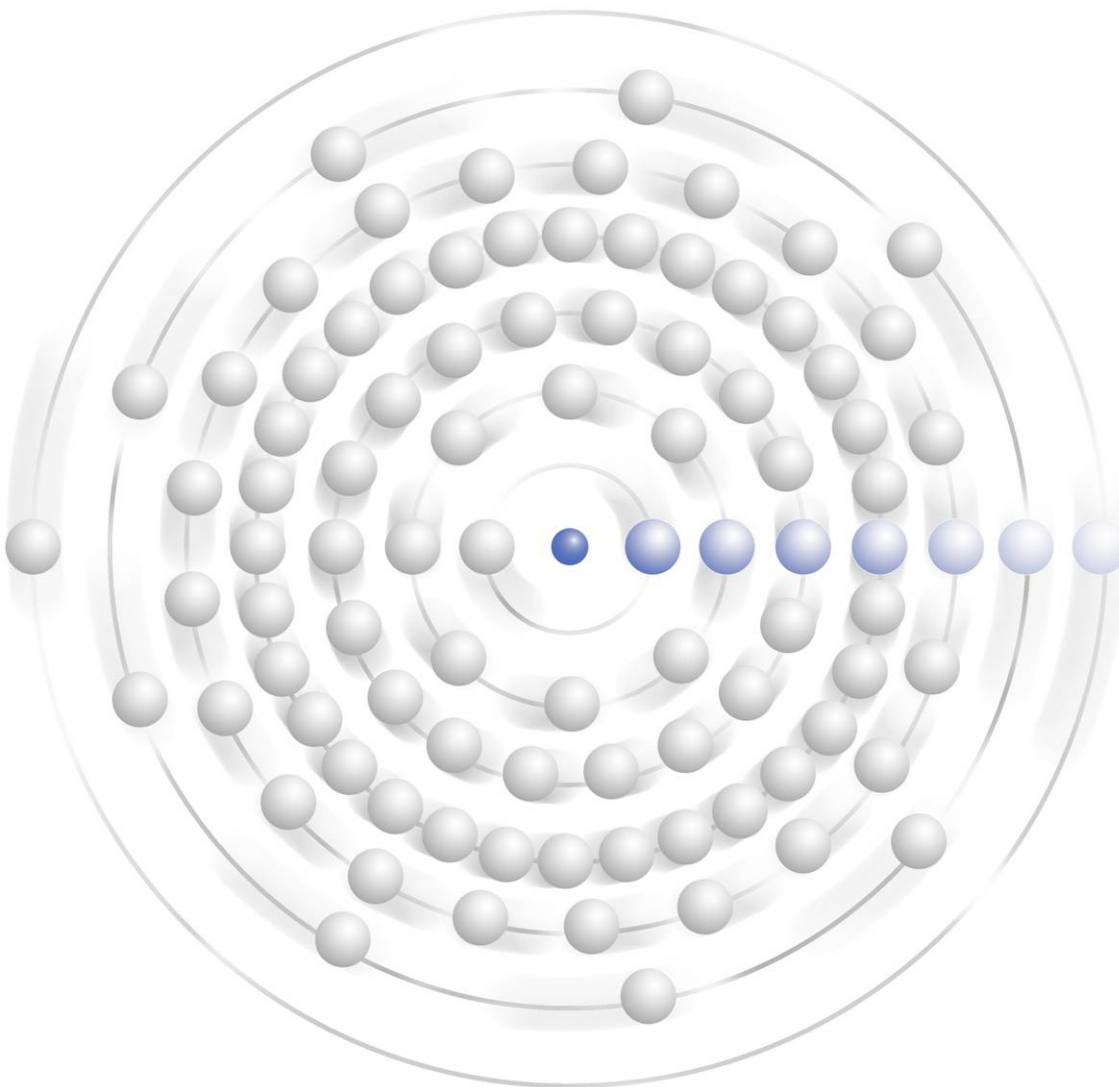




Fabrication Market Outlook

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Introduction

The Ux Consulting Company LLC (UxC) is pleased to present the 2010 *Fabrication Market Outlook* (FMO), which is the fourth annual edition in this series. This year's report builds upon the significant enhancements made in our 2009 edition as part of our continuing efforts to enhance information exchange and understanding in the all-important global nuclear fuel fabrication marketplace.

The focus of this report is fuel fabrication for Light Water Reactors (LWRs), i.e., Boiling Water Reactors (BWRs) and Pressurized Water Reactors (PWRs), as these comprise the great majority of the nuclear plants currently in operation around the world and those planned for the future. The Soviet-designed VVER reactors installed in Russia, Eastern Europe, and a few other countries are, in fact, PWRs. There are also a number of pressurized heavy water reactors (PHWRs) operating in Canada and other nations, gas cooled reactors (GCRs) in the United Kingdom, and several light water cooled, graphite moderated reactors (LGRs) in Russia, but these all represent unique fuel fabrication markets, which are covered in a separate chapter at the end of this report.

In the chapters that follow, we will address many of the diverse commercial, institutional and technical aspects of nuclear fuel, fuel fabrication, and the international fuel fabrication market. The report is intended to serve a variety of purposes:

- To those with little knowledge of fuel fabrication and its markets, it can serve as a primer providing a solid background in the various aspects of the subject and an understanding of how its markets function.
- To those knowledgeable in the fundamentals of fabrication, it offers analyses of a variety of its aspects based on several decades of participation in the fabrication business.
- And to those who are actively involved in the industry as buyers or sellers of nuclear fuel assemblies, it supplies additional insights to assist in the improvement of existing nuclear fuel programs and in the development of new fabrication-related initiatives.

What's New in the 2010 Report?

In the 2010 *Fabrication Market Outlook* (FMO) report, we have continued to use the new content and format adopted last year, and, of course, all of the discussions and analyses have been updated to reflect the events of the past twelve months. We have conducted another survey of international utility attitudes toward the fabrication market, but have expanded last year's version to cover additional topics.

This year's Essay focuses on the question of security of fabrication supply, a topic that has gotten little attention in the industry despite the substantial discussion that has taken place regarding security of natural and enriched uranium supplies.

The analysis of utility contracting issues has been expanded to include the subject of bundling, that is, including supplies of natural and/or enriched uranium from the same supplier in fabrication contracts. This is a topic that has arisen from time to time over the years only to disappear from consideration. Renewed interest in bundling over the past year or so has prompted its inclusion in the 2010 FMO.

This year's fuel fabrication demand projection is, once again, based on UxC's internal requirements forecasting model (URM), which, beginning with UxC's own proprietary forecasts for nuclear power growth, calculates demand on a reactor-by-reactor, cycle-by-cycle basis. The model has been refined and improved over the past year and, we believe, produces more accurate forecasts than in prior years.

As in the past, the focus of the report is fuel for Light Water Reactors (LWRs), i.e., Boiling Water Reactors (BWRs) and Pressurized Water Reactors (PWRs); but we also include a discussion of fuel fabrication for the pressurized heavy water reactors (PHWRs) operating in Canada and other nations, the gas cooled reactors operating in the United Kingdom (Magnox, AGR), and the light water cooled, graphite moderated reactors (LGR) in Russia (e.g. RBMK designed reactors).

Finally, as part of our continuing efforts to improve and enhance the analysis of the fuel fabrication markets, the authors made significant efforts to engage with as many of the global fuel fabricators to obtain the most accurate and up-to-date information. We would like to express our appreciation to all of those whose support and cooperation were instrumental in the preparation of this report.

• Roussely Report

In the discussion of AREVA in **Chapter 5 – The World's Nuclear Fuel Fabricators**, reference is made to the so-called Roussely Report, a study commissioned by the French Government to recommend an appropriate structure for the French nuclear industry to enhance its ability to compete in international markets for new reactors and fuel. The report was submitted to the government in May, but it was only in late July, just as this FMO report was going to press, that there was any indication of its contents and the government's reaction to them.

It now appears that a strategic partnership between AREVA and the French national utility Electricité de France (EDF) will be formed, with EDF being the dominant partner. This will be done not only to improve French marketing prospects, but to end the public feud between the companies. Despite some earlier calls for the dismantling of AREVA, it will remain intact. The government will also proceed with the sale of up to 15% of AREVA to outside interests, most likely Mitsubishi Heavy Industries and/or the sovereign wealth funds of Kuwait and Qatar.

While only limited details of possible changes in the French nuclear industry have been released to date, it does not appear that any of them will have a significant impact on the fuel fabrication industry in France or elsewhere around the world.

Structure of Report

Since the major changes to the structure of the FMO in 2009, this year's edition continues with our efforts to create a user-friendly text with each chapter having clear and distinct information. The reader is encouraged to begin at Chapter 1, as there is intended to be a continuous and logical flow to the report; however, each individual chapter provides a unique topical coverage that can also be used independently from the rest of the report contents. The report is structured as follows:

Before launching into the detailed discussions, and to orient those without a great deal of experience in the fabrication industry, we begin with **Chapter 1 – Nuclear Fuel Fabrication Market Primer**, which outlines the fundamental differences in terms of technical and commercial factors between the market for fabrication services and those for uranium, conversion, and enrichment.

This is followed by **Chapter 2 – Essay: (In)Security of Supply – What About Fabrication?**, which provides an analytical discussion on the question of security of fabrication supply. This is a topic that has gotten little attention in the industry despite the substantial discussion that has taken place regarding security of natural and enriched uranium supplies.

Chapter 3 – Reactor Developments and Demand Outlook begins our review of the fabrication market fundamentals with a look at current and future demand. This chapter presents UxC forecasts for nuclear power growth and the resulting fabrication demand projection using our new UxC Requirements Model (URM).

Continuing along the lines of demand analysis, **Chapter 4 – Utility Procurement Approaches and Contracting Issues** includes a discussion of the actions taken by utilities to fill their fuel demand. It also presents the results of our utility survey.

The supply side of the equation is addressed in **Chapter 5 – The World's Nuclear Fuel Fabricators**. The chapter includes profiles of each of the world's LWR fuel vendors, their production facilities, the products they produce, the markets they serve, and additional items of interest. It also presents UxC's forecast of fuel fabrication supply over the next two decades.

Chapter 6 – Supply and Demand Analysis pulls all of the preceding discussions together with a comparison of supply and demand for LWR fuel on both a global level as well as in each of the principal geographic market segments.

Since the market for fabricated LWR fuel is segmented both geographically and technically, these market segments are discussed and analyzed in **Chapter 7 – Global and Regional Market Analysis**.

Chapter 8 – Nuclear Fuel Fabrication Prices discusses the factors impacting current and future LWR fuel prices and presents UxC’s latest projections for both PWR and BWR fuel fabrication prices in different regional markets through 2030.

Finally, in **Chapter 9 – Non-LWR Fuel Fabrication Markets**, we present a discussion of the unique fuel fabrication markets for PHWRs, GCRs, and LGRs.

The report also contains a series of appendices, which provide background information and other useful items on the fabrication market. These include:

- Appendix A – History of the Nuclear Fuel Fabrication Industry
- Appendix B – Typical Fuel Fabrication Service Contracts
- Appendix C – UxC 2010 Fuel Fabrication Market Survey Sample
- Appendix D – Design & Manufacture of Nuclear Fuel Assemblies
- Appendix E – Fuel Fabricator Contact Information
- Appendix F – Glossary