



Conversion Market Outlook



– NOTICE –

UxC, LLC (“UxC”) shall have title to, ownership of, and all proprietary rights in this Report. Under United States federal copyright law (17 USC 101 et seq.) it is illegal to reproduce this Report by any means without written permission from UxC.

The information contained in this Report is obtained from sources that UxC believes to be reliable. UxC makes no warranty or representation, express or implied, with respect to the accuracy, completeness or usefulness of the information contained in this Report and UxC, to the maximum extent permitted by law, assumes no liability for the use or effects of any of the information or data contained in this Report.

It is UxC’s strict policy not to endorse, promote, or recommend any particular securities, currencies, or other financial products or instruments. Nothing contained in this Report is intended to constitute investment, legal, tax, accounting or other professional advice and the reader should not rely on the information provided in this Report for making financial decisions.

The Ux U₃O₈ Price[®] and other Ux Price indicators are developed by UxC and are proprietary and exclusive intellectual property of UxC. These price indicators are provided to UxC’s customers through the Ux Weekly[®] publication and are made available on UxC’s public website solely at UxC’s discretion. They may not be reproduced or otherwise used without UxC’s express permission.

UxC[®], Ux Weekly[®], Ux U₃O₈ Price[®], UxC BAP[®], U-PRICE[®], and SWU-PRICE[®] are trademarks of UxC, LLC.

Table of Contents

Executive Summary	i
<i>Market Trends and Latest Developments</i>	i
<i>Essay: Implications of Russia's War for the Conversion Market</i>	i
<i>Price and Contracting Review</i>	ii
<i>Supply and Demand Overview</i>	iii
<i>Market Outlook and Price Forecast</i>	iii
Introduction	6
• Conventions Used in the Report	6
1 – Essay: Implications of Russia's War for the Conversion Market	7
Shifts in Demand	8
• Open vs. Captured Markets	9
Impacts on Current and Future Supplies	9
• Primary Suppliers	9
Cameco	9
ConverDyn	10
Orano	11
TVEL/TENEX	11
CNNC	12
• Secondary Supplies	12
Western Enricher Sales	12
Inventories	12
• Potential New Supply Sources	13
Westinghouse-SFL	13
GLE PLEF	13
New Market Dynamics	14
• Market Participant Views	14
• Market Participant Actions	15
Open Market Supply and Demand Outlook	16
Final Thoughts	17
2 – Conversion Contracting and Price Review	18
Spot Market Activity	18
• Review of 2022 Spot Market Activity	18
• Trends in Spot Supply and Demand	24
Long-Term Contracting Activity	25
• Review of 2022 Long-Term Contracting Activity	25
• Long-Term Contract Demand Over the Next 12 Months	27
Movements in Spot and Long-Term Pricing	29
• Spot Price Indicators	29
• Long-Term Price Indicators	30
3 – Requirements and Demand Outlook	31
Reactor Capacities Anticipated by 2040 by Country	31
Alternative UxC Reactor Forecast Scenarios	34
Demand Forecast Scenarios	35
• Reactor Requirements vs. Market Demand	35
• UxC Conversion Market Demand	35
UxC Requirements Model (URM)	35
Demand Forecast	36
Reviewing Uncovered Utility Requirements	38
4 – Primary and Secondary Supply Outlook	41
Supply Overview	41
Producer Updates	45
• Cameco	45
Production Status and Outlook	45
• ConverDyn	46
Metropolis Restart Status	46

Production Status and Outlook.....	46
• Orano	47
Production Status and Outlook.....	47
• Russia (TVEL/TENEX).....	48
Energoatom Terminates Nuclear Fuel Imports from TVEL	48
Czechia Airlifts Russian Nuclear Fuel	48
TVEL Fuel Transferred Through Finland en Route to Slovakia.....	49
Bulgarian Parliament Pushes for Nuclear Fuel Diversification	49
Westinghouse to Supply Nuclear Fuel to Finland's Loviisa	50
TVEL Signs New Fuel Contract with Armenia's Metzamor	50
Russian Suspension Agreement.....	50
• China (CNNC).....	51
Current Production Capacity	51
New Production Capacity.....	51
• Westinghouse-Springfields Fuels Ltd. (SFL).....	52
Secondary Supplies	53
• U.S. Department of Energy	53
Uranium Reserve	54
• Russian Government Inventories.....	54
• Enricher Sales.....	55
Urenco	55
Orano	55
Western Enricher Sales Forecast.....	56
Russia.....	56
• Commercial Inventories	57
Utility Inventory Holdings.....	58
• Fuel Banks	60
• MOX and Reprocessed Uranium	61
Beloyarsk 4 Operating on a Full MOX Core	61
EU MOX Utilization	61
Japan Receives MOX Fuel Shipment	61
EDF's RepU Contract with TENEX Reportedly Suspended	62
• Secondary Supplies Forecast & Analysis	63
Policy Issues Affecting the Market	65
• U.S. Uranium Reserve	65
Legislative Action to Support Uranium Reserve Establishment	65
• U.S. DOE Seeks to Boost LEU/HALEU Availability	66
• Russian Suspension Agreement.....	67
Sunset Review	68
Early Importation Request.....	68
Contract Approval Request	68
Russian Sanctions Update.....	69
Legislative Efforts to Limit Russia's Trade with the U.S.	69
• Canadian Sanctions.....	70
• Europe's Policy on Russian Nuclear Fuel Imports	70
5 – Conversion Market Indicators	72
Near-Term Indicator Summary.....	72
Near-Term Technical Analysis	73
6 – Market Outlook and Price Forecasts	74
Near-Term Outlook.....	74
• Spot Market.....	74
Recent Developments.....	74
Outlook.....	74
• Long-Term Contract Market	74
Recent Developments.....	74
Outlook.....	74
Medium-Term Outlook.....	75
• Will Metropolis Restart as Planned?	75
• Can Orano Fulfill its CMXII Ramp-Up Plans?	75
• Will Russian EUP Deliveries be Curtailed?	75
• Will China Increase its Exports?	75

- How Much Secondary Supply Is Left? 75
- Long-Term Outlook 77
 - Supply and Demand Fundamentals..... 77
 - Market Views on Conversion 78
 - Long-Term Trends 79
- UxC Spot Conversion Price Forecasts..... 80
 - General Assumptions..... 80
 - Price Definitions 80
 - Mid Spot Price Scenario – 50% Probability 81
 - High Spot Price Scenario – 25% Probability..... 84
 - Low Spot Price Scenario – 25% Probability..... 87
 - Composite Spot Price Results 90
- UxC Long-Term Conversion Price Forecasts 92
 - Mid Case LT Price Scenario Assumptions..... 92
 - High Case LT Price Scenario Assumptions 92
 - Low Case LT Price Scenario Assumptions..... 92
 - LT Price Forecast Scenarios..... 93
 - LT Composite Price Forecast 93
- Appendix A – Spot Price Indicator Methodology** **95**
 - Indicator System Overview 95
- Appendix B – Statistical Review** **97**
 - Historical Review..... 97
 - Future Outlook and Forecast 101

List of Figures

- Figure E-1. Open Market Supply & Demand i
- Figure E-2. Ux Conversion Prices ii
- Figure E-3. Spot Prices and Purchases by Form ii
- Figure E-4. Long-Term Contracting Volumes..... ii
- Figure E-5. Base Case Conversion Supply vs. Demand..... iii
- Figure E-6. Ux NA Spot Price Projection..... iii
- Figure E-7. Ux EU Spot Price Projection..... iii
- Figure 1. Conversion Market Shares in 2021 7
- Figure 2. Pre-War vs. Post-War Base Case UF₆ Demand Forecasts, 2020-2035..... 8
- Figure 3. Responses to UxC Survey 14
- Figure 4. Responses to UxC Survey 15
- Figure 5. Open Market Conversion Base Supply vs. Demand, 2022-2040 16
- Figure 6. Spot Conversion Volume..... 18
- Figure 7. Annual Spot Conversion Volume by Form, 1992-2022..... 18
- Figure 8. Spot Conversion Volume by Method..... 19
- Figure 9. Spot Conversion Volume by Need 19
- Figure 10. Quarterly Spot Conversion Volume by Buyer Group, 1992-2022 20
- Figure 11. Quarterly Spot Conversion Volume by Seller Group, 1992-2022 20
- Figure 12. Share Comparison of Spot Volume by Form, 2003-2022 21
- Figure 13. Quarterly Spot Conversion Volume by Form vs. Price, 1992-2022 22
- Figure 14. Spot vs. Long-Term Conversion Contracting Activity, 1993-2022 22
- Figure 15. Ux Spot Conversion Prices vs. Volume, 1998-2022 23
- Figure 16. Annual Spot Conversion Volume, 1992-2022 24
- Figure 17. Long-Term Conversion Contracting Activity, 2022..... 25
- Figure 18. Long-Term Conversion Contracting Activity, 1993-2023 27
- Figure 19. Spot Ux Conversion Prices, 1997-2022 29
- Figure 20. Ux Conversion Prices 30
- Figure 21. UxC Nuclear Generating Capacity Forecast, 2008-2040..... 32
- Figure 22. UxC Base, High, and Low Case Nuclear Capacity Forecasts, 2008-2040 34
- Figure 23. URM 2022-Q4 vs. 2022-Q2 Conversion Market Demand, 2008-2040 36

Figure 24. URM Base Demand Cases With & Without Inventory Build, 2008-2040	37
Figure 25. UxC Uncovered Conversion Requirements Estimate, 2022-2040.....	38
Figure 26. Comparison of Uncovered Conversion Requirements, 2015-2040	39
Figure 27. Base Case Conversion Supply vs. Demand, 2008-2040.....	42
Figure 28. High Case Conversion Supply vs. Demand, 2008-2040.....	43
Figure 29. Low Case Conversion Supply vs. Demand, 2008-2040	44
Figure 30. U.S. Utility Inventories, 1983-2021.....	59
Figure 31. Total Inventories Owned by EU Utilities, 2017-2021	60
Figure 32. Base Case Secondary Conversion Supplies Disposition, 2018-2040	63
Figure 33. Conversion Net Indicator Value vs. Price, 1992-2022	72
Figure 34. Conversion Spot Prices, 1981-2022	73
Figure 35. NA Spot Price vs. 6-Month Moving Avg.	73
Figure 36. Net Changes in the Conversion Spot Price by Month, 1981-2022	73
Figure 37. Base Case Conversion Supply vs. Demand, 2008-2040.....	77
Figure 38. Responses to UxC Survey	78
Figure 39. UxC Mid Spot Price Scenario Projection and Annual Variance, 1985-2040	83
Figure 40. UxC Mid Conversion Spot Price Projections, Current vs. Constant \$	83
Figure 41. UxC High Spot Price Scenario Projection and Annual Variance, 1985-2040	86
Figure 42. UxC High Conversion Spot Price Projections, Current vs. Constant \$	86
Figure 43. UxC Low Spot Price Scenario Projection and Annual Variance, 1985-2040.....	89
Figure 44. UxC Low Conversion Spot Price Projections, Current vs. Constant \$.....	89
Figure 45. UxC Composite Conversion Spot Price Projection Previous Midpoint Comparison.....	90
Figure 46. UxC Composite Spot Price Scenario Projection and Annual Variance, 1985-2040	91
Figure 47. UxC Composite Conversion Spot Price Projections, Current vs. Constant \$	91
Figure 48. UxC Conversion Long-Term Price Projection Comparison, 2005-2040	93
Figure 49. UxC Conversion Long-Term Composite Price Projections, 2005-2040.....	94
Figure A-1. Historic Conversion Net Indicator Value vs. Price, 1981-2022	95
Figure B-1. Monthly Spot Conversion by Form vs. Price, 1998-2022	97
Figure B-2. Long-Term Conversion Contracting Volumes, 1993-2023	98
Figure B-3. Ux Conversion Prices, 1995-2022.....	100
Figure B-4. URM 2021-Q4 vs. 2022-Q2 Conversion Market Demand, 2008-2040	101
Figure B-5. URM Base Demand Cases with & without Inventory Build, 2008-2040.....	101
Figure B-6. UxC Uncovered Conversion Requirements Estimate, 2022-2040	102
Figure B-7. WNA 2019 vs. 2021 World UF ₆ Requirements Forecast, 2018-2040	103
Figure B-8. Base Case Conversion Supply vs. Demand Case, 2008-2040.....	104
Figure B-9. High Case Conversion Supply vs. Demand Case, 2008-2040	105
Figure B-10. Low Case Conversion Supply vs. Demand Case, 2008-2040	106
Figure B-11. UxC Mid Conversion Spot Price Projections, Current vs. Constant \$	107
Figure B-12. UxC High Conversion Spot Price Projections, Current vs. Constant \$	107
Figure B-13. UxC Low Conversion Spot Price Projections, Current vs. Constant \$	107
Figure B-14. UxC Composite Conversion Spot Price Projections, Current vs. Constant \$	108
Figure B-15. UxC Composite Spot Price Scenario Projection and Annual Variance, 1985-2040	108
Figure B-16. UxC Conversion Long-Term Price Projection Comparison, 2005-2040.....	109
Figure B-17. UxC Conversion Long-Term Composite Price Projections, 2005-2040	109

List of Tables

Table 1. Spot Conversion Market Statistics, 2020-2022	23
Table 2. Utility Conversion Long-Term Contracts Summary, 2022	25
Table 3. 2022 Awarded Utility Long-Term Conversion Contracting Activity	26
Table 4. Potential Long-Term Conversion Activity Over the Next 12 Months	28
Table 5. Reactor Units & Nuclear Capacities Anticipated by Country by 2040	32
Table 6. UxC Base, High, and Low Case Nuclear Reactor and Capacity Forecasts, 2022-2040	34
Table 7. URM Conversion Market Demand Forecasts, 2022-2040	37
Table 8. UxC Total Conversion Requirements Volume Estimate, 2022-2040	40
Table 9. UxC Uncovered Conversion Requirements Volume Estimate, 2022-2040	40
Table 10. UxC Uncovered Conversion Requirements Percentage Estimate, 2022-2040	40
Table 11. World Conversion Capacity vs. 2021 & 2022 Estimated Production	41
Table 12. Base Case Primary Conversion Supply, 2022-2040	42
Table 13. Base Case Non-Traditional Supply, 2022-2040	42
Table 14. High Case Primary Conversion Supply, 2022-2040	43
Table 15. High Case Non-Traditional Supply, 2022-2040	43
Table 16. Low Case Primary Conversion Supply, 2022-2040	44
Table 17. Low Case Non-Traditional Supply, 2022-2040	44
Table 18. Arguments for 2024-2026 Price Movements	76
Table 19. Overview of Key Assumptions Used in each Scenario	80
Table 20. Key Assumptions Used to Develop Mid Price Scenario	81
Table 21. UxC Annual Conversion Spot Price Projections – Mid Price Scenario, 2022-2040	83
Table 22. Key Assumptions Used to Develop High Price Scenario	84
Table 23. UxC Annual Conversion Spot Price Projections – High Price Scenario, 2022-2040	86
Table 24. Key Assumptions Used to Develop Low Price Scenario	87
Table 25. UxC Annual Conversion Spot Price Projections – Low Price Scenario, 2022-2040	89
Table 26. UxC Annual Conversion Spot Price Projections – Composite Scenario, 2022-2040	91
Table 27. UxC Conversion Long-Term Price Projection Scenarios, 2022-2040	93
Table 28. UxC Conversion Long-Term Composite Price Projections, 2022-2040	94
Table A-1. Recent Conversion Indicators, 2021-2022	96
Table B-1. Spot Market Statistics, 2019-2022	97
Table B-2. Utility Long-Term Conversion Contracts Summary, 2018-2022	98
Table B-3. Ux Conversion Prices, 1994-2022	99
Table B-4. URM Conversion Market Demand Forecasts, 2022-2040	101
Table B-5. UxC Uncovered Conversion Requirements Volume Estimate, 2022-2040	102
Table B-6. WNA 2021 Requirements Forecast, 2020-2035	103
Table B-7. Base Case Primary Conversion Supply, 2022-2040	104
Table B-8. Base Case Non-Traditional Supply, 2022-2040	104
Table B-9. High Case Primary Conversion Supply, 2022-2040	105
Table B-10. High Case Non-Traditional Supply, 2022-2040	105
Table B-11. Low Case Primary Conversion Supply, 2022-2040	106
Table B-12. Low Case Non-Traditional Supply, 2022-2040	106
Table B-13. UxC Conversion Spot & Long-Term (LT) Price Projections, 2022-2040	110

Introduction

The *Conversion Market Outlook* update report is organized as follows:

Chapter 1 presents our essay “**Implications of Russia’s War for the Conversion Market,**” which examines how Russia’s invasion of Ukraine has impacted the global UF₆ industry. This includes a review of changes that have already been recorded so far in 2022 along with an analysis of the likely longer-term implications resulting from the fallout of Russia’s war and efforts to remove Russian nuclear fuel supplies from various open markets.

Chapter 2 summarizes the recent contracting activity in the spot and long-term markets and identifies factors influencing contracting in both markets over the past year. This section also examines the near-term spot demand outlook and the long-term contracting demand outlook.

Chapter 3 reviews UxC’s proprietary nuclear power forecasts developed in its *Nuclear Power Outlook* (NPO) as well as conversion demand forecasts based off the *UxC Requirements Model* (URM). Note that our latest reactor and demand forecasts, which extend through 2040, include significant updates based on the latest developments in the nuclear power market. This chapter also includes a review of uncovered utility conversion requirements.

Chapter 4 reviews the primary sources of conversion supply and recent developments associated with each supplier. This section also provides sections that review the various secondary sources and government policy actions that affect the market.

Chapter 5 reviews the trends in UxC’s Conversion Market Indicators since the last report and includes a technical analysis of near-term price movements.

Chapter 6 projects both spot and long-term prices through 2040 for three different scenarios (Mid, High, and Low cases), based on various assumptions for key factors. Additionally, this section includes detailed discussion of the conversion market outlook and analyzes major trends and future developments in the coming decades.

The report contains two appendices. A historical review and development methodology for the UxC Conversion Market Indicators is presented in **Appendix A**. **Appendix B** contains tables and figures that provide additional and expanded data to those presented in the body of the report. Appendix B’s design allows it to be used as a standard reference source providing both historical and current market data.

• Conventions Used in the Report

Unless otherwise stated, quantities are given in millions kgU as UF₆ and prices in terms of US\$/kgU as UF₆. Price forecasts are presented in current (year-of-delivery) U.S. dollars.