



## CONTENTS

		<u>Page</u>
General Remarks by J.S. Foster		6
CHAPTER I	SUMMARY	9
	Growth of Electrical Power	
	Growth of Nuclear Power	
	Nuclear Scenarios	
	Uranium Demand	
	Uranium Resource Estimates	
	Uranium Availability	
	Unconventional Uranium Resources	
	Undiscovered Uranium Resources	
	Measures of Required Effort	
	Thorium Resources Supply	
	Improvements in Fuel Utilization	
	Penetration of Advanced Fuel Cycles	
	Principal Conclusions	
CHAPTER II	PERSPECTIVE ON NUCLEAR POWER	35
	Introduction	
	Basis of the Assessment	
	Growth of Nuclear Power	
	Demands on Resources	
	(a) Cumulative Uranium Requirements	
	(b) Uranium Commitments	
	(c) Annual Uranium Demand	
	(d) Annual Demand for Separative Work	
	(e) Annual Reprocessing Requirements	
	(f) Plutonium Inventories	
CHAPTER III	URANIUM RESOURCES SUPPLY	67
	Supply Evaluation - The Problem	
	Classification and Terminology	
	Data Base and Methodology	
	Fossil Fuels versus Uranium	
	Existence versus Availability	
	Efforts Towards Solutions	
	Known Uranium Resources	
	(a) Conventional Resources	
	Types of Deposits	
	Resource Estimates	
	Exploitation Technology	
	Production Capabilities	
	Constraints on Availability	
	Measures of Required Effort	

(b)	Unconventional Resources	
	Swedish Shales	
	Phosphate Rock	
	Lignites	
	Copper Leach Solution	
	Marine Black Shales	
	Igneous Rocks	
	Seawater	
	Undiscovered Uranium Resources	
	Nature of the Problem	
	Existing Estimates	
	Exploration Technology	
	Discovery Costs	
	Exploration Activity	
	References	

CHAPTER IV	TECHNOLOGICAL RESOURCES	137
	(a) Present Status	
	Reactors	
	Uranium Hexafluoride Production	
	Uranium Enrichment	
	Fuel Fabrication	
	Fuel Reprocessing	
	Heavy Water Production	
	Unit Costs	
	(b) Future Prospects	
	General	
	Lowering Uranium Enrichment "Tails" Assay	
	Uranium and Plutonium Recycle	
	The Thorium Fuel Cycle	
	The Fast Breeder Fuel Cycle	
	Fuel Reprocessing	
	Waste Management	
	Mixed-Oxide Fuel Fabrication	
	Long-Term Prospects	
	Other Applications	
	Investment Requirements	
APPENDIX A	REGIONAL GROUPINGS FOR WORLD ENERGY CONFERENCE	157
APPENDIX B	THE FISHER-PRY SUBSTITUTION MODEL	161
APPENDIX C	URANIUM - A HISTORICAL SKETCH	165
	A Byproduct of Radium	
	Uranium for Defense	
	The Decline	
	The Buyers' Market	
	The Sellers' Market	
	References	

APPENDIX D	THORIUM RESOURCES SUPPLY	177
	Background Sketch	
	Known Thorium Resources	
	Additional Sources of Thorium	
	Summary and Conclusions	
	References	
APPENDIX E	ADVANCED FUEL CYCLES IN AN EXPANDING NUCLEAR POWER SYSTEM	193
APPENDIX F	AN ASSESSMENT OF NUCLEAR PROCESS HEAT FROM HIGH TEMPERATURE REACTORS AND THE IMPACT ON WORLD ENERGY RESOURCES	197
	Introduction	
	Technologies	
	Applications	
	Future Energy Demand and Substitution Potential	
	Impact on World Resources	
	Conclusions	