



4.1.2.1	Market Products and Demand.....	4-7
4.1.2.1.1	Dark Fiber and DWDM.....	4-7
4.1.2.1.2	Trends in Lit Bandwidth Pricing.....	4-8
4.1.2.1.3	Sampling of Utility Trends Selling Fiber Products.....	4-11
4.1.2.1.3.1	Dark Fiber.....	4-12
4.1.2.1.3.2	Wavelength Services.....	4-15
4.1.2.1.3.3	Lit Bandwidth Services.....	4-15
4.1.2.1.3.4	Other Services.....	4-16
4.1.2.2	Other Considerations: On-Net, Off-Net and Access Agreements.....	4-18
4.1.2.3	Factors Impacting Price Differentiation and Market Trends.....	4-20
4.2	Commercial Fiber Strategies for Today's Utilities.....	4-22
4.2.1	Partnering Considerations in Today's Telecom Business Climate.....	4-23
4.2.2	Legal/Regulatory Considerations.....	4-25
4.2.2.1	At the Federal Level.....	4-25
4.2.2.2	Examples of State Regulatory Considerations.....	4-26
4.2.2.3	At the Local Level.....	4-27
5.	Cost/Benefit Comparisons of Fiber With Other Technology Options.....	5-1
5.1	Considerations for Transport and Access.....	5-1
5.1.1	Financial Analysis Methodology.....	5-1
5.1.2	Breakeven Mileage.....	5-2
5.2	Fiber Cable and Associated Costs.....	5-3
5.2.1	Options for Cable Modes.....	5-3
5.2.1.1	What Utilities are Deploying.....	5-4
5.2.2	Type of Cable Being Deployed.....	5-4
5.2.2.1	OPGW versus ADSS in Overhead Power Lines.....	5-5
5.2.3	Cable Sizing and Extent of Cable Deployment.....	5-6
5.2.4	Age of Fiber in Use.....	5-7
5.2.4.1	A Sampling of Installed Costs.....	5-8
5.2.4.2	Performance and Reliability of Fiber.....	5-8
5.3	Fiber and Application to Disaster Recovery Networks.....	5-8
6.	Conclusions and Summary.....	6-1
6.1	Fiber for Utility Internal Use.....	6-1
6.2	Use of Fiber in Commercial Applications.....	6-2
6.2.1	Growth Areas in the Commercial Market.....	6-2

List of Figures

Figure 1-1: Utility Drivers and Priorities to Implement Fiber.....	1-2
Figure 1-2: A Sampling of UTelco Service Offerings.....	1-7
Figure 2-1: Areas of the US.....	2-2
Figure 3-1: Utility Drivers and Priorities to Implement Fiber.....	3-2
Figure 3-2: Statistics for Wireless Carrier Market.....	3-12
Figure 3-3: WiMax and Mesh Network Interoperability.....	3-13
Figure 3-4: Traditional UTelco Evolution of Services.....	3-19



TABLE OF CONTENTS

1. Executive Summary 1-1
1.1 Fiber Application and Technology Trends 1-1
1.1.1 Trends in the Use of Wave Division Multiplexing 1-3
1.2 Fiber Use in Utility Operations 1-3
1.2.1 Commercial Applications of Utility Fiber 1-4
1.3 Assessment of Current Fiber Business Climate 1-5
1.3.1 The Rise of Ethernet 1-6
1.3.2 Sampling of Utility Trends Selling Fiber Products 1-6
1.4 Commercial Fiber Strategies for Today's Utilities 1-6
2. Introduction 2-1
2.1 Background 2-1
2.2 Purpose and Scope 2-1
2.2.1 Methodology 2-2
3. Analysis of Major Fiber Network Trends 3-1
3.1 Fiber Application and Technology Trends 3-1
3.1.1 Converged Networks 3-3
3.1.1.1 Separation of Data Paths within the Consolidated Infrastructure 3-4
3.1.2 Other Technology Trends 3-4
3.1.2.1 Ethernet 3-4
3.1.2.2 Trends in the Use of Wave Division Multiplexing 3-7
3.1.2.3 Edge Technologies 3-8
3.1.2.3.1 Transport Connectivity for Internal Requirements 3-8
3.1.2.3.2 Transport Connectivity for Commercial Requirements 3-9
3.2 Fiber Use in Utility Operations 3-9
3.2.1 Use of Fiber in Substations 3-10
3.2.1.1 SONET and T1 on Optical Fiber 3-10
3.2.2 Use of Fiber for Network Controls 3-11
3.2.3 Fiber and its Use for Backhaul Applications 3-11
3.2.3.1 WiFi/WiMax and Other Wireless Technologies 3-12
3.2.3.2 Broadband over Power Line 3-14
3.2.3.3 Carriers and Other ISPs 3-14
3.2.3.4 Utility Use for Substation Connectivity 3-15
3.2.4 Fiber Buildouts Along New Transmission Corridors 3-16
3.3 Fiber Applications for Utility Architectures 3-16
3.3.1 Trends Across Utility Sectors 3-16
3.3.1.1 Munis, Co-ops, and Large IOUs 3-16
3.3.1.2 Role of Geography in Utility Architectures 3-17
3.3.2 Utility Use of Fiber for Private Communications 3-18
3.3.2.1 Private Assets as a Platform for Growth into Commercial Ventures 3-18
4. Assessment of the Current Fiber Business Climate 4-1
4.1 Trends of the Fiber Market Circa 2007 4-2
4.1.1 Profile of Fiber Service Providers, Target Customers, and Networks 4-3
4.1.2 Market Product and Pricing Trends 4-5



Figure 4-1: The Market "Squeeze" of Circuit Prices4-9

Figure 4-2: Relative Bandwidth Price Trends 2004-20064-10

Figure 4-3: US Private Line Market Size.....4-10

Figure 4-4: Examples of UTelco Service Offerings4-12

Figure 4-5: Sampling of Utility Trends on Dark Fiber Pricing and Terms.....4-14

Figure 4-6: Lit Bandwidth Service Trends at Selected Utility Providers4-17

Figure 5-1: Typical Communications Alternative Annual Charge Analysis5-2

Figure 5-2: Cable Route Miles Installed by Organization5-6

Figure 5-3: Planned Cable Additions as Percentage of Existing Plant5-7

Figure 5-4: Age of Fiber by Organization Type5-7

Figure 5-5: Typical Fiber Architecture to Support Disaster Recovery and Robust Communications.....5-9

List of Tables

Table 4-1: Regional sampling of Dark Fiber as Offered by MUNI & Other Service Providers.....4-12

Table 5-1: Sampling of Installed Fiber Costs (\$ per Mile).....5-8

Appendix A: Telecommunications: Statistical Trends 1999-2005.....