

TABLE OF CONTENTS

PREFACE	I	Markup Component of System Price	31
SECTION 1 - INTRODUCTION	1	Markup by Real-Time System Price Levels	31
<i>PJM Market Background</i>	1	Day-Ahead Markup	32
<i>Conclusions</i>	1	Unit Markup Characteristics	32
<i>Role of MMU in Market Design Recommendations</i>	3	Markup Component of System Price	33
<i>Recommendations</i>	3	Markup by System Price Levels	33
<i>Highlights and New Analysis</i>	4	Markup Component by Fuel, Unit Type	33
<i>Total Price of Wholesale Power</i>	5	Frequently Mitigated Unit and Associated Unit Adders – Component of Price	34
Components of Total Price	5	<i>Market Performance: Load and LMP</i>	34
SECTION 2 – ENERGY MARKET, PART 1	7	Load	34
<i>Overview</i>	7	Locational Marginal Price (LMP)	39
Market Structure	7	Load and Spot Market	62
Market Performance: Markup, Load and Locational Marginal Price	8	<i>Demand-Side Response (DSR)</i>	64
Demand-Side Response	9	PJM Load Response Programs Overview	64
Conclusion	10	Participation	64
<i>Market Structure</i>	12	SECTION 3 - ENERGY MARKET, PART 2	73
Supply	12	<i>Overview</i>	73
Demand	12	Net Revenue	73
Market Concentration	13	Existing and Planned Generation	74
Local Market Structure and Offer Capping	14	Credits and Charges for Operating Reserve	74
Local Market Structure	15	Conclusion	75
<i>Market Performance: Markup</i>	30	<i>Net Revenue</i>	77
Real-Time Markup	30	Capacity Market Net Revenue	77
Unit Markup Characteristics	31	New Entrant Net Revenues	77



TABLE OF CONTENTS

- New Entrant Combustion Turbine 79
- New Entrant Combined Cycle 79
- New Entrant Coal Plant 80
- New Entrant Day-Ahead Net Revenues 81
- Net Revenue Adequacy 83
- Existing and Planned Generation* 88
 - Installed Capacity and Fuel Mix 88
 - Energy Production by Fuel Source 88
 - Planned Generation Additions 89
- Operating Reserve* 95
 - Credit and Charge Categories 95
 - Credit and Charge Results 97
 - Characteristics of Credits and Charges 100
 - Impacts of Revised Operating Reserve Rules 102
 - Concentration of Unit Ownership for Operating Reserve Credits 107

SECTION 4 – INTERCHANGE TRANSACTIONS 109

- Overview* 109
 - Interchange Transaction Activity 109
 - Interactions with Bordering Areas 109
 - Interchange Transaction Issues 113
 - Conclusion 117
- Interchange Transaction Activity* 118
 - Aggregate Imports and Exports 118
 - Interface Imports and Exports 119
- Interface Pricing* 122
 - PJM Interface Pricing with Organized Markets 123

- Operating Agreements with Bordering Areas 127
- Interchange Transaction Issues* 128
 - Loop Flows 128
 - TLRs 130
 - Up-To Congestion 131
 - Interface Pricing Agreements with Individual Companies 132
 - Spot Import 135
 - Willing to Pay Congestion and Not Willing to Pay Congestion 136
 - Ramp Availability 136

SECTION 5 – CAPACITY MARKET 137

- Overview* 137
 - RPM Capacity Market 137
 - Generator Performance 140
 - Conclusion 140
- RPM Capacity Market* 142
 - Market Structure 142
 - Market Conduct 147
 - Market Performance 151
- Generator Performance* 154
 - Generator Performance Factors 154
 - Generator Forced Outage Rates 155

SECTION 6 - ANCILLARY SERVICE MARKETS 161

- Overview* 161
 - Regulation Market 161
 - Synchronized Reserve Market 163
 - DASR 165

Black Start Service 165

Conclusion 166

Regulation Market 167

Market Structure 167

Market Performance 169

Regulation Market Changes 170

Synchronized Reserve Market 171

Market Structure 171

Market Conduct 173

Market Performance 174

Day-Ahead Scheduling Reserve (DASR) 176

Black Start Service 176

SECTION 7 – CONGESTION **177**

Overview 177

Congestion Cost 177

Congestion Component of LMP and Facility or Zonal Congestion 177

Economic Planning Process 178

Conclusion 179

Congestion 180

Total Calendar Year Congestion 180

Monthly Congestion 180

Congestion Component of LMP 181

Congested Facilities 181

Congestion by Facility Type and Voltage 181

Constraint Duration 184

Constraint Costs 186

Congestion-Event Summary for Midwest ISO Flowgates 188

Congestion-Event Summary for the 500 kV System 190

Zonal Congestion 191

Summary 191

Details of Regional and Zonal Congestion 193

SECTION 8 – FINANCIAL TRANSMISSION AND AUCTION REVENUE RIGHTS **227**

Overview 227

Financial Transmission Rights 227

Auction Revenue Rights 229

Market Performance 229

Conclusion 229

Financial Transmission Rights 230

Market Performance 231

Auction Revenue Rights 239

Market Structure 239

Market Performance 240

