

TABLE OF CONTENTS

REPORT BODY

| | |
|--|----|
| About This Report..... | 10 |
| Executive Summary..... | 12 |
| About Butadiene..... | 15 |
| Description..... | 15 |
| Applications..... | 15 |
| Butadiene Production Pathways Diagram..... | 16 |
| Process Overview..... | 17 |
| Product(s) Generated..... | 17 |
| Process Inputs..... | 17 |
| Technology Maturity Assessment..... | 18 |
| Highlights & Remarks..... | 20 |
| Industrial Site..... | 21 |
| Introduction..... | 21 |
| Process Unit Description..... | 23 |
| Site Infrastructure Description..... | 27 |
| Key Process Input and Output Figures..... | 31 |
| Labor Requirements..... | 31 |
| Capital Investment..... | 32 |
| Fixed Capital..... | 33 |
| Working Capital..... | 35 |
| Additional Capital Requirements..... | 36 |
| Total Capital Investment..... | 37 |
| Operating Costs..... | 38 |
| Operating Variable Costs..... | 40 |

* Available in 'Extended' and 'Advanced' versions only

| | |
|---|-----|
| Operating Fixed Costs..... | 41 |
| Depreciation..... | 41 |
| Total Operating Cost..... | 41 |
| Product Value Analysis..... | 43 |
| Corporate Overhead..... | 44 |
| Return on Capital Employed (ROCE)..... | 44 |
| Process Economics Summary..... | 45 |
| Product Value Composition..... | 45 |
| Economic Datasheet..... | 45 |
| Economic Remarks..... | 47 |
| References..... | 48 |
| Analysis Methodology..... | 50 |
| APPENDIX A - ABOUT INTRATEC..... | A.1 |
| APPENDIX B - TERMS & CONDITIONS..... | B.1 |
| APPENDIX C - REPORT SHARING TERMS..... | C.1 |
| APPENDIX D - EXTENDED ANALYSIS*..... | D.1 |
| Utilities Consumption Breakdown..... | D.2 |
| Utilities Consumption Figures..... | D.2 |
| Impact of Utilities on Total Operating Cost..... | D.3 |
| Economic Analysis for Different Capacities..... | D.4 |
| Introduction..... | D.4 |
| Capital Investment Comparison..... | D.4 |
| Operating Cost & Product Value Comparison..... | D.5 |
| Project Implementation & Construction Schedule..... | D.7 |
| Materials & Utilities Pricing Data..... | D.9 |
| Analysis Pricing Basis..... | D.9 |

* Available in 'Extended' and 'Advanced' versions only

LIST OF TABLES

| | |
|---|-----|
| Economic Analysis Summary..... | 14 |
| Process Technology Maturity Scale..... | 19 |
| Raw Materials Consumption..... | 31 |
| Products Generation..... | 31 |
| Labor Requirements..... | 31 |
| Plant Cost Estimate Accuracy Range (USD Million)..... | 34 |
| Owner's Cost Summary..... | 34 |
| Fixed Capital Summary..... | 35 |
| Working Capital Breakdown..... | 35 |
| Additional Capital Requirements Breakdown..... | 36 |
| Operating Variable Costs Breakdown..... | 40 |
| Operating Fixed Costs Breakdown..... | 41 |
| Operating Cost Summary..... | 41 |
| Corporate Overhead Costs Breakdown..... | 44 |
| Butadiene Production from Ethanol - Datasheet..... | 46 |
| Process Contingency Factor Estimation Methodology..... | 55 |
| Project Contingency Factor Estimation Methodology..... | 56 |
| Fixed Capital Estimate Accuracy Range..... | 60 |
| Maintenance Cost Estimation Methodology..... | 63 |
| Marketing & Advertising Cost Estimation Methodology..... | 65 |
| Research & Development Cost Estimation Methodology..... | 65 |
| Expected ROCE Factor Estimation Methodology..... | 66 |
| Net Utility Consumption Rates..... | D.2 |
| Utilities Share in Total Operating Cost..... | D.3 |
| Capital Investment Analysis for Different Capacities..... | D.5 |

* Available in 'Extended' and 'Advanced' versions only

| | |
|---|-----|
| Operating Cost & Product Value Analysis for Different Capacities..... | D.6 |
| Project Phases Schedule..... | D.7 |
| Materials & Utilities Prices (United States)..... | D.9 |

LIST OF FIGURES

| | |
|---|-----|
| Butadiene Production Pathways Diagram..... | 16 |
| Industrial Site Configuration..... | 22 |
| Butadiene Production Unit - Block Flow Diagram..... | 24 |
| Plant Cost Summary (USD Million)..... | 33 |
| Capital Investment Summary (USD Million)..... | 37 |
| Operating Cost Breakdown..... | 42 |
| Product Value Composition..... | 45 |
| Production Cost Report Development Methodology..... | 51 |
| Cost Contribution of Each Utility..... | D.3 |
| Capital Investment (USD Million) Versus Plant Capacity..... | D.4 |
| Operating Cost Versus Plant Capacity..... | D.5 |
| Implementation & Construction Schedule..... | D.8 |