

## General Process Plant Cost Estimating Engineering

Industrial Construction Estimating Manual focuses on industrial process plants and enables the contractor, subcontractor, and engineer to use methods, models, procedures, formats, and technical data for developing industrial process plant construction estimates. The manual begins with an introduction devoted to labor, data collection, verification of data, coding, productivity measurement, the unit quantity model, and computer-aided cost estimating. It goes on to provide information on construction materials, database systems, work estimating, computer-aided estimating, detailed labor estimates, bid assurance, and detailed applications to construction. Practical examples based on historical data collected from past installations are also included as well as a detailed glossary, Excel and mathematical formulas, metric/standard conversions, area and volume formulas, and boiler man-hour tables. Industrial Construction Estimating Manual aids contractors, subcontractors, and engineers with a balance-detailed estimating method using the unit quantity model and is an excellent resource for those involved in engineering, technology, and construction estimating. Provides a detailed estimating method using the unit-quantity model to prepare construction estimates Delivers information on construction materials, databases, labor estimates, computer-aided estimating, bid assurance, and applications to construction. Utilizes historical data, from a database of previous similar work, calculates material cost and labor by category, and produces both summary and detailed man-hour and cost estimates.

least, the author wishes to thank his constantly helpful wife Maggie and his secretary Pat Weimer; the former for her patience, encouragement, and for acting as a sounding-board, and the latter who toiled endlessly, cheerfully, and most competently on the book's preparation. CONTENTS Preface / iii 1. INTRODUCTION / 1 Frequently Used Economic Studies / 2 Basic Economic Subjects / 3 Priorities / 3 Problems / 6 Appendixes / 6 References / 6 2. EQUIPMENT COST ESTIMATING / 8 Manufacturers' Quotations / 8 Estimating Charts / 10 Size Factoring Exponents / 11 Inflation Cost Indexes / 13 Installation Factor / 16 Module Factor / 18 Estimating Accuracy / 19 Estimating Example / 19 References / 21 3. PLANT COST ESTIMATES / 22 Accuracy and Costs of Estimates / 22 Cost Overruns / 25 Plant Cost Estimating Factors / 26 Equipment Installation / 28 Instrumentation / 30 v vi CONTENTS Piping / 30 Insulation / 30 Electrical / 30 Buildings / 32 Environmental Control / 32 Painting, Fire Protection, Safety Miscellaneous / 32 Yard Improvements / 32 Utilities / 32 Land / 33 Construction and Engineering Expense, Contractor's Fee, Contingency / 33 Total Multiplier / 34 Complete Plant Estimating Charts / 34 Cost per Ton of Product / 35 Capital Ratio (Turnover Ratio) / 35 Factoring Exponents / 37 Plant Modifications / 38 Other Components of Total Capital Investment / 38 Off-Site Facilities / 38 Distribution Facilities / 39 Research and Development, Engineering, Licensing / 40 Working Capital / 40

Industrial Process Plant Construction Estimating and Man-Hour Analysis focuses on industrial process plants and enables the estimator to apply statistical applications, estimate data tables, and estimate sheets to use methods for collecting, organizing, summarizing, presenting, and analyzing historical man-hour data. The book begins with an introduction devoted to labor, productivity measurement, collection of historical data, verification of data, estimating methods, and factors affecting construction labor productivity and impacts of data. It goes on to explore construction statistics and mathematical spreadsheets, followed by detailed scopes of work ranging from coal-fired power plants to oil refineries and solar plants, among others. Man-hour schedules based on historical data collected from past installations in industrial process plants are also included as well as a detailed glossary, Excel and mathematical formulas, area and volume formulas, metric/standard conversions, and boiler man-hour tables. Industrial Process Plant Construction Estimating and Man-Hour Analysis aids industrial project managers, estimators, and engineers with the level of detail and practical utility for today's industrial operations and is an ideal resource for those involved in engineering, technology, or construction estimation. Identify quantity differences with the comparison method and eliminate impacts between proposed and previously installed equipment Understand how to implement statistical and estimating methods, scopes of work, man-hour tables and estimate sheets to produce direct craft man-hour estimates, RFPs, and field change orders Set up and utilize Excel templates to automate statistical functions that will perform mathematical applications key to process plant construction

This report presents a cost analysis of Vinyl Chloride production from acetylene and hydrochloric acid. The process examined is a typical acetylene hydrochlorination process. In this process, anhydrous hydrogen chloride is reacted in vapor phase with acetylene over a mercuric chloride catalyst producing Vinyl Chloride. This report examines one-time costs associated with the construction of a United States-based plant and the continuing costs associated with the daily operation of such a plant. More specifically, it discusses: \* Capital Investment, broken down by: - Total fixed capital required, divided in production unit (ISBL); infrastructure (OSBL) and contingency - Alternative perspective on the total fixed capital, divided in direct costs, indirect costs and contingency - Working capital and costs incurred during industrial plant commissioning and start-up \* Production cost, broken down by: - Manufacturing variable costs (raw materials, utilities) - Manufacturing fixed costs (maintenance costs, operating charges, plant overhead, local taxes and insurance) - Depreciation and corporate overhead costs \* Raw materials consumption, products generation and labor requirements \* Process block flow diagram and description of industrial site installations (production unit and infrastructure) Keywords: Chloroethene, 1,2-Dichloroethane, Hydrochlorination

Desalination Project Cost Estimating and Management examines the key issues associated with the estimation of costs

for desalination plants. It covers all aspects of desalination project cost estimating and management: direct and indirect capital costs, fixed and variable operation and maintenance costs, and total costs for water production. In addition, it provides a detailed overview of the factors that influence project costs and discusses the technological and project delivery methods to control and optimize project costs. The book includes cost curves for the most commonly used seawater desalination facilities and numeric examples illustrating how to prepare a budgetary cost estimate for a typical desalination project. Features: •Presents a comprehensive engineering overview of key issues associated with desalination project cost estimating. •Includes cost curves which can be used for budgetary level estimates of capital, and operation and maintenance (O&M) expenditures. •Contains easy to use cost-estimating rules of thumb derived from actual desalination projects. •Includes several numeric examples illustrating the cost estimating process.

An immense treasure trove containing hundreds of equipment symptoms, arranged so as to allow swift identification and elimination of the causes. These rules of thumb are the result of preserving and structuring the immense knowledge of experienced engineers collected and compiled by the author - an experienced engineer himself - into an invaluable book that helps younger engineers find their way from symptoms to causes. This sourcebook is unrivalled in its depth and breadth of coverage, listing five important aspects for each piece of equipment: \* area of application \* sizing guidelines \* capital cost including difficult-to-find installation factors \* principles of good practice, and \* good approaches to troubleshooting. Extensive cross-referencing takes into account that some items of equipment are used for many different purposes, and covers not only the most familiar types, but special care has been taken to also include less common ones. Consistent terminology and SI units are used throughout the book, while a detailed index quickly and reliably directs readers, thus aiding engineers in their everyday work at chemical plants: from keywords to solutions in a matter of minutes.

Consists of a report on the survey of 37 states and Alaska, and a summary for the United States.

Part I: Process design -- Introduction to design -- Process flowsheet development -- Utilities and energy efficient design -- Process simulation -- Instrumentation and process control -- Materials of construction -- Capital cost estimating -- Estimating revenues and production costs -- Economic evaluation of projects -- Safety and loss prevention -- General site considerations -- Optimization in design -- Part II: Plant design -- Equipment selection, specification and design -- Design of pressure vessels -- Design of reactors and mixers -- Separation of fluids -- Separation columns (distillation, absorption and extraction) -- Specification and design of solids-handling equipment -- Heat transfer equipment -- Transport and storage of fluids.

At the early project stages of plant construction, cost estimates for projects in the process industry are a prerequisite for gaining a competitive advantage in a global market with increasing commodity prices, engineering and installation costs. This book gives readers a detailed overview of the structure of cost estimates in brownfield and greenfield plant projects and the method of preparing the required accompanying

documentation. Using a project example, the book presents a cost estimate with different levels of accuracy. The attachment comprises cost estimation templates and corresponding documents that can also be ordered separately from the publisher as Word and Excel files. • Basics of cost estimation • Cost estimation types, classes and methods • Planning (engineering) • Equipment and material procurement • Installation and construction • Exemplary templates.

NOTE TO THE READER: All forms and material that were previously on a CD-ROM that accompanied this book have been moved to the following web site: <http://booksupport.wiley.com> Tested-and-proven techniques for quick, accurate estimates Here is the first manual that guides engineers, planners, and contractors through the process of estimating the cost of building water treatment facilities. Based on more than eighty years of the two authors' collective experience, the Cost Estimating Manual for Water Treatment Facilities not only enables you to arrive at a dependable estimate, it shows you how to do it quickly with a minimum of information and supporting data. In order to ensure reliability, the authors have compiled and analyzed the results from their own construction cost estimates for more than 500 projects as well as the results from many other engineers and contractors. The manual identifies forty-three treatment processes, nine types of water treatment plants, plus five additional types of advanced water treatment plants. The authors then demonstrate how to calculate costs for each element, accounting for needed mark-ups and allowances in order to arrive at the total plant construction cost. To help you make your own estimates, the manual provides: Examples of cost estimates for different water treatment processes Historical data from several public agencies Sample tables for 10 mgd and 100 mgd product water flow rates for each type of treatment plant Website access with Excel spreadsheets that enable you to perform estimates using your own data Now that the Cost Estimating Manual for Water Treatment Facilities is available, you no longer have to rely on hunches and anecdotal information; you have a proven, scientific method that leads to reliable estimates.

Presents an accessible approach to the cost estimation tools, concepts, and techniques needed to support analytical and cost decisions Written with an easy-to-understand approach, Cost Estimation: Methods and Tools provides comprehensive coverage of the quantitative techniques needed by professional cost estimators and for those wanting to learn about this vibrant career field. Featuring the underlying mathematical and analytical principles of cost estimation, the book focuses on the tools and methods used to predict the research and development, production, and operating and support costs for successful cost estimation in industrial, business, and manufacturing processes. The book begins with a detailed historical perspective and key terms of the cost estimating field in order to develop the necessary background prior to implementing the presented quantitative methods. The book proceeds to fundamental cost estimation methods utilized in the field of cost estimation, including working with inflation indices, regression analysis, learning curves, analogies, cost factors, and wrap rates. With a step-by-step introduction to the practicality of cost estimation and the available resources for obtaining relevant data, Cost Estimation: Methods and Tools also features: Various cost estimating tools, concepts, and techniques needed to support business decisions Multiple questions at the end of each chapter to help readers obtain a deeper understanding of the discussed methods and techniques An overview of the software used in cost estimation, as well as an introduction to the application of risk and uncertainty analysis A Foreword from Dr. Douglas A. Brook, a professor in the Graduate School of Business and Public Policy at the Naval Postgraduate School, who spent many years working in the Department of Defense acquisition environment Cost Estimation: Methods and Tools is an excellent reference for academics and practitioners in decision science, operations research, operations management, business, and systems and industrial engineering, as well as a useful guide in support of professional cost estimation training and certification courses for practitioners. The book is

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also appropriate for graduate-level courses in operations research, operations management, engineering economics, and manufacturing and/or production processes.

"Written by engineers for engineers (with over 150 International Editorial Advisory Board members), this highly lauded resource provides up-to-the-minute information on the chemical processes, methods, practices, products, and standards in the chemical, and related, industries. "

This expanded edition introduces new design methods and is packed with examples, design charts, tables, and performance diagrams to add to the practical understanding of how selected equipment can be expected to perform in the process situation. A major addition is the comprehensive chapter on process safety design considerations, ranging from new devices and components to updated venting requirements for low-pressure storage tanks to the latest NFPA methods for sizing rupture disks and bursting panels, and more. \*Completely revised and updated throughout \*The definitive guide for process engineers and designers

\*Covers a complete range of basic day-to-day operation topics

This report presents a cost analysis of General Purpose Polystyrene (GPPS) production from styrene. The process examined is a typical continuous bulk polymerization process. This report was developed based essentially on the following reference(s): (1)

"Polystyrene and Styrene Copolymers", Ullmann's Encyclopedia of Industrial Chemistry, 7th edition (2) "Styrene Plastics", Kirk-Othmer Encyclopedia of Chemical Technology, 4th edition Keywords: INEOS, Versalis, Polystyrene, GPPS

A definitive encyclopedia of cost estimating manhours, material costs, equipment, indirects & subcontracts for numerous types of Process Plants & General Construction remodeling, maintenance & new construction. This easy-to-use system provides both composite unit prices as well as the detailed line item data used to arrive at those standards. The Richardson Rapid Estimating System presents a systematic takeoff procedure enabling estimates to be produced correctly, quickly & accurately. The accounts include Manhours for performing Labor, Unit Prices, & Illustrations. All the information is described so that it can be used in any locality. Includes explanations on how to use the Manhours & Unit Prices so they can be applied to unusual jobsite situations. The four volumes are updated annually & contain detailed information covering Sitework, Concrete, Masonry, Structural Steel, Carpentry, Architectural Features, HVAC Plumbing, Process Piping, Instrumentation, Electrical, & Process Equipment. With our exclusive Richardson Rapid Estimates, you get over 20,000 pre-built estimates with Unit Costs to provide estimates that can be used every day. Richardson's three volume "General Construction Estimating Standards" 1995 edition (ISBN 1-881386-18-X) presents the same information as the "Process Plant Estimating Standards" but excludes the Process Plant specific information. Other products include Seminars, Software, Databases, Foreign Location Factor Manual. For more information, write to: RICHARDSON ENGINEERING SERVICES, INC., P.O. Box 9103, Mesa, AZ 85214-9103; or call 602-497-2063.

Construction Cost Estimating equips a new generation of students and early-career professionals with the skills they need to bid successfully on projects. From developing bid strategies to submitting a completed bid, this innovative textbook introduces the fundamentals of construction estimating through a real-life case study that unfolds across its 24 chapters. Exercises at the end of each chapter offer hands-on practice with core concepts such as quantity take-offs, pricing, and estimating for subcontractor work.

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Online resources provide instant access to examples of authentic construction documents, including complete, detailed direct work estimates, subcontractor work estimates, general conditions estimates, markups, and summary schedules. Through its unique mix of real-world examples and classroom-tested insights, Construction Cost Estimating ensures that readers are familiar with the entire estimating process even before setting foot on the jobsite.

Chemical Engineering Economics Springer Science & Business Media

A definitive encyclopedia of cost estimating manhours, material costs, equipment, indirects & subcontracts for numerous types of Process Plants & General Construction remodeling, maintenance, & new construction. This easy-to-use system provides both composite unit prices as well as the detailed line item data used to arrive at those standards. The Richardson Rapid Estimating System presents a systematic takeoff procedure enabling estimates to be produced correctly, quickly & accurately. The accounts include Manhours for Performing Labor, Unit Prices, & Illustrations. All the information is described so that it can be used in any locality. Includes explanations on how to use the Manhours & Unit Prices so they can be applied to unusual jobsite situations. The four volumes are updated annually & contain detailed information covering Sitework, Concrete, Masonry, Structural Steel, Carpentry, Architectural Features, HVAC, Plumbing, Process Piping, Instrumentation, Electrical, & Process Equipment. With our exclusive Richardson Rapid Estimating System, you get over 20,000 pre-built estimates with Unit Costs to provide estimates that can be used everyday. Richardson's three volume GENERAL CONSTRUCTION ESTIMATING STANDARDS 1993 EDITION (1-881386-00-7) present the same information as the PROCESS PLANT ESTIMATING STANDARDS but exclude the Process Plant specific information. Other products include Seminars, Software, & Databases. For more information write to: RICHARDSON ENGINEERING SERVICES, INC., P.O. BOX 9103, Mesa, AZ 85214-9103; or call (602) 497-2063.

Companies live or die on the basis of estimating their costs. Preparing estimates and bidding for new jobs is a complex and often costly process. There is no substitute for on the job training -- until now. Drawing on the authors' combined experience of more than 70 years, Estimating Building Costs presents state-of-the-art principles, practices, and techniques for assessing these expenditures that can be applied regardless of changes in the costs of materials, equipment, and labor. The book is an efficient and practical tool for developing contracts or controlling project costs. The authors cover the major components of the direct cost: estimating procedures and cost trends related to materials, construction equipment, and skilled and unskilled labor. They describe various types of building estimates encountered during the lifecycle of a project, as well as the role and accuracy of each. The book provides an overview of the industry, cost indexes in use, approaches to preparing a detailed estimate, and an in-depth description of the organization and function of the estimating group. Including CSI Master Format and UniFormat codes, estimating forms, a list of available estimating software packages, a detailed construction site and investigation report, the book provides a cost estimating methodology that readers can tailor to their own organizational needs.

Catalysis, Green Chemistry and Sustainable Energy: New Technologies for Novel Business Opportunities offers new possibilities for businesses who want to address the current global transition period to adopt low carbon and sustainable energy production.

This comprehensive source provides an integrated view of new possibilities within catalysis and green chemistry in an economic context, showing how these potential new technologies may become useful to business. Fundamentals and specific examples are included to guide the transformation of idea to innovation and business. Offering an overview of the new possibilities for creating business in catalysis, energy and green chemistry, this book is a beneficial tool for students, researchers and academics in chemical and biochemical engineering. Discusses new developments in catalysis, energy and green chemistry from the perspective of converting ideas to innovation and business Presents case histories, preparation of business plans, patent protection and IP rights, creation of start-ups, research funds and successful written proposals Offers an interdisciplinary approach combining science and business

This revision of the author's bestselling earlier work on cost estimating has been updated to provide currently applicable examples, data and techniques. Two new chapters have been added covering: computer tools and models for cost estimating, where to get these tools, and the features to look for; software cost estimating with special emphasis on the effect of CASE tools on software productivities and resulting software costs. A complete set of inflation tables is now included to permit conversion from any year dollars to any other year dollars from 1959 through 1997. Retains its comprehensive coverage of the elements needed to embark on a cost estimating task. Strengthened are the invaluable parts of the book which tell the estimator how to produce a competitive and credible cost estimate. Manufacturing standards for hardware and electronics are retained as are handy tables for determining the costs of engineering, design, documentation, drafting and testing.

Offers coverage of each important step in engineering cost control process, from project justification to life-cycle costs. The book describes cost control systems and shows how to apply the principles of value engineering. It explains estimating methodology and the estimation of engineering, engineering equipment, and construction and labour costs

Industrial Piping and Equipment Estimation Manual delivers an invaluable resource for day-to-day operations. Packed full of worksheets covering combined and simple cycle power plants, refineries, compressor stations, ethanol, hydrogen and biomass plants, this reference helps the construction engineer and estimator learn how to create bids where scope and quantity differences can be identified and project impacts estimated. Beginning with an introduction devoted to labor, productivity measurement, estimating methods, and factors affecting construction labor productivity and impacts of overtime, the author then explores equipment through hands-on estimation tables, including sample estimates and statistical applications. The book rounds out with a glossary, abbreviations list, formulas, and metric/standard conversions, and is an ideal reference for estimators, engineers and managers with the level of detail and equipment breakdown necessary for today's industrial operations. Includes day-to-day worksheets to help users estimate equipment and piping for any plant or refinery project Presents the comparison method to estimate similarities and differences between proposed and previously installed equipment Helps users understand and produce more accurate direct costs with sample estimates

Comprehensive and practical guide to the selection and design of a wide range of chemical process equipment. Emphasis is

placed on real-world process design and performance of equipment. Provides examples of successful applications, with numerous drawings, graphs, and tables to show the functioning and performance of the equipment. Equipment rating forms and manufacturers' questionnaires are collected to illustrate the data essential to process design. Includes a chapter on equipment cost and addresses economic concerns. \* Practical guide to the selection and design of a wide range of chemical process equipment. Examples of successful, real-world applications are provided. \* Fully revised and updated with valuable shortcut methods, rules of thumb, and equipment rating forms and manufacturers' questionnaires have been collected to demonstrate the design process. Many line drawings, graphs, and tables illustrate performance data. \* Chapter 19 has been expanded to cover new information on membrane separation. Approximately 100 worked examples are included. End of chapter references also are provided.

Construction Engineering Calculations and Rules of Thumb begins with a brief, but rigorous, introduction to the mathematics behind the equations that is followed by self-contained chapters concerning applications for all aspects of construction engineering. Design examples with step-by-step solutions, along with a generous amount of tables, schematics, and calculations are provided to facilitate more accurate solutions through all phases of a project, from planning, through construction and completion. Includes easy-to-read and understand tables, schematics, and calculations Presents examples with step-by-step calculations in both US and SI metric units Provides users with an illustrated, easy-to-understand approach to equations and calculation methods

Known as the Blue Book this fourth edition continues with the endorsement from the Association of Cost Engineers. The guide is designed to be an aid for student engineers in the design activities undertaken during their course and help young engineers in industry to compile their own set of cost data. With much of the material in the third edition retained, the major changes are: new cost data; up-dated cost index information (which has been donated by industrialists); and short-cut estimating techniques up-dated.

This complete revision of Applied Process Design for Chemical and Petrochemical Plants, Volume 1 builds upon Ernest E. Ludwig's classic text to further enhance its use as a chemical engineering process design manual of methods and proven fundamentals. This new edition includes important supplemental mechanical and related data, nomographs and charts. Also included within are improved techniques and fundamental methodologies, to guide the engineer in designing process equipment and applying chemical processes to properly detailed equipment. All three volumes of Applied Process Design for Chemical and Petrochemical Plants serve the practicing engineer by providing organized design procedures, details on the equipment suitable for application selection, and charts in readily usable form. Process engineers, designers, and operators will find more chemical petrochemical plant design data in: Volume 2, Third Edition, which covers distillation and packed towers as well as material on azeotropes and ideal/non-ideal systems. Volume 3, Third Edition, which covers heat transfer, refrigeration systems, compression surge drums, and mechanical drivers. A. Kayode Coker, is Chairman of Chemical & Process Engineering Technology department at Jubail Industrial College in Saudi Arabia. He's both a chartered scientist and a chartered chemical engineer for more than 15 years. and an author of Fortran Programs for Chemical Process Design, Analysis and Simulation, Gulf Publishing Co., and Modeling of Chemical Kinetics and Reactor Design, Butterworth-Heinemann. Provides improved design manuals for methods and proven fundamentals of process design with related data and charts Covers a complete range of basic day-to-day petrochemical operation topics with new material on significant industry changes since 1995.



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This practical reference/text provides a thorough overview of cost estimating as applied to various manufacturing industries, with special emphasis on metal manufacturing concerns. It presents examples and study problems illustrating potential applications and the techniques involved in estimating costs.;Containing both US and metric units for easy conversion of world-wide manufacturing data, Estimating and Costing for the Metal Manufacturing Industries: outlines professional societies and publications dealing with cost estimating and cost analysis; details the four basic metalworking processes - machining, casting, forming, and joining; reveals five techniques for capital cost estimating, including the new AACE International's Recommended Practice 16R-90 and the new knowledge and experience method; discusses the effect of scrap rates and operation costs upon unit costs; offers four formula methods for conceptual cost estimating and examines material-design-cost relationships; describes cost indexes, cost capacity factors, multiple-improvement curves, and facility cost estimation techniques; offers a generalized metal cutting economics model for comparison with traditional economic models; and more.;Estimating and Costing for the Metal Manufacturing Industries serves as an on-the-job, single-source reference for cost, manufacturing, and industrial engineers and as a text for upper-level undergraduate, graduate, and postgraduate students in cost estimating, engineering economics, and production operations courses.;A Solutions manual to the end-of-chapter problems is available free of charge to instructors only. Requests for the manual must be made on official school stationery.

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