JULY 2026

Report Methodology

Commodity Production Costs

850+	REPORTS
260+	COMMODITIES
10	INDUSTRIES

CHAPTER 1

Methodology Overview

SUMMARY

- Each report is a single-process techno-economic assessment — one commodity made by one production route, in one country and one quarter — built bottom-up from a conceptual plant design reconstructed from public literature.
- The catalog spans 850+ reports across 260+ commodities and ten industries, every one produced by the same fixed seven-step workflow, so any two reports can be compared on a consistent basis.
- The analysis draws on public technical and cost-engineering literature, and classifies each production route on a five-level technology-maturity scale that drives assumptions throughout the estimate.
- Shared Intratec principles — public official sources, no commercial ties to market participants, and impartial, auditable methods — govern the analysis, and the full methodology is public.

A Commodity Production Costs report is a techno-economic assessment of a single industrial process: a bottom-up estimate of what it costs to build and run a plant that manufactures a given commodity, and of the product value that follows. Each report examines one production route for one commodity, in one country — typically the United States — for one quarter. The analysis rests on a conceptual process design: a representative plant reconstructed from public technical literature, not a specific company's confidential design. From that design the report estimates the capital investment needed to build the plant, the operating costs of running it, and the product value that would sustain that investment — a preliminary, benchmark-grade estimate rather than a detailed engineering document.

Across the full catalog, 850+ reports span 260+ commodities in ten industries, with companion reports extending the same analyses to 33 countries. Every report is produced by one fixed methodology, applied identically regardless of the commodity, route, or country, so any two reports rest on the same cost basis and can be read against one another directly. That methodology belongs to a family of Intratec solutions built on a common foundation: the vast majority of data comes from public official sources, no commercial relationships are held with market participants, and all figures are produced by impartial, auditable methods that trace each value back to its inputs and the rules that produced it. The full methodology is public, requiring no subscription or login.

Methodology in a Nutshell

Every report is built by the same fixed sequence of seven steps, applied identically to every commodity, production route, and country. The early steps establish the process and reconstruct it as a design; the later steps turn that design into a cascade of cost estimates.

1. **Bibliographical research** — the production process is studied from public technical literature, reviewed by the Intratec team.
2. **Process overview** — the chemistry is characterized: main reactions and stoichiometry, conversions, yields and selectivity, side reactions, catalysts, the quality required of each raw material, and the uses and specifications of the product.
3. **Technical analysis** — the process is reconstructed as a conceptual design, divided into its inside- and outside-battery-limits areas and captured in a block flow diagram.
4. **Industrial site examination** — the process units, supporting infrastructure, plant capacity, and labor requirements are defined from that design.
5. **Capital investment estimating** — the funds required to build the plant and make it operational.
6. **Operating cost estimating** — the recurring cost of running the plant.
7. **Product value estimating** — the price the product must sustain to cover all costs plus a return on the capital invested.

The first three steps build the understanding of the process; the fourth turns it into a site definition; and the final three produce the cost cascade that the report consolidates into a one-page datasheet. The later steps are developed across the chapters that follow — the industrial site examination in Chapter 2, and the three cost estimates in Chapters 3, 4, and 5. The bibliographical research, process overview, and technical analysis that precede them are the subject of the remaining sections of this chapter.

Bibliographical Research

The production process behind every report is studied first from public technical literature — patents, encyclopedias, textbooks, technical papers, and non-confidential licensor information — reviewed by the Intratec team. This body of public knowledge is what lets each analysis be a reconstruction of a representative plant rather than a disclosure of any one company's confidential design.

The figures that populate the analysis are drawn almost entirely from public sources as well, in three main categories:

* **National government statistics bureaus and foreign trade agencies** — official transaction prices and wage rates.
* **International organizations.**
* **Futures markets exchanges.**

Together these supply the commodity prices, utility costs, and labor costs for the specific country and quarter each report examines; the prices and wage rates used are average transaction values for that region and period.

Alongside the process literature, the methodology rests on an established body of cost-engineering and process-economics literature — textbooks, handbooks, and technical papers on capital-cost estimation, process economics, and chemical-plant design. These works underpin the cost models and estimating methods applied throughout the analysis. The complete list of the reference literature behind the methodology is given in Chapter 7.

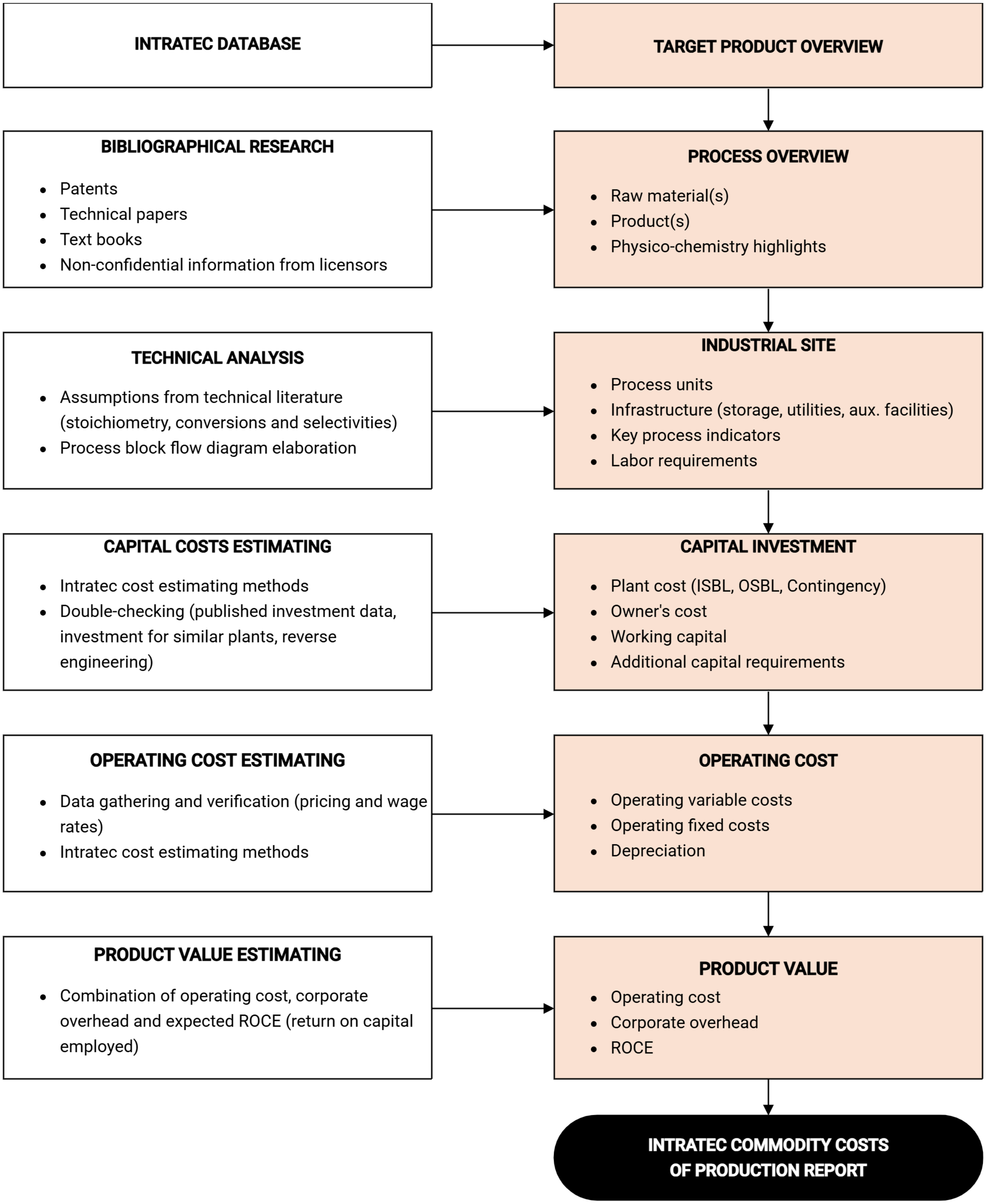

Figure 1.1 The seven-step methodology workflow

Process Overview

Understanding the process comes in two stages, both completed before any cost is estimated. First, the chemistry is characterized: the main reactions and stoichiometry, conversions, yields and selectivity, side reactions, and catalysts, together with the quality required of each raw material and the uses and specifications of the product.

A technical analysis then turns that understanding into a conceptual process design — a technically sound, representative plant reconstructed from public literature, not a specific company's confidential design. The plant is divided into its inside-battery-limits core, the equipment that directly transforms raw materials into the product, and its outside-battery-limits support, the utilities, storage, and auxiliary and administrative facilities the plant needs but that do not directly make the product. The design is captured in a block flow diagram — a schematic of the main processing steps and the material and energy streams that connect them. The site definition this design implies — process units, infrastructure, capacity, and labor — is worked out in Chapter 2.

Each production route is also classified by how proven its technology is, on a five-level scale adapted from the Technology Readiness Level method. This classification — the report's Technology Maturity Assessment — is not a descriptive label alone: it sets several assumptions in the cost model, so that less mature technologies carry larger contingencies, a rougher start-up allowance, wider accuracy ranges, and a higher expected return on the capital invested. The scale runs from the most proven technologies down to those still at the concept stage.

Table 1.1 The five-level process technology maturity scale.

MATURITY LEVEL	WHAT IT INDICATES
Established (Outdated)	A proven technology no longer adopted in new plants — existing plants are being shut down.
Established (In Use)	A proven technology in successful commercial operation, with two or more plants running.
Emerging	A technology at its first commercial plant or at demonstration scale, with performance being validated.
Embryonic	A technology under active development at pilot, bench, or laboratory scale.
Conceptual	An unproven idea or proposal — a paper concept, without analysis or testing.

The precise factors each maturity level sets — the contingencies, the start-up allowance, the accuracy ranges, and the expected return on capital — are given in the chapters that develop the capital, operating, and product-value estimates.

CHAPTER 2

Industrial Site Examination

SUMMARY

- The plant behind each estimate is divided into a core process area and its supporting infrastructure, and the core is decomposed into functional units — significant processing steps grouping equipment with its ancillaries.
- Capital cost is later built up unit by unit from that breakdown, and the type and number of functional units also fix the plant's labor requirements.
- Supporting infrastructure — utility supply, storage, and auxiliary and administrative buildings — reflects the level of integration most typical for the process and location.
- Every analysis runs at a single nominal capacity, a representative world-scale size at which the plant would be competitive globally.

By the end of the technical analysis, the production process exists as a conceptual design: a technically sound, representative plant reconstructed from public technical literature, divided into its core and support areas and captured in a block flow diagram. The fourth step of the seven-step workflow described in Chapter 1 works out what that design implies as a site — the process units at the plant's heart, the infrastructure that surrounds them, and the requirements, capacity and labor, that size the whole.

The quantities fixed at this step carry the rest of the analysis. The breakdown of the process area becomes the basis of the capital investment estimate developed in Chapter 3, and the head-counts derived from it enter the operating cost estimate of Chapter 4.

NOTE

The design examined is conceptual — a representative plant reconstructed from public literature, not the confidential design of any specific company. The same examination is applied identically to every commodity, production route, and country.

Process Unit

For cost estimation, the plant is divided into two areas. Each area is estimated separately, and both carry capital cost.

Table 2.1 The two areas a plant is divided into for cost estimation.

AREA	SCOPE	TYPICAL CONTENTS
ISBL (Inside Battery Limits)	The core process area — the equipment that directly transforms raw materials into the product	Reactors, separation and purification units
OSBL (Outside Battery Limits)	The supporting infrastructure the plant needs but that does not directly make the product	Utility supply, storage, auxiliary and administrative facilities

Splitting the plant this way keeps the estimate organized and lets the same cost structure be compared across different processes. The design itself is represented in a block flow diagram — a schematic of the main processing steps and the material and energy streams that connect them.

Within the process area, the design is decomposed into **functional units**. A functional unit is a significant step in the process where a particular physico-chemical operation takes place — a distillation, a reaction, an evaporation — and it groups the main equipment for that operation together with its ancillaries, rather than isolating a single machine. Each unit is characterized by its cost-relevant attributes, such as the highest operating temperature and pressure it reaches and a representative material of construction.

This decomposition is what makes a bottom-up estimate possible: capital cost is estimated unit by unit and summed, so the plant's cost is built from its constituent operations rather than assessed as a single block. The estimating mechanics are the subject of Chapter 3. The type and number of functional units also drive figures further down the analysis — most directly the labor requirements defined later in this chapter.

Site Infrastructure

Beyond the process core, the plant is assumed to include the OSBL installations required for operation but not directly involved in manufacturing: utility supply and generation, storage for raw materials and products, and auxiliary and administrative buildings.

How much of this infrastructure the plant must carry is not fixed by the process alone — it depends on how integrated the site is with neighboring facilities, that is, whether the plant draws utilities and feedstocks from adjacent sites or provides its own. Each analysis assumes the level of integration that is most typical for the process and location, and that assumption primarily determines the storage capacity the plant must include.

Defining Site Requirements

Two requirements complete the site definition: how large the plant is, and how many people run it.

Each report analyzes a plant at a single **nominal capacity**, chosen so the plant would be competitive on a global scale — a representative, world-scale size for the process rather than the capacity of any one existing plant. This keeps reports comparable, because every analysis reflects an efficient, modern plant. For processes where scale strongly affects the economics, the Premium edition's Plant Capacity Assessment recalculates capital costs, operating costs, and product value across alternative capacities.

Labor requirements are read directly off the functional-unit breakdown: the type and number of process operations determine how many people are needed to run the plant. Two categories are counted.

Table 2.2 The labor categories counted in the site definition.

CATEGORY	WHAT IT COUNTS
Operating labor	The operators required per shift to run the process
Supervision labor	The supervisors overseeing those operators, per shift

Combined with the wage rates of the country and period analyzed, these head-counts give the plant's labor cost; how wages are defined and how labor enters the cost calculation are treated in Chapter 4.

NOTE

Some roles are deliberately excluded from the labor estimate — outsourced labor, technical assistance, plant engineers, and general services such as purchasing, employee relations, and catering — because they fall outside the standardized operating-labor basis.

With the process units mapped, the infrastructure set, and capacity and labor fixed, the conceptual process design is complete. The chapters that follow turn it into the cost estimates, beginning with capital investment in Chapter 3.

CHAPTER 3

Capital Investment Estimating

SUMMARY

- The total funding a project needs splits into three parts — fixed capital (plant cost plus owner's cost), working capital, and additional capital requirements — and only fixed capital is depreciated over the plant's life.
- ISBL and OSBL investments come from Intratec preliminary cost models applied unit by unit; process and project contingencies are then added as percentage factors set by technology maturity, information availability, and plant complexity.
- Every fixed-capital estimate is validated through three independent cross-checks and carries a published accuracy range — from −15% / +25% for an established, well-documented process to −40% / +70% for a conceptual one — on a class 4 budgetary basis.

Every Commodity Production Costs report states the total funding required to build the plant it examines and to bring that plant into operation. That funding — the capital investment — is estimated in three parts, each developed separately in this chapter:

Table 3.1 The three components of capital investment.

COMPONENT	WHAT IT COVERS
Fixed capital	The depreciable investment in the plant itself — its plant cost plus the owner's cost of making it operational
Working capital	The funds, beyond fixed capital, needed to keep the plant running day to day once it has started up
Additional capital requirements	One-time start-up expenses incurred between the end of construction and stable, on-specification operation

Fixed capital is itself the sum of plant cost and owner's cost, and is the portion of the investment that is depreciated over the plant's life.

Plant Cost

The plant cost is the estimated cost of constructing the plant, and the largest part of fixed capital. It is built up from four elements — the two battery-limits investments plus the two contingencies that buffer them:

Table 3.2 The four elements of plant cost.

ELEMENT	WHAT IT REPRESENTS
ISBL investment	Construction of all the process areas shown in the block flow diagram — the plant's core production units
Process contingency	A buffer for technical information that is absent or uncertain
OSBL investment	Construction of the supporting infrastructure outside the process areas
Project contingency	A buffer for the cost changes a project accumulates as it evolves

The ISBL (inside battery limits) investment covers the process areas defined during the conceptual design described in Chapter 2; the OSBL (outside battery limits) investment covers the supporting infrastructure around them. Both are estimated with the cost models below; the two contingencies are then added as percentage factors driven by the technology's maturity.

THE PRELIMINARY COST MODELS

The ISBL and OSBL investments are estimated with Intratec preliminary cost models, applied to each functional unit of the plant. The models are founded on a number of established cost-estimating methods and rest on the mathematical and statistical processing of an extensive volume of actual cost data. For a given unit, the model output already includes the direct materials and labor of construction together with the construction indirect costs — not only the bare equipment.

When a unit falls outside the range the cost models cover — a nonstandard or unusual piece of equipment — its cost is estimated instead from engineering design software or from supplier quotations. Because they work from preliminary information and a conceptual process design, the models produce a benchmark-grade estimate rather than a detailed engineering quotation.

PROCESS CONTINGENCY

Process contingency covers the risk that the technical information behind an estimate is absent or uncertain — the less that is known about a process, the larger the buffer. It is added to the ISBL investment and typically falls between 5% and 30% of it. The exact factor is set by two things: how mature the production technology is, and how much information is available about it. The table gives the factor by technology maturity (rows) and information availability (columns); the five maturity levels are defined in Chapter 1.

Table 3.3 Process contingency as a percentage of ISBL investment, by technology maturity and information availability.

TECHNOLOGY MATURITY	LOW	AVERAGE	HIGH
Established (Outdated)	15%	10%	5%
Established (In Use)	15%	10%	5%
Emerging	18%	15%	—
Embryonic	22%	—	—
Conceptual	26%	—	—

NOTE

A blank cell marks a combination that does not occur. Limited information is inherent to the least-mature technologies, so average- or high-information estimates are not available for them.

PROJECT CONTINGENCY

Project contingency accounts for the additional costs a project tends to accumulate as it develops: estimating errors, incomplete specifications, changes in labor cost, strikes, adverse weather, and inflation. It is applied to the total process capital, with the factor set by the technology's maturity and the plant's complexity:

Table 3.4 Project contingency as a percentage of total process capital, by technology maturity and plant complexity.

TECHNOLOGY MATURITY	LOW	AVERAGE	HIGH
Established (Outdated)	15%	20%	25%
Established (In Use)	15%	20%	25%
Emerging	20%	25%	30%
Embryonic	25%	30%	35%
Conceptual	30%	35%	40%

Where the process contingency narrows as information improves, the project contingency widens as plant complexity grows — the factor rises across the columns as well as down the maturity rows, and every maturity-complexity combination occurs.

THE DISCIPLINE BREAKDOWN

The plant cost is presented in two complementary ways. Alongside the ISBL and OSBL split, it is also given as a breakdown per discipline — the same total cost rearranged by the type of construction work involved:

Table 3.5 The plant cost rearranged by construction discipline.

GROUP	WHAT IT GATHERS
Direct process costs	Bare equipment, equipment setting, piping, civil work, steel, instrumentation and control, electrical, insulation, and painting
Indirect costs	Engineering and procurement, construction materials and indirects, general and administrative overheads, and the contract fee
Project contingency	The same project-evolution buffer, added to the discipline total

Both breakdowns — by battery-limits area and by discipline — appear in the report, in the plant-cost breakdown appendix, so plant cost can be examined from either angle.

VALIDATION CROSS-CHECKS

Fixed-capital estimates are cross-checked against independent references before a report is finalized. Three double-checks are applied:

1. **Published investment data** — actual investment figures for comparable projects, adjusted for differences in time, location, and capacity.
2. **Similar plants** — the fixed capital of plants of a similar nature.
3. **Reverse engineering** — working back from the known profitability of a process to the investment it implies.

Together these confirm the estimate sits in a realistic range. How close an estimate is expected to come to an actual figure is quantified later in this chapter, under Fixed Capital Estimate Accuracy.

Owner's Cost

The owner's cost covers expenses required to make the plant operational but not part of building it. Together with the plant cost, it makes up fixed capital. It has three components:

* **Initial charge of chemicals and catalysts** — the first fill of a chemical or catalyst, counted here only when that inventory lasts more than a year and is a significant expense; shorter-lived inventories are treated as working capital instead.
* **Prepaid royalties** — royalty charges levied on proprietary portions of the plant, generally 0.5–1% of plant cost.
* **Miscellaneous costs** — generally 5–10% of plant cost, covering preliminary planning, HAZOP and environmental studies; legal costs, rights of way, permits and fees; long-distance pipelines, transport equipment and plant vehicles; the initial stock of maintenance materials; owner's engineering; and owner's contingency.

Fixed Capital Estimate Accuracy

The accuracy of a capital cost estimate is expressed as a range around the reported fixed-capital figure, and it is set by the same two drivers as process contingency: how mature the production technology is, and how much information is available about it. The less proven the technology and the less that is known about it, the wider the range. The table gives the expected accuracy range by technology maturity (rows) and information availability (columns):

Table 3.6 Expected accuracy range around the reported fixed-capital figure, by technology maturity and information availability.

TECHNOLOGY MATURITY	LOW	AVERAGE	HIGH
Established (Outdated)	−25% / +40%	−20% / +30%	−15% / +25%
Established (In Use)	−25% / +40%	−20% / +30%	−15% / +25%
Emerging	−30% / +50%	−25% / +40%	—
Embryonic	−35% / +60%	—	—
Conceptual	−40% / +70%	—	—

As in the contingency tables, a blank cell marks a combination that does not occur. High-information estimates do not exist for the least-mature technologies: while a process is still in development or scale-up, its uncertainties keep the amount and reliability of the information about it from being comparable to an established technology's.

The ranges are asymmetric — for example +50% / −30% rather than a symmetric ±40% — because a lack of available information usually leads to underestimating a project's cost rather than overestimating it. The upside allowance is therefore larger than the downside: an estimate is more likely to fall short of the eventual cost than to exceed it, so the range extends further above the reported figure than below it.

These ranges follow the class 4 budgetary estimate standard — a conceptual-level cost estimate used for investment screening and preliminary feasibility decisions. A Commodity Production Costs report is a class 4 budgetary estimate, not a process design package, a front-end engineering design package, or construction-ready engineering. This class matches the conceptual basis of the analysis and is the reference point behind the accuracy ranges reported for capital and operating costs. The standing design assumptions behind every estimate, and the caveats that govern comparisons with actual plant costs, are treated in Chapter 6.

Working Capital

Working capital is the funding a project needs beyond fixed capital to get the plant into operation and meet its running obligations. It is estimated as the net of seven items, each tied to a defined cost basis:

Table 3.7 The seven working-capital items and their cost bases.

ITEM	BASIS
Accounts receivable	A number of days of total operating cost plus corporate overhead — the credit extended to customers
Accounts payable	A credit, subtracted: a number of days of operating cash cost plus corporate overhead received from suppliers
Product inventory	A number of days of total operating cost plus corporate overhead
Raw material inventory	A number of days of delivered raw-material cost
In-process inventory	One day of cash cost plus corporate overhead — material held in pipelines and vessels
Supplies and stores	A percentage of operating labor, supervision, and maintenance cost
Cash on hand	A number of days of cash cost plus corporate overhead

Accounts payable is the one item entered as a credit, reducing the total; the other six add to it. The cash cost and total operating cost these bases draw on are defined in Chapter 4, and corporate overhead in Chapter 5.

Additional Capital Requirements

Additional capital requirements are the one-time expenses of bringing the plant on stream during start-up — the period between the nominal end of construction and correct operation, when the plant makes quality product in the required quantity. Five items make up this final component of the capital investment:

Table 3.8 The one-time start-up expenses and their bases.

ITEM	WHAT IT COVERS
Labor training	Training the plant crew for start-up, based on a number of days of total plant labor cost
Commercialization costs	Marketing the product, building a distribution network, and setting up customer support; generally 0.5–5% of annual cash cost
Start-up inefficiency	An allowance for false starts and runs that cannot yet be sustained; 1% of annual cash cost for established processes, rising to 5% for less mature technologies
Unscheduled plant modifications	Equipment changes or additions needed if the product does not initially meet market specifications
Land and site development	Site preparation such as roads, parking, railroad sidings, lighting, fencing, sewers, and communications

The start-up inefficiency allowance follows the same maturity scale as the contingency and accuracy factors earlier in this chapter: an established process warrants the 1% floor, while a less mature technology — with more false starts to absorb — carries an allowance of up to 5%. With these one-time outlays added to fixed and working capital, the capital investment is complete.

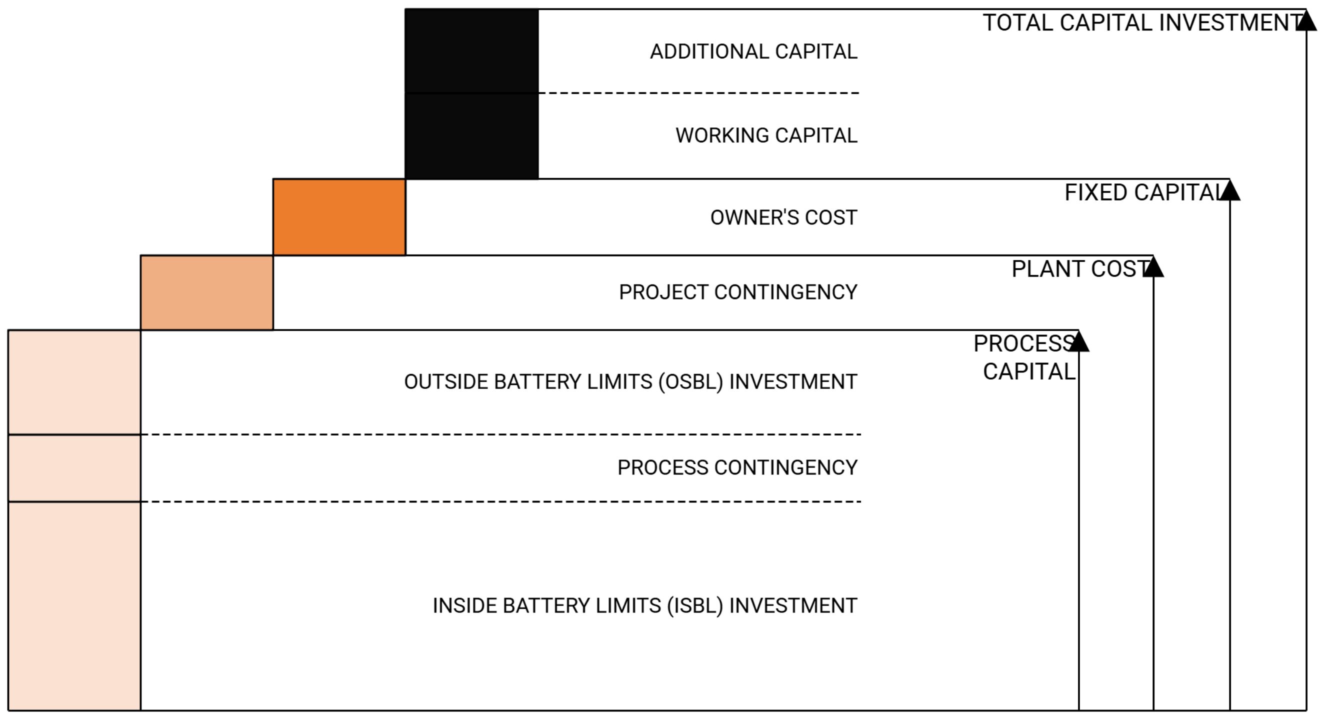

Figure 3.1 Capital Investment Composition

CHAPTER 4

Operating Cost Estimating

SUMMARY

- The recurring annual cost of running the plant is built from three parts — operating variable costs, operating fixed costs, and depreciation.
- The operating cash cost is the out-of-pocket total of variable plus fixed costs; adding depreciation gives the total operating cost.
- Raw-material and utility prices are average transaction values from official government trade statistics, and wage rates come from official government data, both for the country and period each report analyzes.
- Depreciation is straight-line — 10% a year on the process units and owner's-cost assets, 5% a year on the site infrastructure — and is a bookkeeping charge rather than a cash outlay.

Every Commodity Production Costs report states the recurring annual cost of running the plant it examines at its operating rate. That figure — the operating cost — is estimated in three parts, each developed in turn in this chapter:

Table 4.1 The three components of operating cost.

COMPONENT	WHAT IT COVERS
Operating variable costs	Costs that move with output — the raw materials consumed (net of by-product credits) and the utilities drawn
Operating fixed costs	Costs of keeping the plant staffed and maintained, which do not vary directly with the operating rate
Depreciation	The annual write-off of the plant's depreciable capital over its service life

Two summary measures are read off these three components, one built on the other, and both appear in the report's cost cascade. The **operating cash cost** is the recurring out-of-pocket cost of operating the plant — operating variable costs plus operating fixed costs. It excludes depreciation, because depreciation is not an actual cash outlay. The **total operating cost** adds depreciation on top, giving the full cost of operation once the gradual recovery of the plant's capital is included.

Table 4.2 The two operating-cost measures, one built on the other.

MEASURE	HOW IT IS BUILT	DEPRECIATION
Operating cash cost	Operating variable costs plus operating fixed costs	Excluded
Total operating cost	Operating cash cost plus depreciation	Included

In the one-page Production Cost Datasheet the cascade runs from the variable costs up to the cash cost, then to the total operating cost, before corporate overhead and a return on capital are added to reach the product value — the continuation treated in Chapter 5.

Pricing & Wage Rates Definition

The raw material and utility prices behind a report are average transaction prices for the country and time period being analyzed, taken from trade statistics issued by official government agencies. Because they are average transaction values, differences in product quality, discounts tied to volume, and the outcome of contractual negotiations are not reflected.

Some commodities have no trade statistics — for example, intermediate chemicals that are not traded because of transportation constraints and are instead generated and consumed on site. Each of these is valued at a **transfer price**: all the costs of manufacturing that product, plus an amount to pay for the investment made to manufacture it.

Wage rates for plant labor — for both operators and supervisors — are taken from data published by official government agencies, again for the country and period each report analyzes. These prices and wage rates feed the operating variable and fixed costs that follow; the per-shift head-counts the wage rates are applied to come from the plant's functional units, defined in Chapter 2.

Operating Variable Cost

Costs that move with output make up the operating variable cost, the sum of two parts: the net raw material cost and the net utility cost.

The **net raw material cost** is the cost of the raw materials consumed, less the credits earned from any saleable by-products. The raw material cost is the sum, across every feed, of its price multiplied by the amount consumed per unit of product; the by-product credits are then subtracted to give the net figure.

The **net utility cost** is the cost of the steam, electricity, fuel, and refrigeration the plant consumes. How much of each utility a plant uses is estimated separately, through correlations developed internally and refined from an established method in the technical literature. The correlations let consumption be estimated from basic information about the process — rather than from a detailed energy balance — reading their inputs from the block flow diagram defined in Chapter 2, together with the chemical properties of the components involved:

* the number of functional units, and the type of each according to its energy consumption — for instance whether it involves phase changes, or endothermic or exothermic reactions;
* flow rates;
* the heats of reaction involved in the process;
* the molecular weights and approximate boiling points of the components.

Each estimated consumption is then multiplied by the corresponding utility price to give the utility cost. Per-utility consumption figures are itemized in the report's more detailed editions.

Operating Fixed Cost

Keeping the plant staffed and maintained costs largely the same whether it runs at full rate or below it. These operating fixed costs are estimated as eight items, each tied to a defined basis:

Table 4.3 The eight operating fixed-cost items and their bases.

ITEM	BASIS
Operating labor	Operators required per shift and their wage rate, across the shifts and hours worked per year
Supervision labor	Supervisors per shift and their wage rate, on the same basis as operating labor
Maintenance	A percentage of plant cost per year, set by the fluids handled and the industry sector
Payroll charges	Typically 10–50% of the worker cost, varying by country
Operating supplies	A percentage of the total maintenance cost
Laboratory expenses	A percentage of the total labor cost
Plant overhead	A percentage of the combined labor and maintenance cost
Property taxes and insurance	A percentage of the fixed capital per year

The per-shift head-counts for operating and supervision labor come from the plant's functional units, as described in Chapter 2; the wage rates applied to them are the government-sourced rates defined earlier in this chapter. Payroll charges typically run 10–50% of the worker cost, the share varying by country. The plant cost and fixed capital that the maintenance and property-tax bases draw on are estimated in Chapter 3.

MAINTENANCE COST

Keeping the plant's equipment in working order calls for both labor and materials, estimated together as a percentage of plant cost per year. For plants in the United States, maintenance typically ranges from 1% to 4% of plant cost per year, usually split into 30–50% labor and 50–70% materials.

The exact percentage depends on the type of equipment a plant uses — closely tied to the kind of fluid it handles — and on its industry sector. The maintenance factor, as a percentage of plant cost per year, is given by fluids handled (rows) and industry sector (columns):

Table 4.4 Maintenance cost as a percentage of plant cost per year, by fluids handled and industry sector.

FLUIDS HANDLED	BASIC	SPECIALTY	CONSUMER PRODUCT	PHARMACEUTICAL
Solids	2%	3%	4%	2%
Gas-Liquid-Solids	1.5%	2.5%	3.5%	1.5%
Gas-Liquid	1%	2%	3%	1%

Depreciation

The plant's depreciable capital is recovered in equal annual amounts across its service life, by the straight-line method. Two service lives are assumed, giving two annual charges:

* **10 years** for the ISBL process units and for the assets derived from the owner's cost — a 10% annual charge;
* **20 years** for the OSBL site infrastructure — a 5% annual charge.

Process and project contingencies are carried in the depreciable base, so the annual depreciation is:

$$\begin{aligned}\text{Depreciation} = {} & 10\% \times (\text{ISBL investment} + \text{process contingency} + \text{ISBL project contingency}) \\ & +5\% \times (\text{OSBL investment} + \text{OSBL project contingency}) \\ & +10\% \times \text{owner's cost}\end{aligned}$$

The contingencies and capital components in this formula are defined in Chapter 3. Although depreciation is added to the operating cash cost to reach the total operating cost, it is not an actual cash outlay: it is treated as an operating expense for accounting purposes, allowing the cost of the plant to be recovered over time.

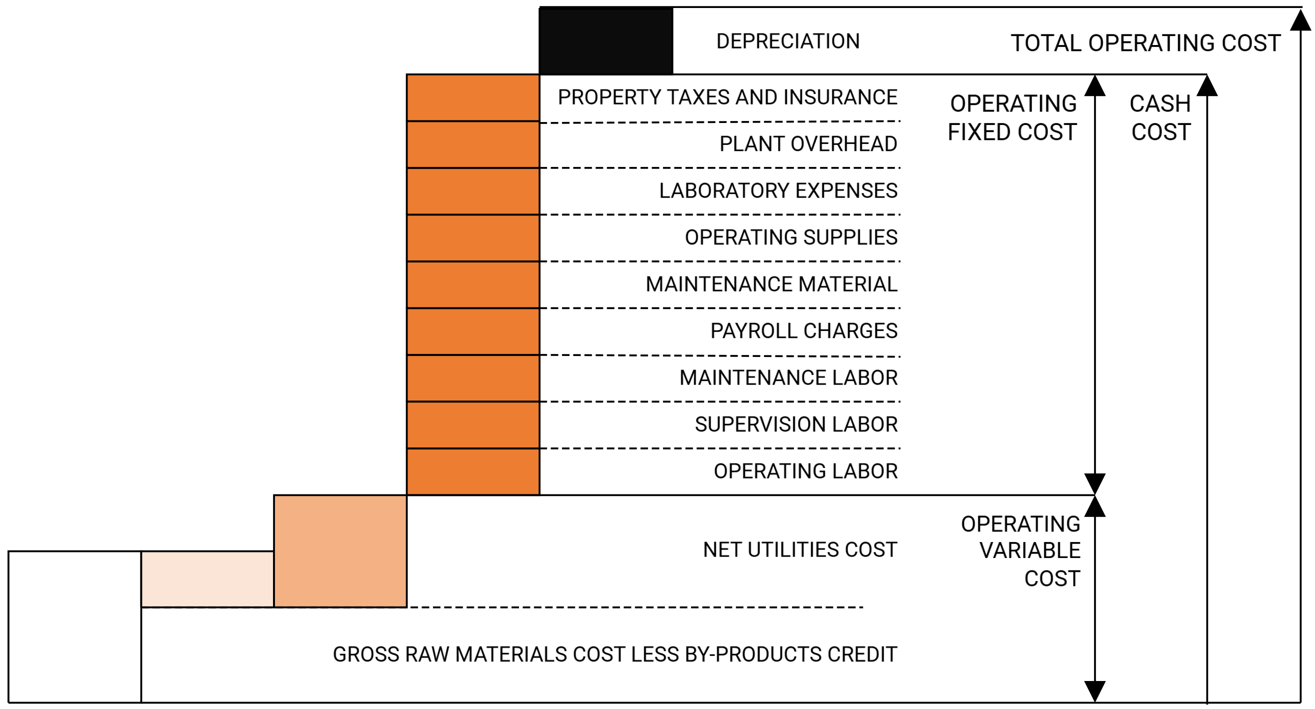

Figure 4.1 Operating Costs Composition

CHAPTER 5

Product Value Estimating

SUMMARY

- A single figure closes the report's cost cascade: the sum of operating variable costs, operating fixed costs, depreciation, corporate overhead, and the expected return, expressed in US dollars per amount of product.
- That figure — the product value — is the price a product must sustain for the plant to recover its full cost of production and earn the expected return; it is not the market price, and it is not a price forecast.
- Corporate overhead adds four company-level costs — administration, information technology, marketing & advertising, and research & development — each estimated as a percentage of a defined cost basis.
- The expected return applies a return on capital employed (ROCE) percentage set by industry sector and technology status, within the 5–25% range typical of a new chemical plant, and it reflects technical risk only.

Every Commodity Production Costs report closes its cost cascade with a single figure: the product value, the bottom line of the one-page Production Cost Datasheet. It is the price the product would have to sustain for the plant to recover every cost of production and earn an expected return on the capital invested — the return on capital employed (ROCE). Five components build the figure:

Table 5.1 The five components of the product value.

COMPONENT	WHAT IT COVERS
Operating variable costs	Costs that scale with output — chiefly raw materials and utilities
Operating fixed costs	Costs incurred regardless of output — labor, maintenance, and the like
Depreciation	The depreciable capital written off over the plant's life
Corporate overhead	Company-level costs beyond the plant — administration, information technology, marketing, and research & development
Expected ROCE amount	The return the capital invested in the plant is expected to earn

The first three components are the plant's operating costs, estimated in Chapter 4; the capital-dependent quantities behind them — the fixed capital that drives the depreciation charge and the capital costs that drive the expected return — come from the estimates of Chapter 3. Corporate overhead and the expected ROCE amount are then added on top, and the sum is the product value, expressed in US dollars per amount of product — a monetary value per physical unit of output, such as US dollars per metric ton. Reporting every product value on the same monetary and physical basis keeps the figure comparable across commodities, countries, and reports; the currency basis and the standardization of physical quantities follow the shared conventions described on the methodology site.

The product value is not the market price, and confusing the two is the most common misreading of a report. The two figures answer different questions:

* **Product value** — a *calculated* figure: the sum of operating costs, corporate overhead, and an expected return on capital. It states what the product must be worth for a plant to cover its full cost of production and earn a target return.
* **Market price** — the actual value practiced in market transactions: what the product is really bought and sold for, set by supply, demand, and negotiation.

Because it reflects the cost of production plus a required return rather than market conditions, the product value works as a minimum-price-style indicator — roughly the level a producer would need to reach to justify the investment. A market price below the product value signals that production would not earn its expected return; a price above it signals headroom.

Nor is the product value a price forecast. Each report reflects a single period of analysis — one quarter — and states the production economics of that period only, using data already finalized for that quarter; reports contain no forecasts of any kind. Reports from different quarters can be compared to see how production economics have shifted over time, but each individual figure — the product value included — is a point-in-time estimate, not a prediction of where prices are heading.

Corporate Overhead

Head-office costs — the costs of running the business that are not directly tied to operating the plant — enter the product value through four components. Each is estimated as a percentage of a cost basis already established in the preceding chapters: labor and maintenance costs and the operating cash cost from Chapter 4, and the fixed capital from Chapter 3.

Table 5.2 The four corporate overhead components and their cost bases.

COMPONENT	ESTIMATED AS
Administration	A percentage of the sum of total labor and maintenance costs
Information technology	1.4% of fixed capital per year
Marketing & advertising	A percentage of operating cash cost at full capacity, set by industry sector
Research & development	A percentage of operating cash cost at full capacity, set by industry sector and technology readiness

The marketing & advertising factor depends on the plant's industry sector alone, ranging from 0.8% of operating cash cost for basic commodity producers to 6% for consumer products:

Table 5.3 Marketing & advertising factors by industry sector.

INDUSTRY SECTOR	MARKETING & ADVERTISING
Basic	0.8%
Specialty	1.6%
Consumer Product	6%
Pharmaceutical	5%

Research & development varies along two dimensions: the industry sector and how proven the production technology is. Technologies under development — those not yet established at a commercial scale, sitting at the conceptual, embryonic, or emerging stages of the technology maturity scale introduced in Chapter 1 — carry higher factors than established technologies in commercial use:

Table 5.4 Research & development factors by industry sector and technology status.

INDUSTRY SECTOR	ESTABLISHED	UNDER DEVELOPMENT
Basic	2%	3%
Specialty	3%	5%
Consumer Product	2%	2.5%
Pharmaceutical	12%	17%

NOTE

Industry averages. The overhead factors above are typical of each industry sector, not of any single company. A particular analysis may adopt different assumptions where the specific process or context warrants.

Return on Capital Employed (ROCE)

The last component added to the product value is the return the capital invested in the plant is expected to earn, expressed per unit of product. It enters the calculation as

$$\text{expected ROCE amount} = \frac{\text{capital costs} \times \text{expected ROCE percentage}}{\text{annual production}}$$

which converts the plant's capital costs — estimated in Chapter 3 — into US dollars per amount of product. Most chemical companies aim for a ROCE of 5–25% for the construction of a new plant. The exact percentage assumed in a report depends on the industry sector and on how proven the production technology is — the same two dimensions that set the research & development factor — with less mature technologies assigned a higher expected return:

Table 5.5 Expected ROCE percentages by industry sector and technology status.

INDUSTRY SECTOR	ESTABLISHED	UNDER DEVELOPMENT
Basic	7%	10%
Specialty	12%	15%
Consumer Product	15%	18%
Pharmaceutical	20%	25%

The higher return demanded of a less mature technology reflects one kind of risk only: the **technical risk** arising from uncertainties in the production process itself. A less proven process carries more technical uncertainty and more cost uncertainty, so its capital is expected to earn more. Several other risks that a real investment decision would weigh are deliberately not reflected in the expected return:

* Changes in the business environment.
* Shifts in the product's market.
* Increased competition.
* Variations in raw-material and product prices.
* Changes in government policy.

Because these are left out, the product value isolates the economics of the production process itself, leaving market and policy risk to be judged separately by the reader.

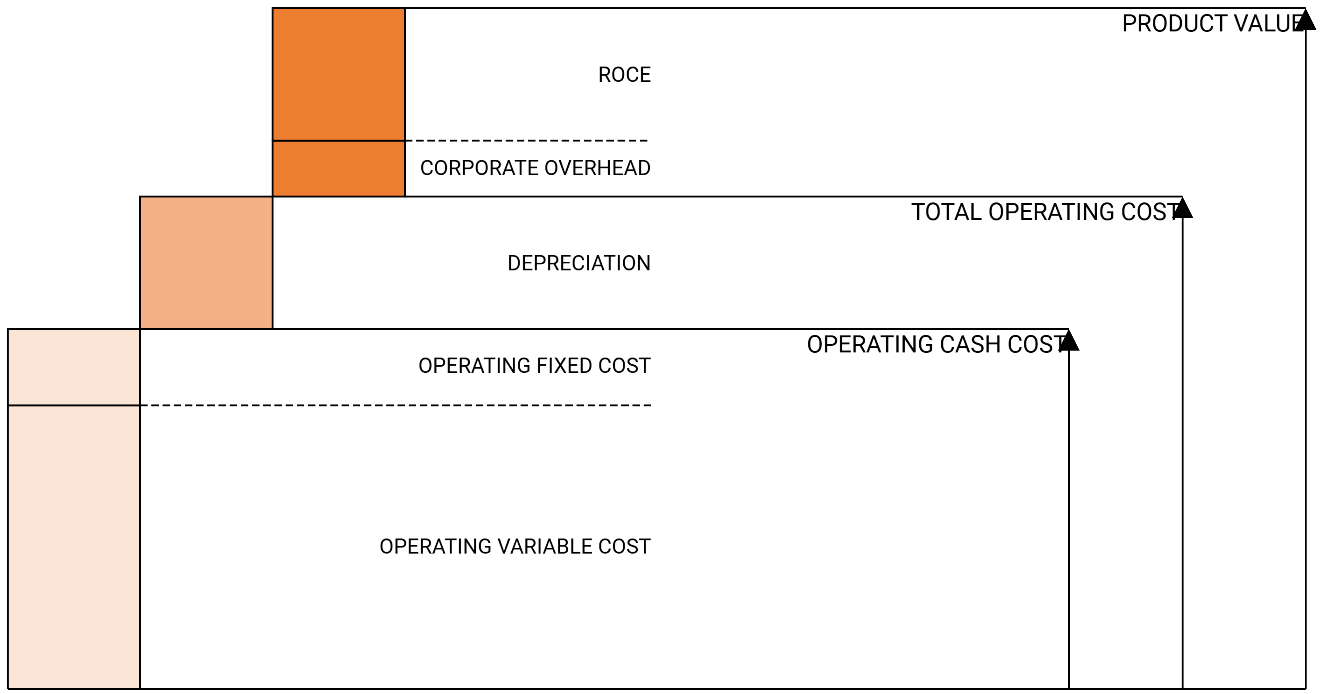

Figure 5.1 Product Value Composition

CHAPTER 6

Disclaimers and Limitations

SUMMARY

- No commercial relationships are maintained with the participants of the markets covered, and the methodology approach is fully public while the calibration of its models stays protected.
- Every estimate assumes a standardized design practice, a clear-field site, and a typical large single-line capacity, keeping reports comparable across commodities, routes, and countries.
- An estimated project cost is a projection of the probable cost, not an exact number — seven factors can make it legitimately diverge from an actual plant cost or a contractor's quote.
- A report is a Class 4 budgetary estimate built for investment screening and feasibility decisions, not a process design package or construction-ready engineering.

Commodity Production Costs is built on impartial, auditable methods, disclosed openly and applied within stated boundaries. Every report declares the design basis its figures rest on, the ways an estimate can legitimately differ from an actual plant cost, and the level of engineering the analysis does and does not represent — so a reported cost is read for what it is: a consistent, benchmark-grade projection of the probable cost rather than an exact number.

Independence and Impartiality

The analysis rests on impartial, auditable methods applied to data drawn, for the vast majority, from public official sources — statistics bureaus, trade agencies, multilateral organizations, and market exchanges. Private sources and producers' data are used only with permission from the rights holders, and a Commodity Production Costs report is not a primary source for pricing data.

No commercial relationships are maintained with the participants of the markets covered — the producers, traders, and other firms active in those markets — and surveys are used only in very exceptional circumstances. This removes the incentive for any single party to influence the results, and keeps the analysis independent of the interests it measures.

Transparency is maintained without exposing internals. The methodology approach is fully public, requiring no login or subscription: the data sources, the structure of the analysis, and the estimation approach are all disclosed. What remains proprietary is the precise calibration — the model parameters behind the published figures. The approach is disclosed; the parameters are protected.

Design Assumptions Behind Every Estimate

Unless a report explicitly states otherwise, its figures reflect the same kind of modern, world-scale plant, defined by a common basis applied to every analysis.

Table 6.1 The design basis applied to every estimate unless a report states otherwise.

ASSUMPTION	WHAT IT ESTABLISHES
Standardized design practice	Engineering practice typical of major chemical companies.
Clear-field site	Construction on a site with no existing infrastructure to reuse or build around.
Large single-line capacity	A typical large capacity produced on a single production line.

Holding this basis constant is what keeps reports comparable across commodities, production routes, and countries — every analysis prices the same class of plant. The specific design standards a real project adopts can move both its capital and its operating costs, so where a report departs from this basis, it says so.

The conceptual-design basis also shapes how the reported consumption figures should be read. Raw material and utility consumptions are derived from the conceptual process design and are generally reasonably accurate, but they tend to be somewhat understated relative to a real operating plant: a running plant loses material and energy to vessel vents, unscheduled equipment, inerting systems, inaccuracies in physical-property data, and start-up and shutdown, along with other operations not addressed at the conceptual-design stage. The reported consumptions are therefore sound estimates that a real plant will tend to exceed slightly, rather than fall below.

Comparisons with Actual Plant Costs

A reported estimate can be set alongside an actual plant cost or a contractor's quotation, but the comparison has to allow for factors that make the two legitimately differ. Three concern the process design behind the figures being compared:

* **Minor process differences** — small, often unnoticed differences between similar processes can noticeably affect cost.
* **Omitted process areas** — leaving process areas out of the design considered can invalidate a comparison with the estimate presented.
* **Overdesign** — industrial plants may be overdesigned for particular objectives or situations.

The other four concern prices and commercial conditions at the time of the comparison:

* **Equipment and construction cost swings** — rapid fluctuation of equipment or construction costs can invalidate a capital estimate.
* **Market price swings** — market price fluctuations can invalidate an operating cost estimate.
* **Below-margin bids** — equipment vendors or engineering companies may provide goods or services below profit margins during economic downturns.
* **Location-specific taxes and fees** — some locations impose higher taxes and fees, which can affect costs considerably.

Errors from these and other factors — cost and labor changes, construction problems, weather, strikes — are partly absorbed by the project contingency built into the capital investment estimate, described in Chapter 3. An estimated project cost is not an exact number, but a projection of the probable cost.

Limitations of the Analysis

A Commodity Production Costs report is a preliminary economic evaluation, and it must not be used as a process design package, a design basis, or a front-end engineering design (FEED) package. The difference is the level of engineering detail: the report reconstructs a conceptual process design from public information — enough to estimate costs to a benchmark accuracy — while a design package specifies a plant to the level of detail an engineering contractor needs to build it.

The estimates follow the Class 4 budgetary estimate standard — a conceptual-level cost estimate used for investment screening and preliminary feasibility decisions. This class matches the conceptual basis of the analysis, and it is the reference point behind the accuracy ranges reported for capital and operating costs (the fixed-capital ranges appear in Chapter 3).

> **NOTE**
>
> A production cost report supports preliminary economic decisions — screening, feasibility analysis, and comparison. It is not engineering documentation, and does not replace a design basis, a FEED package, or a licensor's process design.

Usage limitations specific to each product — what each report should and should not be used for — are documented in the Intratec Help Center. The timing conventions each report carries — the period of analysis, the quarterly Series, the IC Index, and Revision Control — are documented in the Timing and Updates article on the methodology site.

CHAPTER 7

Methodology References

SUMMARY

- The methodology stands on an established body of published reference literature — textbooks, handbooks, and technical papers on process design and cost estimation for the chemical and process industries.
- Recurring terms are defined in the online Glossary, and the methodology site always carries the most recent edition of the methodology.

The methodology rests on an established body of reference literature — textbooks, handbooks, and technical papers on process design and process economics, and on the cost-engineering practices used to estimate capital investment and production costs in the chemical and process industries. This bibliographical foundation, drawn on throughout the development of Commodity Production Costs and the elaboration of its methodology, is listed below, alongside where recurring terms are defined and where the up-to-date methodology can be found.

Bibliography

Table 7.1 Reference literature behind the Commodity Production Costs methodology.

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Defined Terms

Recurring terms used throughout the methodology — the capital investment components, product value elements, and estimate accuracy classes — are defined in full in the Glossary on the methodology site: methodology.intratec.us/glossary.

The Up-to-Date Methodology

This document reproduces the methodology as of the edition date printed on its cover. The methodology itself is reviewed continuously — data sources are checked and replaced, models are recalibrated, and clarifications from subscriber feedback are folded in, with every change documented in the monthly Release Notes — so a downloaded or printed copy gradually falls behind. The most recent version is always the one published on the methodology site, publicly available with no subscription or login required: methodology.intratec.us.