WHITE PAPER

Make Your Estimate a True Strategic Weapon

Best Practices for Implementing the Global Standard of Cost Estimating

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Improving Competitiveness in a Challenging Market

Capital projects are a key element in improving competitiveness in the process industry. To improve plant operations, reliability or safety; capital investment is usually required. To reduce energy use and carbon footprint, capital projects are usually involved. To take advantage of lower feedstock costs or the opportunity to improve profits with a new product mix, almost always significant capital investment is required.

As project owners and supporting engineering firms' services businesses go through the current downturn, new cost estimating tactics must be employed to stay competitive in the market. Speed, agility, flexibility and creative project control measures are required by all stakeholders in order to achieve successful project outcomes, maximize return on investment, take advantage of market changes and arrive at industry leading positions. Using this period to identify and address departmental weaknesses and optimization opportunities is viewed as a pragmatic approach to increase efficiency, reduce project variances, develop trust and deliver seamless applications that keep pace with the latest mega project trends.

Over the past two years, capital investment in oil, gas, and upstream production experienced a significant slowdown, as these commodities moved into a short term oversupply position. The dynamics of refining, petrochemical and fine chemical investments are much more opaque, and somewhat dependent on specific locations and specific companies, so their environment is much more difficult to assess. Pricing, market and capital access all play a part.

While the industry has experienced five to ten-year boom and bust cycles for several decades, with an overall long-term upward trend, this time around a combination of circumstances makes many observers feel that this cycle is different. Amidst the fog of future trends, the market seems to be reaching an upturn point. But there are deeper, long-term implications for the planning and execution of capital projects. The drive for more efficient ways of engineering projects, combined with the turnover of a generation of experienced estimators, creates an appetite and requirement to rethink the entire methodology and business processes of capital planning, bidding and estimating across the industry.

For both EPCs and owner operators, the need for change is driven by some similar factors. First, there is an industry-wide shortage of experienced estimators. The trimming of the estimating function that occurred as the capital project market contracted has created the need to do much more with fewer experienced people. Second, the shorter bid timelines put teams in the position of starting the estimate concurrently with developing the preliminary conceptual design. This requires major changes in work processes between engineering disciplines and estimating. Third, the fluidity of project objectives and scope is requiring unprecedented agility in changing the scope of estimates part way through a bid process. That agility cannot be supported with traditional approaches.

This white paper discusses strategies for accelerating implementation of new estimating approaches that can dramatically impact efficiency and agility.

The Need for Change, and the Associated Challenges

Change is often difficult for businesses because the known weaknesses in a familiar and well established business process are usually chosen over the more efficient and effective process because it requires strong management commitment embracing the change by all affected people. It's the old proverb that sums up the reluctance to change; "better the devil you know, than the devil you don't know".

In the area of capital cost estimating, your business is most probably using a large number of factor-based calculations built into proprietary Microsoft Excel spread sheets to manage the activity of building the estimate. While your business might have high perceived confidence in these spread sheets and the people that support and manage them, this approach has a number of drawbacks and business risks. These include; **(a)** hard-to-compress labor costs involved in assembling counts of equipment and bulks and adding them to spreadsheets; **(b)** quality checking requirements in managing families of spreadsheets involving data consistency and versioning in light of very manual re-entry of data; **(c)** the lack of transparency to the user of the spreadsheet of the underlying calculations; **(d)** inconsistency between individual estimators using their own personal calculation methods; **(e)** change control issues as bid changes occur and the resulting modifications cascade from spreadsheet to spreadsheet; **(f)** inability of a factor-based principal to accurately handle extrapolation beyond known sizes and outside of known locations and workforce parameters; **(g)** challenges in merging estimates from multiple organizations in mega projects involving several EPC project partners; **(h)** lack of transparency between owner and contractor.

It has been shown many times over, that capital cost estimation will almost always be more efficient, consistent, accurate and transparent with a model-based approach that incorporates engineering models to build up scope from sized equipment lists. Model-based estimating additionally provides a common platform to estimate a project throughout its lifecycle. Using this common platform, you can improve bidding accuracy, validate design costs against built-in benchmarks, and save time through improved workflows that reduce the manual transfer of data.

Aspen Capital Cost Estimator™, the trusted industry standard for model-based estimating, has demonstrated the ability to reduce estimating time by up to 50% at companies such as Technip, Linde and Reliance Industries. Estimating man-hour savings of 50–80% have been documented by organizations such as Phillips 66 and S&B Engineers and Constructors. Furthermore, the technology has been able to reduce estimate variance by 20% among estimators in the same group, while improving estimating accuracy from your initial Class V estimate to your detailed estimate bid package (Class II). To further support the asset creation workflow, ACCE can be seamlessly integrated with project simulation and risk mitigation solutions to further improve and enhance the efficiency of project workflows.

However, what has set some of these successful organizations apart in their ability to achieve a step change in their estimating business process? It is initially because of a successful implementation approach and in the long term a sustained training plan to maintain and increase familiarity and confidence in the solution as well as a thorough understanding of how to unlock the broad capability of ACCE to achieve highly accurate and repeatable results.

Several of the most successful recent adopters of the aspenONE® engineering solution for estimating have been guided through an implementation process by our Implementation Service Provider (ISP) partner, Strategic Estimating Systems (SES).

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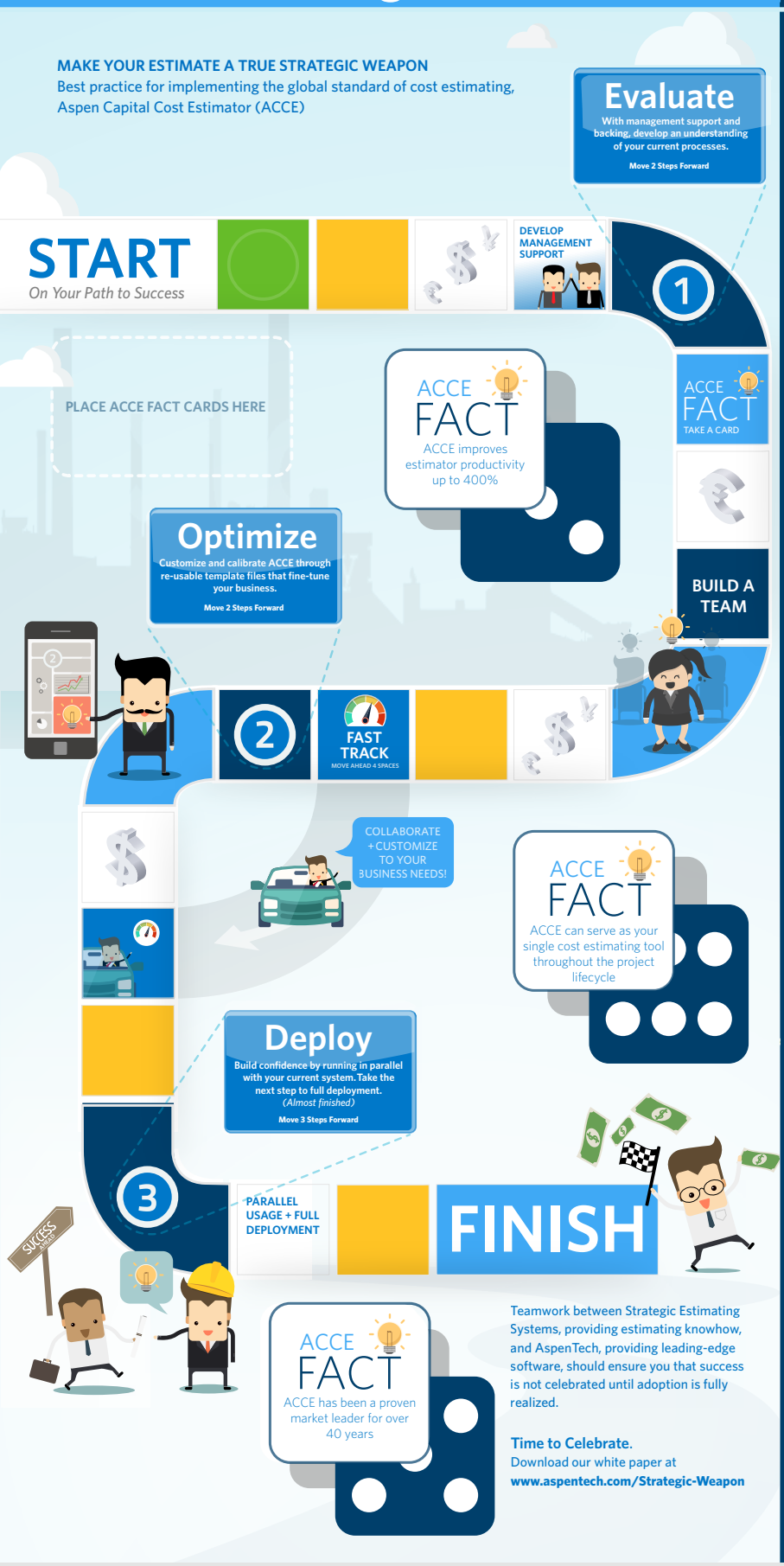
Win The Bidding Game

For Ages 8 and Up

MAKE YOUR ESTIMATE A TRUE STRATEGIC WEAPON
Best practice for implementing the global standard of cost estimating, Aspen Capital Cost Estimator (ACCE)



Teamwork between Strategic Estimating Systems, providing estimating knowhow, and AspenTech, providing leading-edge software, should ensure you that success is not celebrated until adoption is fully realized.

Time to Celebrate.
Download our white paper at
www.aspentech.com/Strategic-Weapon

ASPENTECH LEADERBOARD

PEMEX

PEMEX achieved less than **15%** estimating variance over a five-year period with **30** major refining projects

BURNS McDONNELL

Burns & McDonnell saved clients **75%** in equipment costs and **25%** in capital costs

Technip

Technip saved **50%** in estimating time during FEED

S&B

S&B engineers saved **80%** of estimated man-hours

Best Practices and Pitfalls

Before discussing the adoption pathway, let's review some key pitfalls that must be avoided in the adoption of new software systems that impact business processes. In a blog posted on February 5, 2016, Cynthia West of Project Insight articulated five issues that she considers systemic causes of project failure:

1. **Lack of leadership sponsorship:** Without this sponsorship, especially in a global organization, it is difficult to create momentum behind global standardization on which business process benefits depend. Key engineering teams may avoid participating, and the total implementation may be underfunded.
2. **Little or no communication plan:** Because cost estimating impacts so many people across a project lifecycle, clear communication is a key success factor. All impacted people must be clear as to why changes are being made.
3. **Little or no incentive to change:** All impacted groups and individuals should be clear on why a better approach is central to their individual and team success.
4. **Trying to go it alone:** An estimating system is an organizational tool—it impacts senior executives through actual users. To ensure success, all impacted stakeholders must understand the new workflows and changes.
5. **Implementing software without considering changes needed in your business process:** ACCE is fundamentally a driver for changing business processes around estimating. If ACCE is implemented with the view of reproducing existing work flows, many of the benefits will be lost.

Mike Monteith, CEO of SES, identified a few specific estimating organization success factors that he has observed working with traditional estimating teams while successfully moving them to a new way of working:

1) Designate a technical champion who becomes the "super user" and internal expert on the software.

2) Designate a business champion who has executive sponsorship and will drive the use of the solution across all elements of the business process.

3) Develop confidence and commitment to the system. If certain parts of the estimate, or certain engineering disciplines are done outside of the software, in the legacy spreadsheets, then the value and power of the system is diminished.

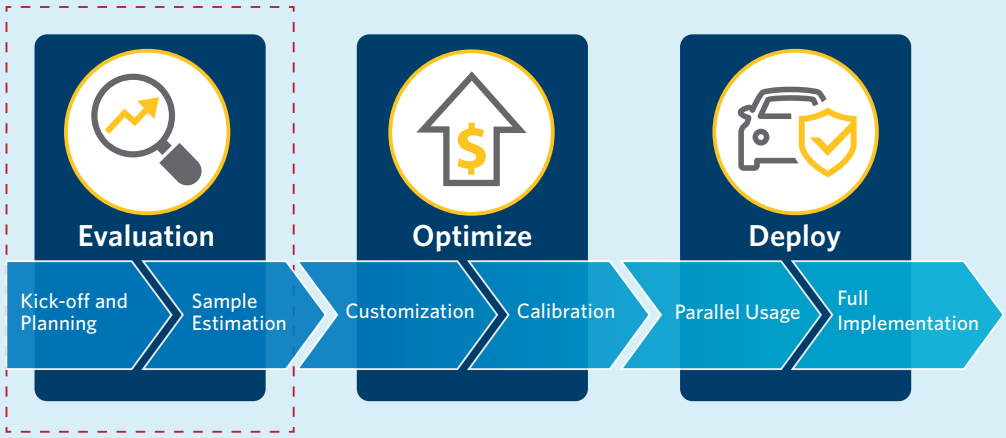
4) Offer sufficient training. ACCE is a different way of working. Those who will use the system need to understand not only how to push buttons, but how the system works so they understand the implications of their choices.

5) Do not replicate previous work processes. A typical traditional estimating process is based around discipline specialists (such as electrical, controls), working separately and combining results. ACCE enables a collaborative approach, based around a strong generalist estimator who creates the overall scope, the model calculates the details, and the specialists review and validate rather than enumerate data.

Adoption Pathway

The adoption pathway recommended by AspenTech and SES is made up of three simple steps: evaluate, optimize and deploy. Those parts can be further broken into six additional discrete steps that can be project managed through a stage-gate process if desired.

Let's break down the adoption process into its components for further examination.



Adoption Pathway Step 1: Evaluation

Evaluation

Kick-off and Planning

The first step in the evaluation process is kick-off and planning. As your partner, SES and AspenTech, would like to understand the current workflow process that your team practices for capital cost estimating. Understanding your process and its maturity level compared with best practice is essential in understanding and developing the required depth and span of the adoption process.

Actions that will occur during kick-off and planning include:

- Conducting a high-level review of a sample cost estimate completed by your company
- Interviewing your cost estimating personnel and project controls staff to understand the current work processes and associated challenges
- Evaluating tools, methodologies and the depth of skill possessed by your estimating team

"An assessment of current methods and how ACCE will be used, performed under the sponsorship of and presented to management, is essential to successful implementation. Getting started with a thorough understanding of a baseline allows for better decisions in the future."

Mike Monteith, CEO, Strategic Estimating Systems

At the conclusion of kick-off and planning, both management and the estimating group champions will be aligned on the full scope of the adoption process.

Sample Estimates

It might be beneficial to speak about the basic principles of how Aspen Capital Cost Estimator works. ACCE is not built on factors, but rather on model-based estimating. Model-based estimating utilizes first principle engineering knowledge and only requires very simple information to provide a Class V estimate. By its design it is inherently scalable, which is a major deficiency of factor based estimating.

As an example, if you were to develop a cost estimate for a refinery fractionating column, you would need the following information: column diameter, Tan/tan length, design pressure, design temperature, material construction, and number of tray information as input. Model-based estimating conceptually builds the column from sheet steel stock, calculating costs to roll and bend the steel, weld, fit with piping, paint, insulate, etc. It would even calculate the type of site requirements such as a pad that is needed. This power of the software, by its inherent nature, makes it scalable.

Based on this simple information, an initial Class IV estimate will be developed which leverages the extensive database of costs and equipment configurations embedded in Aspen Capital Cost Estimator. Running ACCE "out of the box" and comparing it against an existing estimate will allow you to compare methodologies and uncover basic embedded practices in your estimating process that will affect outcome accuracy and variability. Loading additional company design specifications will further tune the model and improve accuracy. Upon completion of the evaluation phase, your business will have accomplished:

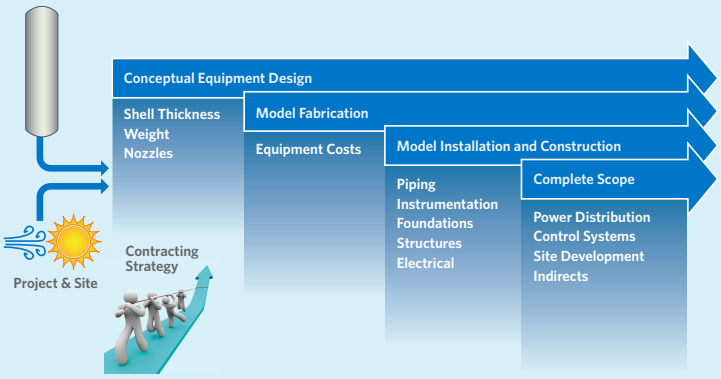
- Basic Aspen Capital Cost Estimator training
- The creation of a multidisciplinary adoption team
- An understanding of areas that might differ between ACCE and your historical data in the areas of CAPEX and OPEX

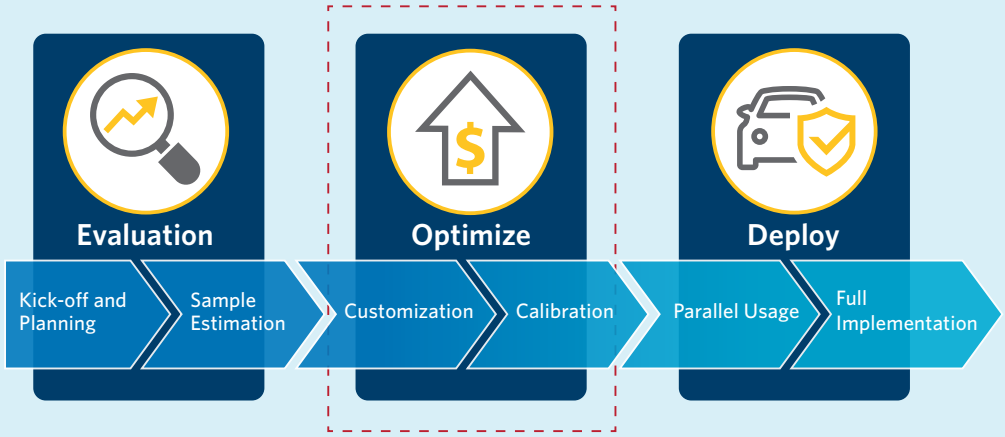
Simple Example of How Model-Based Approach Works:

Column … minimum to more detailed specifications …

Diameter	12ft
Tan/tan length	60ft
Design pressure	30 psig
Design temperature	250 °F

Simple Example of How a Model-Based Approach Works





Adoption Pathway Step 2: Optimize — Customization and Calibration

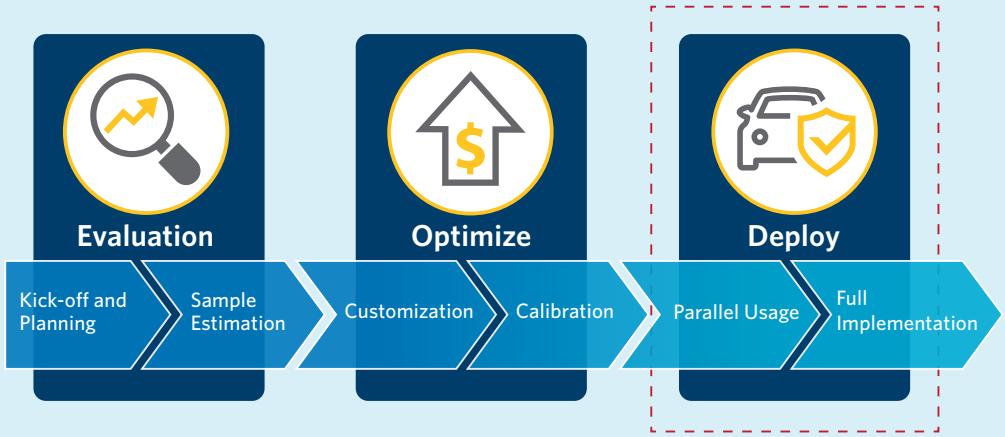
Optimize

Customization

When moving into the optimization phase, your goal will be to tune and optimize the product to match your business and business process infrastructure. Aspen Capital Cost Estimator is built with a large native library of capital and operation cost information, that is updated yearly, which will cover a broad range of applications and geographies. The goal of the customization phase is to build custom models through reusable template files that will leverage both quoted costs and embedded costs to match your businesses environment.

Calibration

At this point in the adoption process, you have built the infrastructure and its time to test it against a known completed bid. Comparing the ACCE results to an actual estimate is a key and valuable exercise as you will determine areas that need further tuning. During this fine tuning stage, you will examine and adjust ACCE results to the actual estimate. Areas to examine are inputting of quotes, commodity pricing, specific supplier agreements and the calibration of unit man-hours.



Adoption Pathway Step 3: Deploy — Parallel Usage to Full Implementation

Deploy

Parallel Usage

Building the estimating and executive team's confidence is an important part of implementing best practice in the bidding and estimating process. Running ACCE in parallel with your legacy system will do two things: build confidence in its tuned output and expose areas where fine tuning calibration and indexing will help you make final adjustments. When your in-house estimators lead the way, they will expose additional estimators to the newly defined workflow and continue to fine tune the data output.

Full Deployment

It's now time to take the final big steps and move to full implementation. Your estimators and executives, who at the onset of the program were reluctant to change, now have seen ACCE in action and base-lined it against legacy systems giving them confidence in the bidding estimate.

Strategic Estimating Systems (SES) is a unique partner alongside AspenTech because they have the global expertise gleamed from scores of ACCE implementations. But what really sets them apart is the ability to take the software to new levels during deployment. High maturity EPC businesses have customized their code of accounts, custom reports and unit rate estimating capabilities to give them true competitive advantage both in speed and agility when delivering bids to their customers, by customizing data and turning it into knowledge.

In with the Good, Out with the Bad

Companies respond differently when implementing a business process change. Some take a leading role early in the process and see the adoption as a time when the benefits outweigh risks, so they move forward with gusto. Others wait and look to minimize risk and change. Our experience has provided us with several insights we'd like to share with you. The following are just a few issues we have heard about and are generalizations of negative behaviors that have resulted in an unsuccessful or partial implementation.

"ACCE results show that it isn't as accurate as the current system used."

ACCE works like an "engineer in a box", meaning that it has a vast amount of reference point costs data in storage, from labor rates to electrical to site costs, that it leverages to create an estimate. The key to optimizing ACCE is to replace key and significant data in major areas that will significantly influence the model. Too many times insufficient training or experience will cause the estimator to center on details that are too small to move the needle of the estimate.

"I still need to run my specialized spreadsheets, because I trust them."

Too many times an estimator will perform part of the estimate (construction indirect, engineering, electrical estimates, etc.) outside the system because they either trust their spreadsheets more or are unfamiliar with the capabilities of ACCE. Not fully leveraging the system causes you to lose the ability for database reuse, causing errors in data translation, and decreasing the agility of your bidding process.

"I like my current workflow and ACCE must fit into the existing estimate work process."

ACCE is a powerful out-of-the-box tool that can be used for Class V through detailed estimates. Because of the inherently strong and large database of retained costing data, the workflow will differ because you will be able to perform more detailed estimates earlier in the bidding process. ACCE works best in a collaborative environment, by gaining optimization or tuning information, such as site specific wage or labor costs, or specific supplier quotes.

"It seems like I spend a lot of time adding information for conceptual estimates."

ACCE is almost infinitely tunable for the most mature user. However, this capability can cause stress to the inexperienced user, as that person might center on low impact details (low voltage power cable schedule) verses something that would majorly impact bidding accuracy (construction labor productivity factor or construction indirects). As the estimator becomes more experienced on ACCE, the knowledge of understanding will improve, positively affecting the model.

These disruptive behaviors usually mean an incomplete or unsuccessful implementation that could leave your estimating function frustrated because they are stuck in the middle, not using legacy systems that they know and trust in creating their estimates, but not fully leveraging the power of the new and more capable system.

So how have others done it?

Over a sustained period of time, the results demonstrating the value of the ACCE model-based estimating, have been reported by several global organizations. Fluor has improved business processes and project execution efficiency, with ACCE as an integral component. ACCE also supports Fluor's third generation modular design methodologies. S&B Engineers and Constructors are producing estimates with 70% less man-hours for FEL 1 and 2 estimates and 50% less man-hours for FEL 3 estimates. Burns and McDonnell are able to evaluate more design alternatives, to effectively and transparently communicate with clients, and propose brownfield solutions that reduce anticipated CAPEX by 15–30% on debottlenecking projects. PEMEX benchmarked 30 major refinery capital projects estimated using ACCE over a five-year period. Over those 30 projects, PEMEX's estimating organization achieved accuracy at a consistent level of approximately 21% for Class IV estimates and approximately 8 to 16% for Class III estimates. ConocoPhillips, a downstream organization (now Phillips66), benchmarked their estimating results over a five-year period during which they switched from using a factor-based estimating approach to using ACCE. Phillips66 reduced their capital estimating variance (at the FEL 3 stage) from a 40% variance with factor-based estimating to a 12% variance with ACCE. They concurrently were able to improve the productivity of their estimators by a 10:1 ratio.

Next steps

The economic times are challenging enough to make your estimators and business executives require assurance of adoption when seeking to improve agility, flexibility and prepare ever exacting bids in less time. As the market demands have increased, Aspen Technology has continued an unparalleled investment in R&D that has made Aspen Capital Cost Estimator a global industry standard for bidding and estimating capital projects. However, even that is not enough. Good solutions are less effective without a fully committed team, management support for a new business process, and strong training.

Teamwork between SES, providing estimating knowhow, and AspenTech, providing leading-edge innovative software, should assure you, your estimators and business executives that success is not celebrated until adoption is fully realized.

AspenTech is a leading supplier of software that optimizes process manufacturing — for energy, chemicals, engineering and construction, and other industries that manufacture and produce products from a chemical process. With integrated aspenONE® solutions, process manufacturers can implement best practices for optimizing their engineering, manufacturing, and supply chain operations. As a result, AspenTech customers are better able to increase capacity, improve margins, reduce costs, and become more energy efficient. To see how the world's leading process manufacturers rely on AspenTech to achieve their operational excellence goals, visit **www.aspentech.com**.

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