

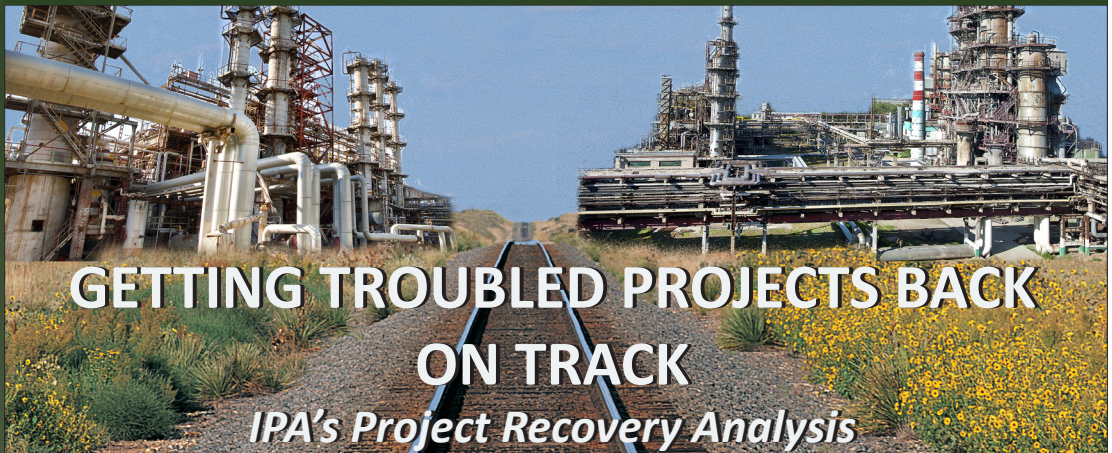
*Independent Project Analysis, Inc. is the preeminent organization for quantitative analysis of capital project effectiveness worldwide. At IPA, we provide practices you can use to ensure your success.*

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By Jordan Sealock, Business Area Manager, IPA Chemicals, Life Science & Nutrition

**A**lthough organizations never plan for their projects to go “off the rails,” it is still a fairly common occurrence in the capital project world.

In fact, when IPA looked at globally completed projects costing more than US\$50 million that were authorized within the last 10 years, we found that one-fifth of projects experienced at least 25 percent cost growth. Almost 40 percent experienced at least the same amount of schedule slip.

More disappointing, one of every five projects were *both* 20 percent more expensive *and* slower than Industry, and half of projects

did not meet the business objectives. These abysmal results demonstrate the high rate of projects that continue to be failures.

As IPA's clients know, in order to achieve maximum value from the portfolio, projects must be both predictable and competitive. While some projects are not set up to succeed, there are others with good front-end planning and strong teams that still suffer unforeseen problems. When organizations find their projects suffering significant issues during execution, IPA is able to help get the project back on track with its Project Recovery Analysis.

Most IPA project evaluations align  
*Continued on page 6*

## The Lure of Modular Construction

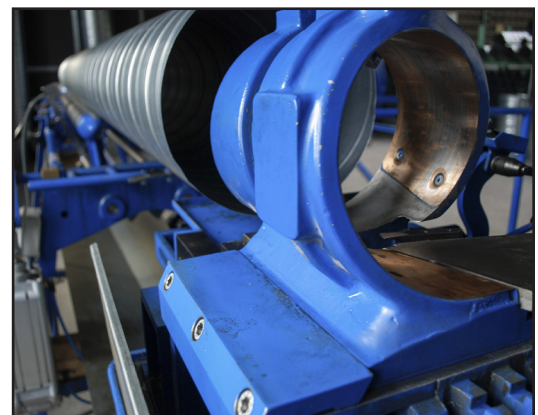
### Assessing the Advantages and Risks

By Andras Marton, Business Area Manager, IPA Hydrocarbon Processing & Transportation, and Jennifer Schroth, IPA Project Analyst

**I**t is easy to understand why using modular construction on projects carries some appeal. The commonly held view is that by moving construction labor activities to fabrication yards rather than performing them at the project site, capital project performance outcomes can be improved in terms of worker safety and cost and schedule effectiveness.

Modular construction allows owner companies to work around the challenges associated with the lack of skilled construction labor in some locations. Constraints and

*Continued on page 10*



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<http://www.ipaglobal.com>



## What's In Store: A Shifting Focus for E&P Spending

### The Case For Benchmarking Business Unit Performance



**Benchmarking:** The E&P sector wastes billions on inefficiencies in small and midsize projects, including maintenance efforts.

**By Katherine Marusin, IPA Plant-Based Systems Manager**

Until recently, the majority of E&P spending targeted increasing production volumes and growth, as well as finding new reserves. Huge, high-profile projects became routine—as did a somewhat casual attitude towards profligate spending. Falling oil prices, geopolitics, and a wave of upcoming regulatory changes have resulted in a new trend—cost cutting. Today, global declines in E&P spending are among the largest since the 1980s. Diminished capital expenditure and the overall focus on cost reduction is likely to continue well into 2016.

What does this mean for IPA's clients?

Although investment in very large projects aimed at bringing production online and finding new reserves is declining, significant capital investment is ongoing. However, on individual projects, this will more routinely reflect spending measured in *millions*, not *billions*.

On average, roughly one-third (and often more) of our clients' overall capital expenditure is dedicated to "small" and "mid-sized" projects, often capitalized maintenance efforts. Generally developed and executed at the business unit level, these projects are vitally important: in addition to ensuring that both production and facilities are maintained, these projects generate cash for the business and provide a refuge for talent no

longer required on larger projects. However, despite their criticality and the enormous amounts of capital required to do them, these projects routinely suffer from shockingly disappointing outcomes—wildly unpredictable costs and schedules, frequent and costly changes, and generally inefficient capital deployment.

Why should a company care about how effectively it has installed that new pipe header, replaced those damaged heat exchanger internals, or increased the efficiency of separator equipment? Because by not doing these projects well, companies waste both time and money. And, these efforts represent a significant portion of most project portfolios.

Another reason business should care? The organizations that most successfully manage capital requirements of any size tend to feel the effects of falling revenue less acutely than their competitors. As the market has shifted, so should our focus. The reality is that the numbers of these "smaller" projects included in capital portfolios will continue to rise, and the potential consequences for not effectively delivering these jobs will become more significant. The case for improvement is strong: fewer than 4 in 10 projects developed and executed at the asset/facility level were delivered successfully.

In 2015, IPA saw that business units operating on- and offshore facilities all struggled with applying Best Practices consistently. Portfolio management challenges and cash constraints imposed by market volatility have complicated matters. Aside from a few bright spots, the general trend for all has been towards underperformance. IPA can confidently conclude that, cumulatively, the E&P sector has wasted billions of dollars on small and mid-sized capital projects in the past year. By contrast, projects done at the best organizations were significantly more competitive and predictable, and successfully avoided costly changes.

At the most successful business unit level organizations, IPA found time and time again that using Best Practices makes the difference. Further, these business units serve to provide a refuge for talent, allowing for the development and retention of project professionals in the face of calls for headcount reduction.

Effective deployment of capital and resources helps ensure these organizations will be ready for eventual recovery. So ask yourself: How effectively does your organization deliver “small” projects?

IPA evaluates the effectiveness of small and midsize projects (on- and offshore) delivered by companies operating in the E&P and Midstream sectors. IPA's quantitative approach to benchmarking allows it to identify practices that drive success (and underperformance) within specific business units. When coupled with quantitative evaluations of organizational staffing, IPA can help a company maintain a competitive edge on its maintenance capital portfolio.

#### FIND OUT MORE

Contact IPA Plant-Based Systems Manager Katherine Marusin at [kmarusin@ipaglobal.com](mailto:kmarusin@ipaglobal.com), or Neeraj Nandurdikar, Director, IPA Oil & Gas Practice, at [nnandurdikar@ipaglobal.com](mailto:nnandurdikar@ipaglobal.com), to learn more about E&P small and midsize project benchmarking.

Visit IPA's website for additional information about IPA's Oil & Gas Practice, including descriptions of tools and services designed to support capital investment for oil and gas operators.

## The CEC's Value to Cost Engineers

### *Annual Conference Unveils Latest Project Cost Metrics, Tools, and Research*

**F**or downstream capital project cost engineers, the opportunity to concentrate on the effective application of project cost metrics and share ideas about cost estimating practices happens once a year—at IPA's Cost Engineering Committee (CEC) conference.

Cost engineers, representing more than 20 owner companies, participated in the 17th annual CEC conference from September 28 to 30, 2015, in McLean, Virginia. This year's CEC conference program emphasized reducing unknowns and risks.

“By doing a better job of identifying risks up front, we get an improved sense of how we can plan for them” from the cost engineer's perspective, Luke Wallace, Associate Director, IPA Project Research Division (PRD) Cost Analysis Group, told conference attendees. To help in diagnosing risks earlier in the project development work process, IPA briefed attendees on a newly developed probabilistic model that measures the probability of a risk's occurrence and the risk's effect on project outcomes should it occur. The output of this model enables CEC users to calibrate their own risk modeling tools.

IPA Subscriptions Services Director Dean Findley, in delivering keynote remarks, outlined some challenges and opportunities cost engineers face today, including field labor productivity uncertainties that can lead to increased costs.

Practices used on projects, such as ensuring delivery of quality engineering designs and vendor data, can reduce variation in labor productivity estimates. The preponderance of project teams that implement these work process Best Practices end up delivering projects that experience little or no cost growth, schedule slip, or operations issues, Findley said.

“Yet we still cut corners and skip steps.” Unrealistic cost

and schedule targets pushed by business executives may be to blame, he said.

So a real challenge is getting business executives to understand the cost engineering function's role in producing project data that really matters to them—especially cost performance and predictability information. The CEC metrics can be used to help cost engineers better engage with business representatives, Findley said.

**The Metrics.** In sessions led by IPA research analysts, CEC conference participants were briefed on the 2015 CEC metrics and how the metrics can be used for cost estimating. The metrics—plus all other data reviewed by the CEC—are derived from IPA's Project Evaluation System (PES®\*) that includes databases with detailed

*Continued on page 12*



\*PES is a registered trademark of IPA

## RESEARCH CORNER



## Quantifying the Unknown: Executing Projects in New Regions

### Meaningful 'First-to-Region' Project Information Can Be Uncovered



**By Alex Ogilvie,  
Deputy Director,  
IPA Project  
Research Division**

**A**mong the challenges our clients' business executives confront on a regular basis is evaluating risks inherent to highly visible capital projects. This is particularly true of regional project risks. What executives lack are detailed and unbiased data to assess the specific risks associated with executing projects in different parts of the world. When an owner company is looking to invest in a region for the first time, the difficulty is even greater.

An IPA study on first-to-region projects completed back in 2005 showed that this class of project took 20 percent longer to complete project definition and cost 20 percent more to design, build, and startup than projects with similar scopes built in regions familiar to the company. A business executive involved in a first-to-region project, who is more likely to have an operations, financial, or marketing background than years of experience developing projects, should not be expected to know everything that the project team must investigate. However, he or she should be expected to ensure their team is sufficiently experienced

and has access to meaningful information on regional labor performance, logistical challenges, and the political environment.

Even if the information were readily available, how does the owner's project team measure the effect of these factors on project performance? Is it possible for them to quantify the risks of doing something for which they have no direct relatable experience? For example, if a company were building a \$3 billion manufacturing plant in a country that currently has no such facility, how would it go about estimating the cost of such a thing? How much contingency should the executive expect the project team to include in its cost estimates? What are the things that are likely to go wrong, and how can those risks be mitigated?

One approach to trying to answer these questions is to identify and evaluate the leveraging factors of a "first-to-region" project—for example, its propensity for experiencing labor strikes. This entails examining similar regions and project characteristics that simulate the conditions of the proposed investment. This can be accomplished through the use of IPA's proprietary database containing detailed cost, schedule, and performance inputs from more than 17,000 completed and ongoing projects worldwide and combining these data with publicly available information.

Then, with the application of a number of statistical methodologies, IPA can produce an analysis of risks specific to executing a project in the given region. In this way, it is possible to estimate the potential effect of various regional factors on project outcomes, and highlight the areas of greatest risk and uncertainty.



IPA can also provide lessons learned specific to the risk factors inherent to the proposed investment. In fact, this approach can be used to aid executives in evaluating project risks even when no actual project data from a region exist. The robustness of IPA's projects database, plus its experience with projects with like characteristics executed in diverse regions, stands apart from other consultancies.

IPA's database represents the very best available "bench lab" for frontier projects that are breaking new ground in any country or region.

When anyone does something for the first time, there is no experience from which to test ideas. When we first

sent humans to the moon, we did a lot of research, testing, and analysis of data to support our efforts. We established working models from engineering theory, and applied it to do something that had never been done before. When we were successful, it was because we used and trusted the data and made appropriate decisions given the risks.

If your strategic capital investments are venturing into new areas, consider how you're going to evaluate the risks of those investments, challenge your perceptions with data, and make your decisions with eyes wide open

to the potential risks. In doing so, this will enable you to navigate the unknown and drive success where it is not yet proven.

**IPA's Project Research Division (PRD) examines the functioning of capital projects and project systems and applies the results to help our customers create and use capital assets more efficiently. For a complete listing of PRD's research initiatives, visit IPA's website at [www.ipaglobal.com/services/research](http://www.ipaglobal.com/services/research).**

## New Approaches to Measuring Engineering Practices

### *New Paper Examines Decline in Engineering Services Performance*

IPA recently completed a document addressing the declining performance of engineering services in capital project development.

Owners are increasingly concerned about this trend and welcome proactive leadership from contractors in finding solutions. Improvement will only be realized if it is measured. Therefore, a number of metrics are proposed to quantify engineering practices and their link to performance.

The new metric will be added to IPA's suite of project metrics and will likely change IPA's Front-End Loading (FEL) Index. The FEL Index is a widely used measure of project risk and is commonly used by owners as a leading indicator and criteria for project authorization.

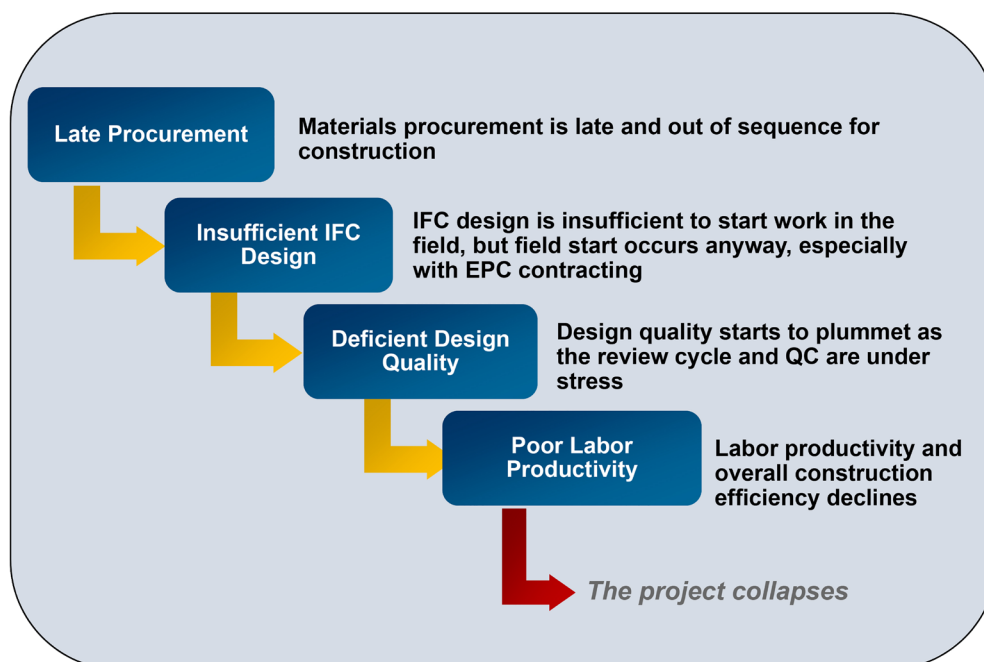
IPA is researching the flow of information throughout a

project, focusing on engineering work packages as they relate to the path of construction. Earlier IPA research has identified engineering slip as being a serious problem for projects, as illustrated below.

The Contractor Research Consortium (CRC) is actively involved in this research. CRC participants in this effort should gain a competitive edge in future capital project development as they will be more informed to implement the new approaches for measuring engineering practices. At the same time, participating owners will benefit through better projects.

**For more information regarding this document or to learn more about the CRC, please contact Dean Findley at [dfindley@ipaglobal.com](mailto:dfindley@ipaglobal.com).**

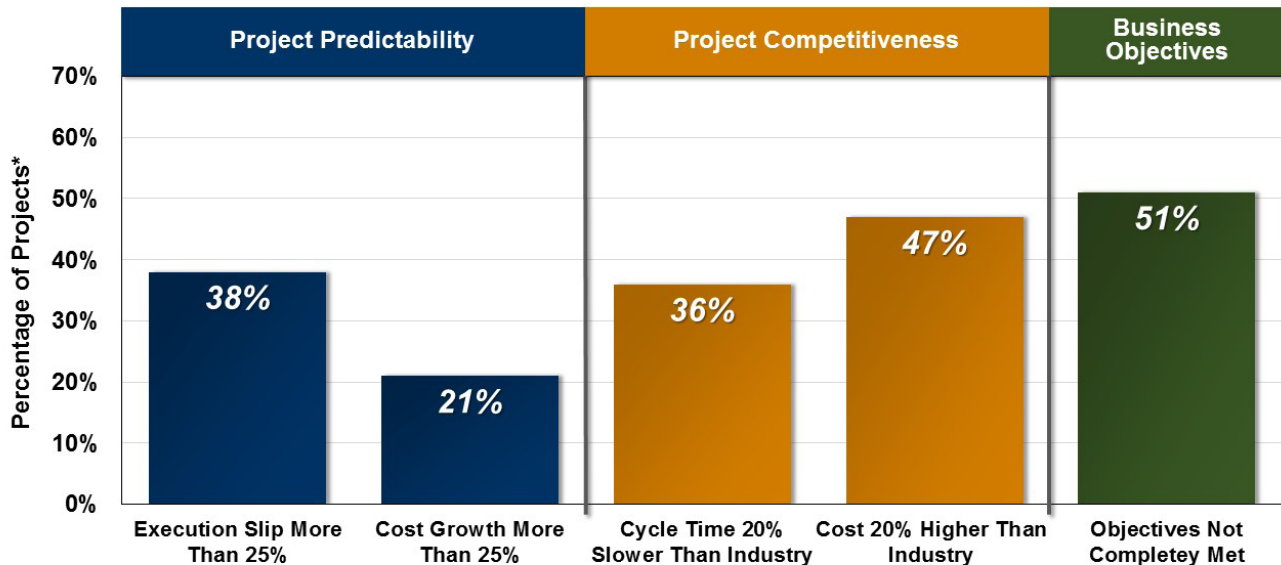
## When Engineering Slips



**Dire Consequences:** The diagram above explains what regularly happens when project engineering slips in schedule.

Continued from page 1

### Project Failures Remain Common



\*Globally completed projects authorized within the last 10 years and over US\$50 million

**Disappointing Outcomes:** One of every five projects were both 20 percent more expensive and slower than Industry, and half of projects did not meet the business objectives.

with project gate reviews, such as assessing the competitiveness of the project targets prior to the Front-End Loading (FEL) 2 gate or measuring execution risks prior to full funds authorization. However, IPA is also called in to evaluate projects in the middle of execution. Although these are sometimes readiness assessments, such as for Construction Readiness or Production Readiness, other times these IPA assessments are requested because a project is in trouble. IPA's Project Recovery Analysis has multiple facets:

- *Forensic evaluation to identify the root causes of the current situation*
- *Team Functionality Survey to assess the team's perception across critical project elements including leadership, team communication and alignment, and project development*
- *Benchmarking analysis to provide cost and schedule metrics: a "should" cost and schedule estimate (the industry average cost and duration for projects of similar characteristics)*
- *Projected cost and completion date (an estimate of the project's likely final outcomes)*
- *A set of actionable recommendations for the remainder of execution, based on the root cause*

*analysis and Team Functionality results, that can be applied to the project to improve its chances for better outcomes*

The forensic evaluation reviews the project history from the time the project team formed to the present to understand what led to the current situation. Using detailed discussions with key project team members (both owner and contractor) and project sponsors, we take a deep dive into the root causes of project events, looking for interdependencies or influences among project drivers, practices, and outcomes.

IPA's Team Functionality assessment quantifies project team members' perceptions about whether the team is working well together and if the foundation is in place to effectively execute the remainder of the project. Research indicates a strong correlation between team member perceptions and project outcomes. IPA highlights critical gaps at the project level and compares results across various groups, including owner versus contractor, manager versus non-manager, and so on.

Most are familiar with IPA's standard industry benchmarking using the PES® system; our primary approach for evaluating projects and assessing their performance is quantitative and statistical. We analyze patterns and trends associated with projects of similar scope facing similar challenges. Our primary evidence for assessing a project is the quantified history of similar

projects captured in multiple regression models. This information also allows us to identify projected project outcomes based on actual project histories.

Using these PES® tools, we are also able to estimate the cost to finish an “off the rails” project as well as its completion date. An IPA Recovery Analysis provides an organization with a clear picture of the projected results based on the status quo and the financial effects if changes on a troubled project are not implemented immediately. Proposed changes can include but are not limited to team and staffing recommendations, schedule modifications, risk management improvements, and identification of the critical path to optimal completion.

Although changing the trajectory of a troubled project

is inherently more difficult during execution, it is not impossible. An IPA Recovery Analysis provides a set of project-specific actions to both the project team and business sponsors to help the organization recover the project and improve its chances of success. More importantly, understanding the true root cause of a troubled project arms organizations with the knowledge necessary to avoid the same issues in the future.

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**To learn more about the IPA Recovery Analysis service, contact Jordan Sealock at [jsealock@ipaglobal.com](mailto:jsealock@ipaglobal.com). Visit IPA's website for additional information about IPA's services for commodity chemicals and specialty chemicals owner companies.**

## USGC Labor Market Study – Current State & Forecast

### *A Service Proving Current Demand, Wages, and Productivity – Direct from On-going Projects*

**T**he dramatic increase in oil and gas production in the United States has driven a significant build-out of infrastructure and capital assets to leverage advantaged feedstock across the country. Since 2012, more than \$200 billion of new capital investment has been announced for the United States, including several large-scale ethylene crackers, fertilizer plants, and LNG export terminals.

Most of the announced projects are onshore processing plants, including refineries, midstream, and chemical facilities in the U.S. Gulf Coast (USGC) region. It was widely anticipated that the projected demand for construction labor resources in the USGC would far outstrip the local supply, putting inflationary pressures on construction wages and driving productivity down. However, the significant decline in crude oil prices could drive major project delays and cancellations and, thus, ease some of the supply chain pressures.

Will there be a supply gap for construction labor in the USGC? If so, which craft and to what extent? How will wages respond? Will productivity change?

To answer these questions and others, IPA has created a new subscription service—*USGC Labor Market Study – Current State & Forecast*—to provide market intelligence to owner companies on construction labor demand and supply and the quantified effect of the market's response to construction labor wages and productivity in the USGC region. The source of information is the stream of project data that IPA gathers directly from owner project teams in face-to-face interviews. The result is a real-time picture of the status of construction labor in various locations in the USGC.

The bi-annual report, available to IPA clients, subject to the terms and conditions of the existing contract between IPA and the subscribing company, provides subscribers with trend data forecasted five years ahead for:

**Construction Labor Demand**—Aggregated projected demand for construction labor resources, provided by craft and major metropolitan area

**Construction Labor Supply**—Aggregated projected labor supply, also provided by craft

**Labor Wages & Productivity**—Current and forecasted labor all-in wages and productivity provided for region and by major metropolitan area

**Metropolitan Areas**—The service provides wage rate and productivity intelligence for Houston-Sugarland-Baytown, Beaumont-Port Arthur, Corpus Christi, New Orleans-Metairie-Kenner, and Gulfport-Biloxi-Pascagoula. The study can be customized to include more regions on request, pending data availability

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**For more information about this new IPA subscription service, please contact Elizabeth Sanborn, IPA Chief Operating Officer, at [esanborn@ipaglobal.com](mailto:esanborn@ipaglobal.com), or Aditya Munshi, Senior Project Analyst, at [amunshi@ipaglobal.com](mailto:amunshi@ipaglobal.com).**



**Finalists:** Project Inspire finalists pose with competition judges, Singapore Committee for UN Women President Trina Liang-Lin (second from right) and Co-Founding Partner MasterCard representative Georgette Tan (far right).  
 Photo Credit: Singapore Committee for UN Women

## IPA Singapore Partners with UN Women for Project Inspire

By Christos Lampris, IPA Asia-Pacific Research Lead

In IPA's world the very mention of the word "project" conjures up images of offshore platforms, refineries, chemical plants with long runs of pipe, heavy equipment, and hard hats. There is great complexity involved in developing and evaluating these projects. Project Inspire, sponsored by the Singapore Committee for UN Women, is not a typical IPA project, but it is certainly no less complex.

Created in July 2010 by the United Nations General Assembly, the UN Entity for Gender Equality and the Empowerment of Women—also known as UN Women—works to eliminate discrimination against women and girls, support empowerment of women, and “achieve equality between women and men as partners and beneficiaries of development, human rights, humanitarian action, and peace and security.”

Project Inspire was launched in 2011 and is co-organized by the Singapore Committee of UN Women and MasterCard. It is a social entrepreneurship competition offering entrepreneurs aged 18 to 35 a platform to pitch an idea for a project that can enable and empower women economically throughout Asia, the Pacific, the Middle East, and Africa. Simply put, participants get the opportunity to present their social ventures for a chance to win grants totaling US\$35,000 to implement them.

IPA's Singapore office became an active participant in UN Women's Project Inspire initiative in 2015. IPA had a role in reviewing more than 400 Project Inspire 2015 entries and helping UN Women select the semi-finalists.

IPA's knowledge of the pillars of successful projects guided the evaluation. Although social ventures are different from capital projects, they share common basic planning elements and drivers of success. IPA drew from elements from its capital Project Evaluation System (PES®) and applied them when evaluating Project Inspire submissions. For example, we assessed (among others) the clarity of project objectives, team formation,



**Best Pitch:** Women In Technology Uganda (WITU) Founder Barbara Birungi (center) earned the Project Inspire 2015 top prize for her pitch to create WITU Hub, a space where women from poor communities in Kampala, the capital of Uganda, can receive training in the areas of technology and entrepreneurship.  
 Photo Credit: Singapore Committee for UN Women



and the extent of implementation planning. This helped IPA identify social venture projects that show great promise in addressing women's empowerment challenges.

Our understanding of what drives successful projects, combined with UN Women's deep understanding of women's empowerment issues, enhanced the selection process. It helped identify social venture projects with strong potential for advancing the committee's mission.

We saw many fantastic ideas and were overwhelmed by the thoughtfulness and dedication of individuals to improving women's livelihoods. The semi-finalists, in particular, not only had great ideas but also provided strong execution plans demonstrating their ability to turn their ideas into successful ventures.

The Grand Final of the 2015 competition took place November 13, 2015. The winner of the grand prize of US\$25,000 was **Women in Technology Uganda (WITU)** with their WITU HUB Project. The project's mission is "to support local women's capacity building and skills development for technology and entrepreneurship by offering a collaborative environment for training,

mentorship, and knowledge sharing."

The runner-up and winner of the US\$10,000 grant was **Emerge Lanka Foundation** with their Beads2Business Project. The project "supports Sri Lankan girls who have been removed from their homes due to abuse ... by providing them financial literacy and business development curriculum through jewelry design and creation."

In addition, **Dare Women's Foundation in Tanzania** received the People's Choice Award for their Tanzanian Women: A Source of their Own Empowerment Project. They raised the greatest amount of funds (over US\$5,000) during the crowdfunding campaign initiated from the semi-final stage.

IPA supports the mission of the Singapore Committee for UN Women to improve the livelihood of girls and women. Project Inspire 2015 was an opportunity for IPA to work closely with UN Women and have an active role in promoting and contributing to its cause. Our recent collaboration with Project Inspire 2015 was a great start to this new partnership. The IPA Singapore office looks forward to contributing to this and other future community outreach initiatives.

***"Our work with IPA Singapore aimed to increase our efficiency at screening submitted projects' quality for Project Inspire, a global social entrepreneurship competition run by Singapore Committee for UN Women and MasterCard. [The IPA team] had come and delivered. We were impressed by the team's expertise in project analysis throughout the process, which has greatly increased our competence in selecting quality projects. Their involvement will not only impact this year's program but also the years after."***

— Singapore Committee for UN Women statement on IPA's role in supporting Project Inspire

## IPA's 2015 Global Community Service Program

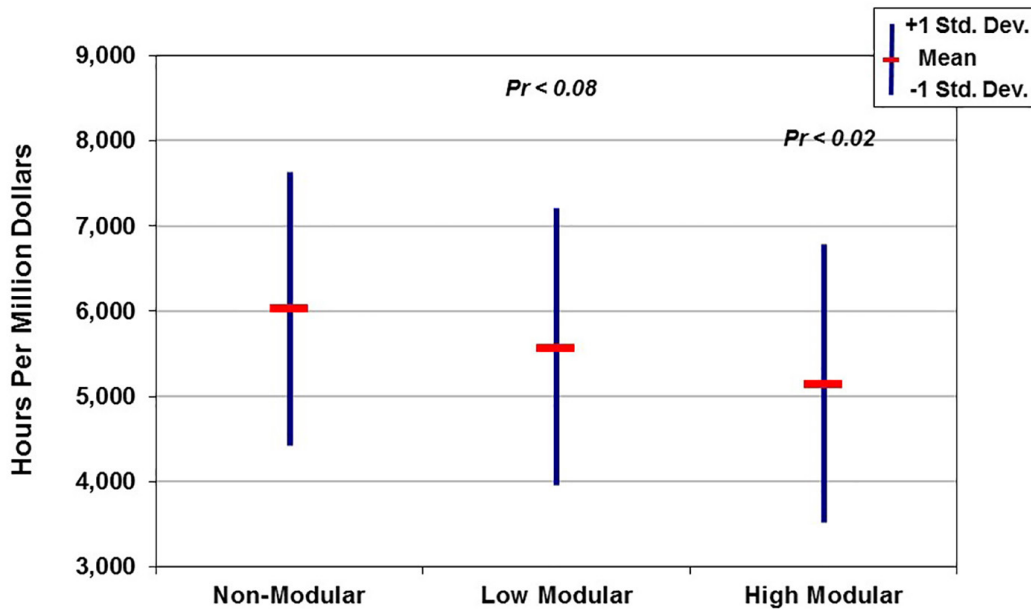
One of IPA's main Principles of Operation is social and ethical responsibility to our customers and our community. IPA staff around the world recognize the importance of giving to our communities, especially helping those who are less fortunate.

In 2015, IPA employees teamed together to support more than 20 charities, including:

- Samaritan Ministry of Greater Washington
- Toys for Tots
- Loudoun Interfaith Relief
- Share Our Strength's No Hungry Kid Campaign
- Make Some Noise (UK Charity Group)
- American Cancer Society
- Nursing Home Lar Adelaide Scarpa in Curitiba, Brazil
- American Red Cross
- Northern Virginia Family Services
- Habitat for Humanity
- Save the Children Charity



### Field Hours Per Project Cost More Modular Requires Fewer Field Hours



Controlled for project size, Normalized to U.S. Gulf Coast

**Figure 1**, above, shows reduced hours per million dollars for projects classified as being highly modular. However, this does not necessarily translate into faster schedule or lower cost. (This figure has been updated from an earlier .PDF version of this newsletter.)

*Continued from page 1*

dangers associated with executing expansion and upgrade projects at an operating plant can be by and large remedied when a large percentage of fabrication work is performed off site. Also, construction can begin as scheduled if work or environmental permits required at the project site are delayed. For these reasons and others, it is not surprising to find that, in recent years, modular construction designs have been on the rise. In 2014, 57 percent of projects over US\$15 million used a modular approach on some scope. But, despite the potential benefits of modular construction, IPA research shows that modular construction is not necessarily more efficient in terms of cost or schedule.

IPA conducted a study examining approximately 800 projects that used modular construction. For the study, modular construction includes modules, skids, and pre-assembled units designed and fabricated as separate components that could have reasonably been constructed in a non-modular fashion, if desired. The performance of the modular projects was then compared with the performance of more traditional stick-built approaches, in which most construction happens at the project site.

Perhaps unsurprisingly, nearly half of the modular projects' project teams said they chose the modular approach as a means of improving labor productivity

by moving construction to a shop (49 percent). Project teams also cited the ability to duplicate multiple installations of similar design at the fabrication yard as a means of cost containment (32 percent). Other reasons they gave included alleviating local labor availability issues (29 percent) and overcoming congested site conditions (29 percent). Several project teams also cited improved worker safety as a reason for choosing a modular approach. However, IPA determined that the challenges, risks, and added costs of modularization are not always recognized.

The study found that using modular construction versus a stick-built approach may not achieve the objectives of improved cost, schedule, and/or safety. As expected, modular construction lowers construction hours in the field, which may be beneficial to projects where site congestion or labor availability is an issue. **Figure 1** shows reduced hours per million dollars for projects classified as being modular. However, as shown in **Figure 2** and **Figure 3**, the average execution duration and cost effectiveness of modular projects is not better than stick-built projects. Moreover, the variance in these outcomes is very large.

To identify what practices drive the variance in outcomes for modular projects, IPA identified a group of projects with the Best performance. The best modular

projects were selected based on their cost and schedule predictability, -5 percent to +10 percent cost deviation and a ±10 percent schedule deviation.

**Project Execution Planning Is Key.**

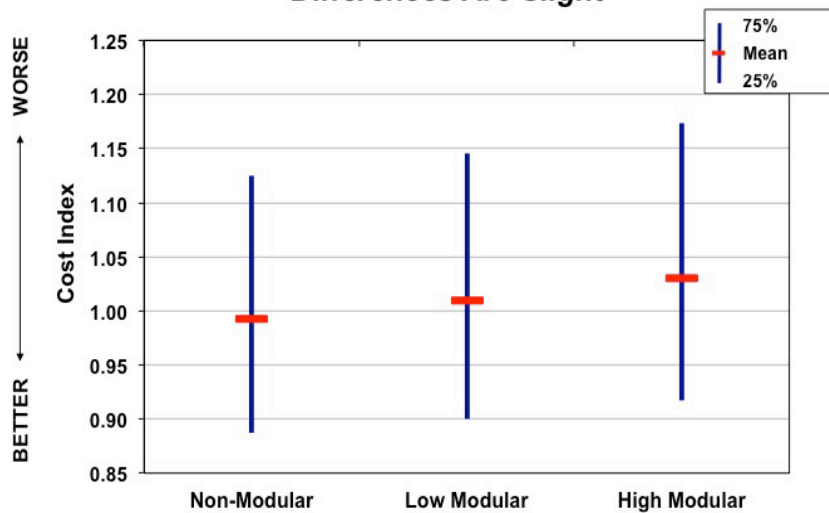
As noted, the average performance outcomes (cost, schedule, and safety) for modular construction projects are essentially the same as when using a non-modular approach. In studying the variance in performance, an important finding is that, to be successful, modular projects require significantly better project practices, particularly with respect to Project Execution Planning. The decision whether or not to employ modular construction and the extent to which modules will be used must be made very early in front-end development, before front-end engineering design (FEED). The Best projects chose the modular strategy when engineering was less than 7 percent complete and had consistently better measures of Front-End Loading (FEL) at authorization. The Best projects also used Constructability Reviews more often and implemented better project controls.

In addition, a strict controls plan is necessary on modular projects to control the activities in the fabrication yard. For instance, with a control plan in place, if a module experiences changes during production, work forces may be pulled from production and shifted to other projects that could have a significant effect on the module's delivery schedule. The best performing modular projects had considerably better control plans and practices.

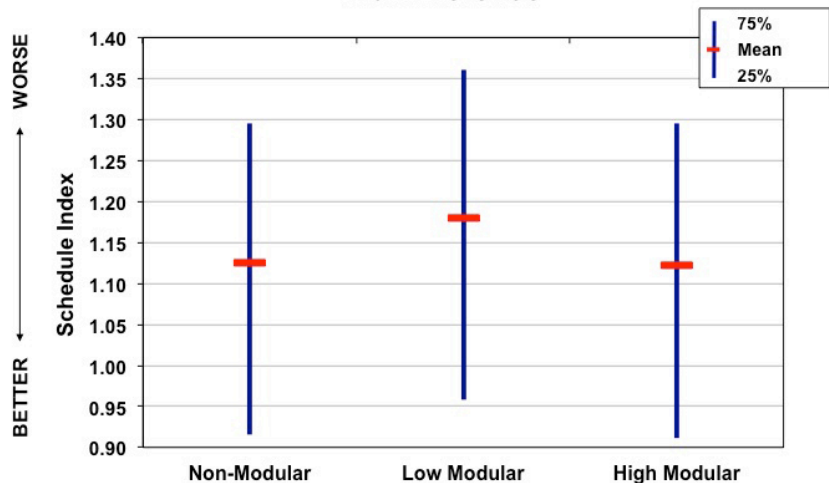
**Further Modular Versus Stick-built Research.**

IPA is considering research to quantify trade-offs between modular and stick-build construction strategies by identifying characteristics of modular projects that drive the risks associated with them. We will also identify Best Practices that effectively eliminate or minimize these risks. Study participants will benefit from a decision-making process for when and to what extent they should use modular construction. Participants will also better understand the risks they take on with modularization and become familiar with Best Practices to ensure effective delivery of their modular projects.

**Cost Competitiveness**  
*Differences Are Slight*



**Schedule Competitiveness**  
*No Difference*



Figures 2 & 3, above, illustrate minimal cost and schedule competitiveness differences between modular and non-modular projects.

**FIND OUT MORE**

If you would like more information about the refining sector performance and Best Practices for modularization study or have interest in participating in future research, please contact Andras Marton, Business Area Manager, IPA Hydrocarbon Processing & Transportation (HPT), at [amarton@ipaglobal.com](mailto:amarton@ipaglobal.com). Visit IPA's website for more information about IPA's project evaluation services for HPT industry owner companies.

Continued from page 3

cost information on more than 17,000 downstream projects worldwide.

The CEC metrics' purpose is to support conceptual estimate development and detailed estimate validation and review. The CEC includes more than 3,000 different cost and schedule metrics derived from actual projects, and these data can be used throughout the project development cycle, from early equipment factored estimates to bottoms-up deterministic estimates.

**Summary cost metrics**, for instance, allow cost engineers to develop cost estimates quickly based on cost ratios developed using IPA's Summary Cost Categories. **Detailed, unit quantity metrics**, which CEC member companies also received at the conference, let cost engineers drill into the detailed metrics to develop more granular cost estimates. Such estimates are useful for quantity-based trade and discipline account evaluations.

"Ultimately, the goal is for owners to use the metrics to improve the cost effectiveness and competitiveness of their capital projects. By knowing a project's competitive position relative to its peers, owners can push back on conservative targets," Wallace said.

In addition, **location cost metrics** are included with the CEC metrics, giving owners the ability to compare the cost of delivering projects in different world regions. The dataset uses the quantity-based metrics through a "bottoms-up" approach to identify regional cost trends.

**Metrics Tools.** CEC member companies receive the raw metrics, but IPA has also developed tools to help them quickly screen the metrics and highlight gaps in generating estimates for their projects.

The **Summary Cost Metric Tool** allows cost engineers to easily select summary metric sets (e.g., ratio to total) and subcategories (e.g., project size and location) to determine general project cost estimate figures. The **Detailed Cost Metric Tool** is able to highlight the differences between the cost and schedule metrics for a particular project against corresponding CEC cost and schedule metrics.

New at this year's CEC conference was the distribution of tables illustrating cost factors for five metrics designated as Key Performance Indicators (KPIs) for project cost performance: 1) project management cost/direct cost, 2) detailed engineering cost/bulk materials cost, 3) construction labor cost/bulk materials cost, 4) piping labor hours/feet of pipe, and 5) structural steel labor hours/tons of steel. IPA then broke out a subset of the KPI metrics for "Best Projects"—projects with cost performance 10 percent better than industry average.

"The industry average is always skewed toward negative outcomes," Wallace said, explaining how the chances of something going wrong is normally higher than the project being executed smoothly. The intent of

providing the five KPI metrics for the Best Projects is to show cost engineers a new set of metrics that drive results in better than industry average cost results.

**New Cost Research.** IPA research analysts unveiled several new project cost studies at the conference. The research presentations covered the following topics:

**Accurate Estimates at FEL 2: Is It Luck or Is There a Better Way to Estimate?**—Observing that projects are developing more accurate estimates by the end of concept selection, IPA examined current estimate development practices use.

**Accurate Estimates for Indirect Costs**—To help shed light on both the estimating practices and the norms for indirect costs, this study focused on the common components that comprise indirect costs. The study looked at estimating methodologies and their accuracy and found that more detailed data and methodologies yield better and more competitive estimates.

**Drivers of Construction Labor Productivity**—Areas such as engineering quality, vendor information timeliness, construction management quality, and site management were all linked to productivity performance and, in many cases, were the main contributors to the project's performance.

**What Do the Best Change Management Processes Look Like?**—Using IPA's projects database and the findings of a survey on change management, this CEC study dissects Industry's change management processes to uncover the mechanics of a thorough change management system.

Breakout sessions and workshops held during the 3-day CEC conference gave attendees opportunities to share knowledge on estimate reconciliation, validation, and change management processes. Several networking opportunities were also held.

The CEC is a subcommittee of the Industry Benchmarking Consortium (IBC), a voluntary association of owner firms facilitated by IPA. The owner companies belonging to the CEC and IBC sponsor many of the world's largest downstream projects.

Oil and gas and other extraction industry companies are members of IPA's Upstream IBC (UIBC) and its subcommittee, the Upstream CEC (UCEC).

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**For more information about the CEC, contact Luke Wallace at [lwallace@ipaglobal.com](mailto:lwallace@ipaglobal.com).**



THE IPA INSTITUTE  
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## Public Course Schedule

*The IPA Institute, a division of Independent Project Analysis (IPA), develops and delivers educational seminars to further IPA's mission to improve capital effectiveness. IPA Institute courses are derived from IPA's extensive research and quantitative analysis of capital projects, linking statistically proven Best Practices to business value. To view full course descriptions, pricing, up-to-date registration details, and special discounts, please visit our website at [www.IPAInstitute.com](http://www.IPAInstitute.com).*

### **Best Practices for Small Projects (22 PDUs)**

February 23-25, 2016: Las Vegas, Nevada

April 5-7, 2016: São Paulo, Brazil

April 12-12, 2016: Sydney, Australia

### **Megaprojects - Concepts, Strategies, and Practices for Success (22 PDUs)**

April 4-6, 2016: New Orleans, Louisiana

### **Project Management Best Practices (22 PDUs)**

March 22-23, 2016: Austin, Texas

April 19-21, 2016: Santiago, Chile

### **Establishing Effective Capital Cost and Schedule Processes (16 PDUs)**

March 22-23, 2016: Houston, Texas

March 29-30, 2016: Dubai, United Arab Emirates

### **On-Demand Webinars**

- **Coping With Resource Limitations on Capital Projects**
- **An Agenda for the Lull: Coping Successfully in Volatile Times**
- **Gatekeeping: The Role and Limitations of Project Assurance**
- **Project Controls Best Practices**
- **Site Improvement: Identifying the Pathway to Success**

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### **In-House Solutions**

Whether you are looking for a Tailored or Off-the-Shelf seminar, IPA Institute in-house training solutions provide a company-focused, cost-effective vehicle to educate large groups within an organization or project team. Improve your company's existing internal training program(s) by incorporating the IPA Institute's extensive experience in capital project research, training, and instructional design.

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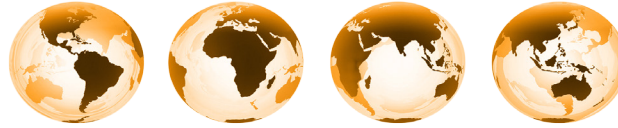
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## Upcoming IPA Events & Presentations



**January 20-21**

### **Pharma Project Portfolio Management Toolbox Conference**

*IPA Chemicals, Life Sciences, and Nutrition Business Area Manager Jordan Sealock will deliver a presentation titled "Herding Cats: Improving Project Performance Through Stage Gates", at the Pharma PPM Toolbox conference in New York City.*

*Sealock's presentation will address the importance of a stage-gated project delivery system, effective gatekeeping strategies, and use of a stage-gated system for successful project portfolio management.*

*Visit <http://www.ebcg.com/event/pharma-ppm-toolbox/> for more information about the event.*

**January 18-19**

### **SPE Forum Series: Next Generation of Smart Reservoir Management**

*IPA E&P Deputy Director Nekkhlil Mishra will speak at an SPE International Forum Series event, Next Generation of Smart Reservoir Management: The Eminent Role of Big Data Analytics, in Dubai, UAE.*

*Mishra's presentation—"Destruction of Value"—will show the typical result on projects, from concept to startup, with regard to the reserves estimates; touch on the core reasons for constant estimate misses; and explore the theory that the timing of data is as key as the data itself.*

*For more information about the event, visit <http://www.spe.org/events/15fme1/>.*

**March 14-17**

### **Industry Benchmarking Consortium 2016 Conference**

*The annual meeting of the Industry Benchmarking Consortium (IBC) provides an independent forum for each participating company to view its performance against other companies' performance. The consortium meeting held in Leesburg, Virginia, highlights Best Practices used and reinforces their use to improve capital effectiveness. During the consortium meetings, attendees learn ways to improve specific elements of capital project execution through presentations and face-to-face discussions.*

*For more information, contact Jennifer Nicolaisen at [jnicolaisen@ipaglobal.com](mailto:jnicolaisen@ipaglobal.com).*

**June 22-23**

### **UCEC 2016 Annual Meeting**

*The Upstream Cost Engineering Committee (UCEC) is an approved subcommittee of the Upstream Industry Benchmarking Consortium (UIBC). The UCEC's purpose is to improve upstream project and business results by providing metrics for better cost engineering. The UCEC metrics provide asset evaluation and concept development professionals with a better understanding of costs and schedules.*

*For more information, contact Jonathan Walker at [jwalker@ipaglobal.com](mailto:jwalker@ipaglobal.com).*



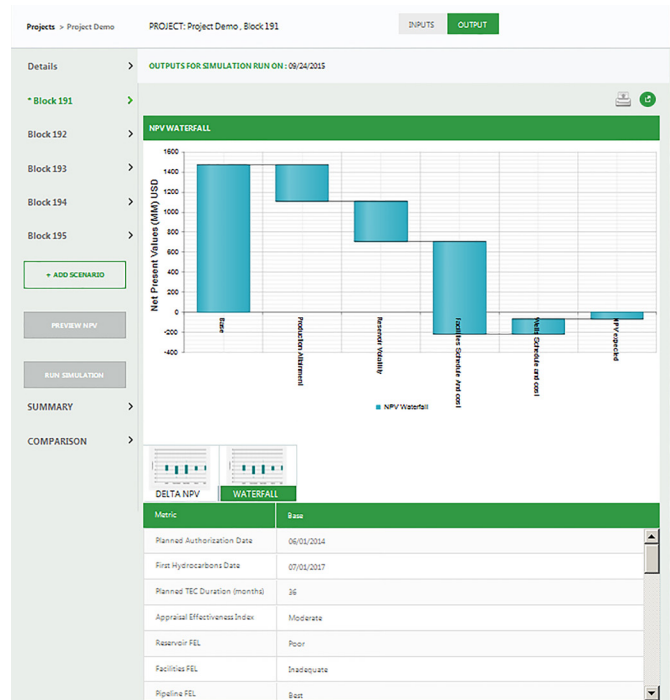
# IPALaunches Online Oil & Gas Asset Economics Simulator Software

IPA's online Oil & Gas Asset Economics Simulator (AES) software is now available to license. Its arrival comes at a critical time for owner companies who have seen their capital expenditures slashed for the foreseeable future as oil prices remain much lower than they have been over the last several years.

AES promotes a more holistic view of total asset performance by consolidating IPA's research on E&P asset successes and failures into the delta net present value (NPV) outcome, an objective capstone measure of asset performance.

Although Monte Carlo simulation is a popular technique for estimating likely E&P asset outcomes, its insights are only as useful as the assumptions that are fed into it. These assumptions, which boil down to probability distributions around key input variables, tend to be too optimistic both in terms of the average and range of possibilities around this average.

What distinguishes the AES is the quality of its underlying inputs, which are based on IPA's extensive database of E&P developments and more than two decades of empirical research linking project practices and outcomes. The software can be used by E&P project professionals to eliminate bias from company estimates and assess the true effect project practices are likely to have on NPV.



**Eliminate Estimate Bias:** A screen shot from an AES software demonstration.

**FIND OUT MORE**

For additional information and to schedule an E&P AES software demonstration, please contact René Klerian-Ramírez, AES Product Manager, at [rklerian@ipaglobal.com](mailto:rklerian@ipaglobal.com).

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IPA improves the competitiveness of our customers through enabling more effective use of capital in their businesses. It is our mission and unique competence to conduct research into the functioning of capital projects and project systems and to apply the results of that research to help our customers create and use capital assets more efficiently.



The IPA Institute's mission is aligned with the overall IPA mission to improve the capital productivity of its clients. The programs offered provide a forum for in-depth understanding of key elements of the capital project process and how to apply these learnings to effect positive changes and improvements, resulting in the more effective use of capital.



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