

Independent Project Analysis, Inc. is the preeminent organization for quantitative analysis of capital project effectiveness worldwide. At IPA, we identify Best Practices to drive successful project outcomes.

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VOLUME 9, ISSUE 3

SEPTEMBER 2017

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The Value in Properly Staffing Chemicals Capital Project Teams

By Natalia Zwart, IPA Manager, Chemicals, Life Sciences, and Nutrition

As most other industrial sectors endure sluggish growth in 2017, the commodity chemical industry continues to experience a revival in project activity. The sustained pace of commodity chemicals industry project activity, especially in the United States, can be attributed to technological advances that have allowed access to new sources of low-cost industrial feedstock. Many owner chemical companies have authorized large capital investments—some the largest in their company’s history—to take advantage of market opportunities in the United States and across Europe.

While opportunities and capital investments are on the rise, chemical company project organizations are moving in the opposite direction. IPA recently surveyed about 30 leading chemical and petrochemical companies on their project organization and teams staffing levels, including surveys on organizational design and capabilities and project team staffing levels. The surveys found owner companies have been

downsizing their project organizations for more than a decade. Chemical companies have largely backed off hiring for project organization positions in the last few years. Only about 10 percent reported project organization staffing increases. Notably,

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IPA's Ed Mellow to Present at Oil & Money 2017 Conference in London

At Oil & Money 2017, a high-profile global energy conference co-hosted by *The New York Times* and *Energy Intelligence*, IPA Founder and President Ed Mellow will speak at an Executive Forum about the oil industry's struggles with project execution and whether recent capital project cost savings can be sustained. Mellow will speak at the conference on October 18.

A Message From IPA

Our hearts go out to all—including our many friends, clients, and their families—who have been affected by Hurricane Harvey and widespread flooding in Houston, Texas, and the surrounding area.

Please consider donating to the American Red Cross or another charity to help the victims of the disaster.

Visit IPA's website at: <http://www.ipaglobal.com>



IPA and Newmont Host Mining Project Benchmarking Forum in Toronto

Independent Project Analysis (IPA), Inc., is hosting a leadership forum on the current and future state of capital projects in the mining industry on September 14-15, 2017, in Toronto, Canada. The 2-day Mining Project Benchmarking Forum, co-hosted by Newmont Mining Corporation, will be attended by senior business and project leaders representing more than a dozen mining industry companies. This is the first time IPA has held a leadership forum exclusively for mining industry leaders.

Following the latest downturn in project activity across the global mining sector, mining companies are looking to achieve higher returns on capital invested as project activity regains momentum thanks to improving commodity prices. This event is designed to offer a select group of mining industry executives the opportunity to share ideas about common ways to improve the effectiveness of capital projects in the mining industry through benchmarking Key Performance Indicators (KPIs) and evaluating project system efficiency and execution practices.

“Participants at the event will review data, metrics, and research opportunities that can be used and expanded upon to promote continuous improvement of mining capital projects and operations,” IPA Mining, Minerals, and Metals Business Area Manager Baqun Ding said. “IPA appreciates Newmont for being a strong promoter of this event. IPA looks forward to working closely with our partners in the mining industry to play our part in industry performance improvement.”

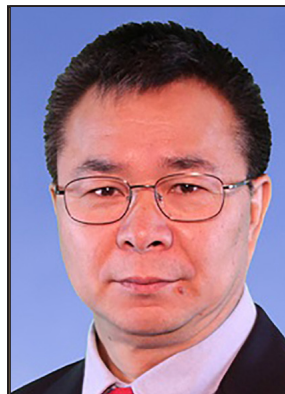
During the first day of the forum, participants will be presented with an overview of how mining projects have performed in recent years. Participants will then review project development practices and challenges common to the industry, including risk profiles, remoteness, project governance, sustainability, and resource/reserve replacement, as well as any barriers to their own capabilities,

to better understand how their company performs.

Also on the first day, IPA will share its data and project evaluation and benchmarking methodology. The group will review common KPIs—such as cost predictability, cost effectiveness, schedule, operability, reserve volatility, operating costs, sustainability, and staffing—and discuss the pros and cons of different measurement approaches.

On the second day, participants will gain insights into benchmarks for sustaining capital allocation and operations performance, such as operating costs and production attainability, and discuss the practices and factors that drive efficiency of sustaining capital use and operating costs.

This is a closed-door event. However, if you are interested in this topic, please contact IPA for more information regarding the challenges facing owner mining companies today and what steps they should take to ensure that corporate shareholders get the most value from their investments in both large projects and in smaller sustaining capital projects.



Baqun Ding, Ph. D., serves as Manager of IPA's Mining, Minerals, and Metals (MMM) Business Area. Since joining IPA in January 2006, Dr. Ding has been involved in the analysis of mineral, exploration & production (E&P), refinery, chemicals, and pipeline projects of different sizes for major international companies. Prior to his current role, Dr. Ding was a member of IPA's Review Board, which reviews all IPA deliverables. In recent years, he has been focused on the evaluation of megaprojects in various industries. He can be reached at bding@ipaglobal.com.

E&P Owner Companies Gather to Examine Drivers of Capital Project Competitiveness



UPSTREAM INDUSTRY BENCHMARKING CONSORTIUM

2017

The Upstream Industry Benchmarking Consortium (UIBC) will gather for its annual meeting November 13-15, 2017, at the Lansdowne Resort in Leesburg, Virginia. A chartered, voluntary association of owner firms in the petroleum, exploration, and production industry, the UIBC supports the continuous improvement of E&P asset development systems.

IPA aids the UIBC in its pursuit of asset development and execution improvements by measuring and comparing performance outcomes, conducting research into asset development practices, and identifying practices that drive the delivery of successful projects. In addition to working toward the UIBC's stated goal of improving the effectiveness and health of owner project system competencies, UIBC members are committed to developing a unified theory of the asset development process by being thought leaders for the oil and gas industry.

Four new IPA-led research studies will be presented at UIBC 2017. A summary for each of the four studies follows.

Lean Scoping, Phase 2: Building on research presented a year ago at UIBC 2016 that focused on costs associated with delivering topsides, this study looks at whether E&P companies have made progress at achieving lean scopes for more asset types in a portfolio. The study also examines how companies can maximize asset value while keeping costs low and what design metrics might improve lean scoping decision making.

Site-Based Portfolio Effectiveness Metrics: Site and sustaining capital projects are taking up an increasing portion of overall capital spend. This study provides owners insights into the effectiveness of projects at initiation, the extent to which portfolio leaders can control projects during execution, and the effectiveness of continuous improvement efforts at the portfolio level.

E&P Pre-Authorization Investments: The oil price downturn has caused E&P companies to rethink which opportunities they should develop and what information they need to make investment decisions. Some are now reaching all the way back to field

discovery and concept selection phases to identify factors that can predict the overall value of an opportunity. This study aims to answer UIBC member companies' questions about whether reservoir size and quality are correlated with appraisal spending and what needs to be done to kill uneconomic opportunities before FEL 2.

Long-Term Reservoir Performance: This study leverages IPA and publicly available reservoir performance data to answer questions including:

- How are reservoirs performing across the first 25 percent to 50 percent of the field life?
- What is the relationship between reservoir understanding and this long-term performance?
- When do companies end up spending more capital to prop up reservoir performance?

Contact (U)IBC Director Andrew Griffith at agriffith@ipaglobal.com to learn more about UIBC 2017 research.

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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.

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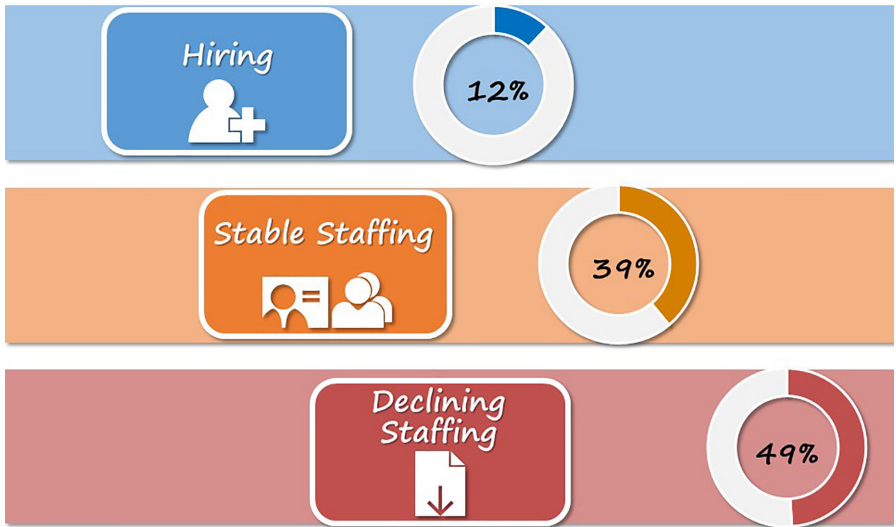
about half of survey respondents said that in-house engineering resources were reduced. However, despite signs that project organizations are stretched too thin, many businesses believe their organizations remain too bureaucratic for today's dynamic business environment. They are led to believe that outsourcing project functions might result in the staffing "agility" they want to execute their entire project portfolio. To the contrary, IPA's research findings are unequivocal: **owner engineering supports better project outcomes.**

In-house engineering capabilities enable teams to deliver more effective projects. In fact, IPA data show robust owner teams drive lower capital costs and more predictable cost performance; the cost avoidance more than compensates for the cost of the owner staff. That is because owners are more productive, are better trained and experienced in the work process, and ultimately, have a larger stake in the project's success.

From IPA's perspective, it is unfortunate that so few chemical companies have maintained adequate resources to complete detailed engineering in-house. Companies that have maintained the capability to at least complete FEL in-house deliver better results relative to those who rely on contractors to complete both front-end and detailed engineering work.

Demographic trends further complicate matters. IPA data show chemicals companies are struggling to staff project organizations with experienced talent. Experience levels for engineering leads, construction managers, and project managers for chemicals have declined significantly over the last decade. Unfortunately, the pool of available qualified resources will likely get even smaller over the next few years. About three-quarters of chemical companies surveyed by IPA fear a further squeeze in the availability of experienced talent to work on chemical projects.

There Has Been Little Hiring in Commodity Chemicals Industry Over the Past 3 Years



Percentages reflect the frequency for organizations in industry

Integrated Project Teams Are Imperative. With chemical companies executing more challenging projects, deficient project organizations are causing more acute project performance pains. A number of past IPA studies have identified the importance of functionally integrated project teams, where the organization assigns personnel to fill critical project functions, including the project manager, lead engineer, and construction manager. Unfortunately, chemical projects today are much less likely to have a functionally integrated project team in place by the time a project is authorized.

IPA research has shown that poorly functioning teams have trouble delivering projects on schedule and, on average, deliver projects at 30 percent higher costs. This cost growth and schedule slip can be attributed to how a lack of functional integration undermines the core foundation of project teams since input and perspectives from key elements of the team are missing. The quality and effectiveness of project management is weakened also.

Toughest Functions to Resource.

So what are the toughest functions for chemical companies to bring on board? IPA's survey shows that estimating, project management, and construction management are currently the three most difficult functions to staff.

Any owner representation in these functions is critical to project success, so let's consider the importance of these three functions in particular.

Owner Estimating: The owner estimating function is critical to assess the bids provided by contractors, thereby providing early input in project development and business support. Owners should not take contractor bids for granted if project cost competitiveness is a factor of a project's success.

IPA data show that contractor-developed estimates typically overestimate project cost by 4 percent. Notably, the overestimating is typically found in bulk materials quantities. Meanwhile, over-estimation in chemical projects authorized in the last 5 years is more pronounced; costs are, on average, overestimated by approximately 11 percent.

Project Management: Project managers have significant influence throughout a project's life cycle. The IPA survey showed that chemical companies take leadership style and personality traits into account only about 10 percent of the time when assigning project managers to projects. Staffing decisions are largely based on past project performance (both small and large projects) and resource availability. Given the demographic trends, it is difficult to find project managers with high levels of experience. But organizations can strategically evaluate in-house talent.

An IPA study completed in 2016 on project management competencies found that matching leadership style and personality traits with key project characteristics is critical to project success. Different project types open themselves to different project manager profiles. For example, the study found that the ideal personality profile for an effective project manager for large projects looks quite different from the effective profile for small projects, specifically in the area of leadership and management styles. This suggests that to effectively transfer a project manager from small projects to large projects, his/her leadership style must evolve accordingly. Simply having a successful small projects project manager "graduate" to serve as the

project manager for larger, more complex projects carries a good deal of risk. In other words, success in smaller projects does not necessarily predict success in complex projects if the individual's personality attributes are not suited for the complex project.

Construction Managers: Project teams continue to struggle with getting timely construction input during project definition. A project requires early input from construction management to ensure constructability is appropriately considered from both a safety standpoint and a design approach. Construction managers should be a member of the core project team starting in the Scoping phase (FEL 2). However, IPA survey results show that construction managers are currently assigned to projects in FEL 2 on less than 40 percent of projects; during FEED, the number increases somewhat to slightly over 50 percent.

For projects that do have the input, it is most likely to come not from a dedicated construction manager but from other team members with construction manager experience or contractors. As owners shift to bring this function back in-house, IPA's competency study findings reflect the need for owners to improve hiring, selection, and development processes to identify the construction managers most capable of helping projects succeed.

Path Forward. The chemicals industry shows no signs of slowing down. A wave of chemical investment has already been announced, and several large projects and megaprojects are in various planning phases. Commodity chemicals businesses need low-cost projects with excellent operability to be successful. Adequate functional representation is key to achieving these goals. The reality is that owner companies and contractors are facing resource shortages today and are likely to continue losing experience to retirement as current projects are completed. However, less than half of chemical companies have developed strategies to deal with resource shortages.

Chemical companies cannot avoid the problem any longer and must take a closer look at the organizational capabilities required to maintain capital excellence. Holding on to in-house resources is a winning strategy. At a minimum, chemical companies should focus on better understanding how their key function profiles allow for better pairing of people and projects. All told, proper talent management and training is even more important in a resource-limited environment.

For more information, contact IPA Chemicals, Life Sciences & Nutrition Business Section Manager Natalia Zwart at nzwart@ipaglobal.com.



2017 Public Course Schedule

Project Management Best Practices (16 PDUs)

September 26-27 Houston, Texas

October 10-11: Paris, France

October 10-11: Bangkok, Thailand

October 10-11: Perth, Australia

November 28-29: São Paulo, Brazil

Best Practices for Site-Based Projects (16 PDUs)

September 19-20: The Hague, Netherlands

October 10-11: Perth, Australia

October 17-18: Orlando, Florida

November 7-8: Kuala Lumpur, Malaysia

Visit www.ipaglobal.com/public-courses for additional information about these courses. The IPA Institute is a PMI® Registered Education Provider

Improving Project Controls Competency: 3 Common Barriers Organizations Need to Overcome

By Isabel Bignon, IPA Research Analyst

The capital projects Industry is stuck in a rut in terms of design and project controls use. Owner companies appear to recognize the importance of project controls, as planning for their use during the development of capital projects has increased some over the last few years. Unfortunately, owners are making no progress implementing project controls practices or strengthening their project team project control competency, thereby risking significant project execution cost growth and schedule slip. Research based on IPA's proprietary capital projects database and its Project Controls Index (PCI) measuring owners' planned and actual project controls practices sheds light on the industry's struggles with improving project controls design and implementation (Figure 1).

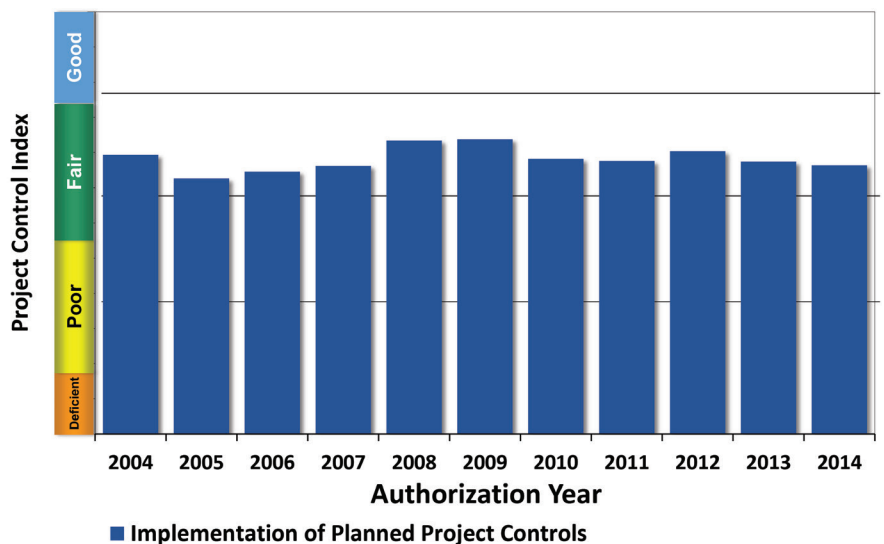
IPA's PCI classifies both the planned and actual use of project controls as *Deficient*, *Poor*, *Fair*, or *Good* based on project management practices that have a statistically significant relationship with project outcomes. On average, project controls in Industry have remained *Fair* for over a decade. This means project controls are not being designed to their full potential for their purpose in improving execution management. When projects do not follow through with their plans during execution, IPA research has determined that owners can expect their project to experience as much as 10 percent cost growth and 10 percent schedule slip from authorization.

IPA set out to find out why owners are having such a difficult time improving their project control practices, given that previous IPA research has proven that project control competency is a capital effectiveness driver. In a study that included surveying more than 100 project control specialists representing dozens of owner companies in several industry sectors, IPA was able to identify three barriers that thwart project controls design and use.

Barrier 1—Under-Resourced or Non-Existent Project Controls Organizations: More than half of project control specialists surveyed said the project controls organization they belong

to is inadequately resourced. A fifth of the respondents said they did not even belong to a structured project controls organization. Past IPA research has shown that project controls systems are less likely to be ready before execution and more likely to experience excessive influence from project managers during execution when there is no project controls organization in place or if the organization does not have the wherewithal to stand against management pushback. Project control specialists also cited insufficient independence and autonomy, understaffing, and lack of controls integration with project teams as resourcing gaps.

Barrier 2—Insufficient Project Controls Contract Requirements: Contracts are the legal documents where, among other things, project controls requirements need to be specified. When contract language pertaining to project control requirements is deficient, project controls run the risk of not being set up correctly. Of the project control specialists surveyed, 21 percent said contract clauses specific to project controls were vague and another 21 percent said they were unfamiliar with project controls details in contracts. Among the problems cited by project control specialists



Projects >\$10 million

Figure 1—No Improvement: Industry's use of project controls during the construction of capital projects has been *Fair*, as measured in IPA's Project Controls Index, going all the way back to 2004, according to IPA's 2016 research into the implementation of project control systems.

¹ Isabel Bignon and Roman Villoria-Siegert, The State of Project Controls, CEC 2016, IPA, September 2016.

are the absence of requirements language, provisions devoid of important details, and unenforceable or unsuitable requirements. When contracts are inadequate, the project controls organization is left in a weakened state and at the mercy of contractors. Bad contracts open the door for inconsistencies, low-quality reporting from contractors, and extra work to make up for the lack of understanding/specificity in the contract agreements. Notably, almost 40 percent of project control specialists said they do not provide input into the contracting process mainly because they are not invited to participate in the process.

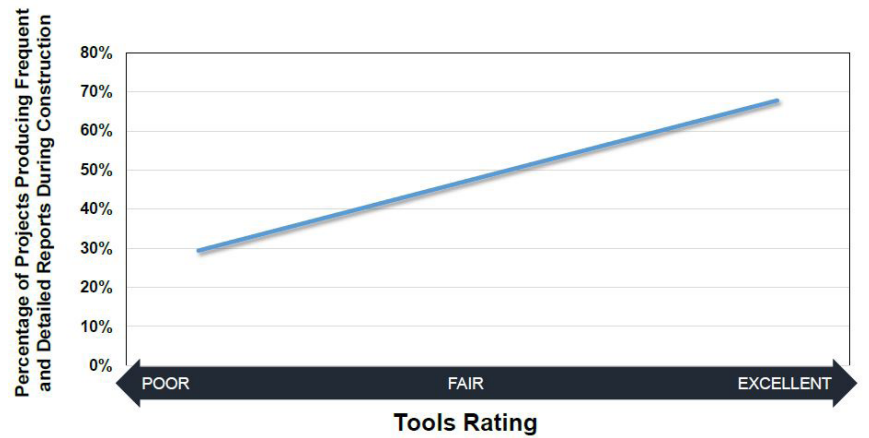


Figure 2—Execution Phase Report Quality: The ability to produce frequent and detailed reports is a function of the quality of tools.

Barrier 3—Deficient Project Control Implementation Processes & Tools:

In response to the IPA survey, over 80 percent of project control specialists rated their tools and processes as deficient. Almost half of project control specialists said they have started a project's execution phase with a project control system (including software, accounts set up, and mechanisms for measuring progress, etc.) that was not ready for use. As a result, they spend time setting up the tools when they are supposed to be using them. In essence, project control specialists are trying to tie their shoes while running the race—definitely not a good strategy for success.

In addition, the poorer the rating project control specialists gave their project control tools, the less capable the tools were in creating regular and detailed reports for project managers (**Figure 2**), which is a known Best Practice. Project control specialists also reported dealing with deficient work processes that result in work duplication like generating reports with the same information in different formats to deliver to different stakeholders. Such challenges for project control specialists prevent project controls from being implemented efficiently and effectively.

How can we destroy or elude these barriers to project controls for capital projects? For a long-term improvement, owners should consider the following general guides:

1. Create or define a project controls organization that ensures appropriate and early staffing and integrates the controls function into the team.
2. Involve controls in the development and enforcement of contracts. This is critical to establishing and holding on to effective controls in execution.
3. Develop or improve processes and tools that work across the system and that are supported by management and the project organization.

For coping with suboptimal conditions, IPA's survey of industry project control specialists found that a proactive approach to controls design can provide some avenues to improvement. Some important strategies shared by our survey respondents include:

- Educating management on the importance of project controls, its staffing, inclusion in contracts, and alignment of stakeholders with processes and tools.
- Developing relationships with upper management, contractors, and the project team to help in dealing with all three barriers presented. For example, project control specialists might consider communicating, stepping-in, and helping contractors when they don't know how to comply with contract requirements or helping them use tools and follow processes.
- Adapting behaviors, processes, and tools to certain situations, by, for example, developing tools to deal with incoming data in different formats, and exploring other ways of dealing with the common challenges project control specialists face in their day-to-day work.

By identifying and understanding the barriers to effective project controls implementation, it is reasonable to expect that the entire capital projects Industry can move from the PCI's *Fair to Good (Best)* classification of performance.

This research is part of a series of studies on functional competency within project teams. Special thanks goes to the project control specialists who participated in the survey, shared their insights, and made this effort possible.

To learn more about this research, contact the author at ibignon@ipaglobal.com.

Upcoming IPA Events & Presentations

- September 26-27** **Cost Engineering Committee (CEC) 2017**
 The CEC is an Industry Benchmarking Consortium (IBC) subcommittee that assists cost engineers by providing metrics and tools that offer an unbiased snapshot of Industry cost and schedule estimates and trends. For more information, contact IBC Director Andrew Griffith at agriffith@ipaglobal.com.
- October 11** **2017 Calgary Energy Roundtable**
 The Energy Roundtable event in Cargary, Canada, will feature a panel discussion in which **IPA Chief Operating Officer Elizabeth Sanborn** will talk about how Canada's oil and gas industry can strengthen its standing as a global energy lead by leveraging a highly skilled workforce, accelerating technological innovation, and restructuring systems and operations for sustained productivity. More information is available at <http://energyroundtable.org/calgary/>.
- October 17** **2017 Breakbulk Americas Summit**
IPA North America Regional Director Phyllis Kulkarni will facilitate a workshop on capital projects logistics management during the 2017 Breakbulk Americas Summit. Contact Breakbulk for additional information.
- October 18** **IPA Founder and President to Speak at Oil & Money Conference**
IPA Founder and President Edward Merrow will speak at the 2017 Oil & Money Conference on the topic of project management in the oil and gas industry. He will discuss whether the industry has taken the opportunity afforded by the downturn in oil prices to improve the execution of major projects. The annual conference, presented by *International New York Times* and *Energy Intelligence*, will be held in London, United Kingdom. For more information, visit <https://www.oilandmoney.com/om2017/51908>.
- October 20-21** **AACE International, Peru Section, 5th Congress of Cost Engineering**
IPA Mining, Minerals, and Metals Business Area Manager Baqun Ding and **IPA Latin America Regional Director Astor Luft** will lead presentations on mining industry trends and the development and use of the Mining and Mineral Processing Uniform Cost Coding Structure (MMP-UCCS) at the AACE International, Peru Section event in Lima, Peru. For more information, visit <http://www.aacei.org.pe/congreso2017/>.
- November 7** **PEERS 2017 Conference**
IPA Site and Sustaining Capital Manager Katherine Marusin will participate in a panel discussion on project management at the PEERS 2017 conference in Norfolk, Virginia. For more information, visit <http://tappipeers.org/>.
- November 13-15** **Upstream Industry Benchmarking Consortium (UIBC) 2017**
 The UIBC provides an independent forum for participating exploration and production (E&P) companies to view key metrics of its project system performance. The consortium highlights Best Practices, reinforcing their importance in driving improvements in asset development and capital effectiveness. For more information, contact IBC Director Andrew Griffith at agriffith@ipaglobal.com.
- December 12-15** **49th Annual ECC Conference**
 IPA will be well represented at the 49th Annual ECC Conference in Boca Raton, Florida. **IPA Hydrocarbon Processing and Transportation Business Area Manager Andras Marton** will be presenting at the Future Leader Working Session (Invite Only) on the topic of leading capital projects to repeatable success. **IPA North America Regional Director Phyllis Kulkarni** will moderate a panel discussion titled "Resilient Project Techniques for Boom and Bust Cycles," during which representatives of owner and contractor firms will discuss program management approaches, speed to market and agility, and supply chain integration in order to maximize overall capital efficiency and profitability. For more information, visit <http://www.ecc-conference.org/2017-Conference/>.

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