IPA

Independent Project Analysis Newsletter

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.

Volume 2, Issue 2 **June 2010**

Research Spotlight: *Sustainable Capital Project Delivery*

Christopher Carabetta

It is hard to pick up any type of business or trade journal lately and not find an article on sustainability. But what is sustainability and what are its benefits and risks for capital projects? Many of IPA's clients already have a corporate-level responsibility or sustainability function that is reporting performance on the "triple bottom line": shareholder returns, environment, and community ***(Figure 1)***. The focus of corporate responsibility can be as global as a climate change policy and as local as the social and economic impact of its operations. The emphasis that companies place on sustainability varies by industry.

Figure 1. **Triple Bottom Line**

The extractive petroleum and mining industries have special sustainability concerns. The sustainability focus in these industries is on obtaining and maintaining a social license to operate and enhancing corporate reputations. Companies in these industries are going further afield to gain access to scarce resources. Capital pro-

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Best Practices for Mining Projects

During the last several years, IPA has analyzed approximately 700 projects in the mining, minerals, and metals industries from around the world. These projects range from smaller sustaining capital projects to multi-billion dollar new mine developments. Research into the performance of minerals companies shows that the best performing organizations have costs 10 percent more competitive than other industry projects. These projects have comparable execution durations, indicating they are not trading schedule for cost.

The ***Best Practices for Mining Projects*** program provides participants with project management Best Practices and learnings targeted to improve cost, schedule, and quality of both mine extraction projects and minerals processing facilities projects.

This 2-day program, as with all IPA Institute programs, can be customized to meet your organization's needs. The instruction method includes lecture, active class discussions, and case studies.

The IPA Institute is recognized as a registered education provider with the Project Management Institute (PMI).

Project Management Institute

The program is intended for all involved in defining, planning, and executing minerals investments. This program is registered with the Project Management Institute (PMI), and enables attendees to earn 16 Professional Development Units (PDUs) upon completion of the course.

To view registration details and to learn about special discounts, please visit our website at **www.IPAInstitute.com**, or call **+1 (703) 729-8300**.

Inside this issue:

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jects are being deployed in less-developed and familiar locations with little infrastructure and high impact on the local population. Maintaining a social license to operate in the presence of increased NGO and government activism and rapid global communications is a challenge that affects the bottom line. Proactively managing a complex network of stakeholders is essential to remaining on the A-list of companies invited to develop and expand assets. Missteps can tarnish corporate reputations and take years to recover from. In extreme cases, production can be interrupted or assets expropriated.

Corporate responsibility, as translated into capital projects, can take many forms. Some projects include budgets for building infrastructure such as schools and health clinics. Others focus on achieving zero water discharge and restoring local flora and fauna. The form of sustainability investment has evolved over the years from unilateral local content and livelihood replacement to more participative community investment and capacity building. Investments are designed to help ensure short- and long-term enterprise and community sustainability. Success is now measured over the asset life cycle and seeks to answer the question: After the asset is closed, is the community better off than if the resource had never been developed in the first place?

Applying sustainability concepts to capital projects requires a new performance model to identify and measure Best Practices ***(Figure 2).*** One could envision that Best Practices exist for integrating sustainability into capital projects, engaging stakeholders, and making effective investments. Further, the magnitude, timing, and type of investment might also be correlated with outcomes and benchmarked. Linking sustainability practices in capital project delivery to outcomes is key to isolating Best Practices. Sustainability outcomes include both direct value creation, such as the benefits of training local labor, and indirect value protection. Value protection can take the form of fewer project delays, added costs, avoidance of project cancellation or expropriation, and fewer disruptions to production. Ultimately, through more effective sustainable project delivery, companies will benefit over the long term through higher company valuation, a better reputation, and more development opportunities.

Figure 2. **Sustainability Applied to Capital Projects**

IPA has been engaged by a major financier of capital projects to use its extensive databases to quantify capital project sustainability risk. The first stage effort is to examine differences in general risk for petroleum E&P and mining projects. We are investigating whether the annualized rate of occurrence (ARO) and severity of risks such as project delays and cost growth are different for developed and developing regions and for onshore and

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offshore petroleum E&P projects. Future research opportunities include isolating specific practices that reduce sustainability driven risks.

Sustainable project delivery is emerging as an increasingly relevant area in the body of capital project knowledge. Research in this field is particularly well suited to IPA's benchmarking capabilities and proven research methodologies.

If you have an interest in participating in a multi-company research study or would like to provide comments on this topic, please contact **Christopher Carabetta** of IPA at **ccarabetta@ipaglobal.com** or **+1 (703) 726-5388**.

Professional Profile: *Christopher Carabetta, Senior Analyst*

Chris has assisted clients with projects across a broad array of areas, including aluminum, steel, chemicals, petroleum refining, foods, and power production. He has led five major capital project benchmarking studies and has consulted on over 120 projects for 22 clients worldwide.

Before joining IPA, Chris worked as a product development management intern for the online brokerage unit of the Donaldson, Lufkin, and Jenrette investment bank. He has also been a consultant with ITT Industries in international programs management where he worked with the Office of the Secretary of Defense to develop international technical cooperation programs. Prior to joining ITT Industries, he served as a project engineer in naval architecture for General Dynamics Electric Boat Division. Chris completed engineering degrees from Penn State and Rensselaer Polytechnic Institute and an MBA from Georgetown University.

Why Owner Involvement Is Critical for Small Project Success

Phyllis Kulkarni

In evaluating over 6,000 small site-based projects around the globe, IPA has observed that many manufacturing sites, being understaffed with owner personnel, delegate management of their small projects to an alliance or preferred contractor. IPA research has consistently found that assigning key roles on small projects to a contractor without adequate owner oversight is a leading root cause of poor project performance. This article will examine disadvantages in delegating small project management to a contractor, and explain how owners can mitigate these risks to achieve competitive performance.

Contractor-led projects are less effective in using Best Practices.

IPA divided 28 sites benchmarked in 2009 into two groups: (1) sites where owner project managers comprise more than 50 percent of the total project managers (i.e., there are more owner project managers at the site than contractor project managers), and (2) sites where owner project managers comprise less than 50 percent of the total project managers. We observed that, on their small projects, the first group achieves better team development (clear objectives, participation from key functions, etc.) than the second group. Achieving good team development on small projects can be challenging, particularly when it comes to securing adequate input from key stakeholders like operations and maintenance. Contractor project managers often have less pull at a site than owner project managers, and struggle to obtain this input. Likewise, the first group of sites uses stronger project controls on its small projects than the second. This is not a surpris-

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ing result, given that sites which delegate project management to contractors often fail to retain (or never had) ownership of the project control function.

Contractor-led projects tend to use more resources than owner-led projects to accomplish the same amount of work.

Site-based projects with a contractor project manager or contractor cost estimator use significantly more engineering hours to complete the same scope of work than projects in which these roles are filled by owner personnel ***(Figure 1)***. This difference can be somewhat mitigated if an owner specialist conducts a detailed cost validation of the contractor's cost estimate, but unfortunately many small projects lack owner capability in this area. In addition, there are clear advantages in engineering productivity when basic design is conducted by the owner rather than by a contractor and the improvement in engineering productivity is magnified when both basic and detailed design are conducted by the owner. Delegating either of these responsibilities to the contractor results in more engineering hours. Owner engineering tends to have a greater stake in producing competitive projects, whereas contractor engineering—even when well integrated into the site—is ultimately beholden to its own management, and motivated to maximize profitability.

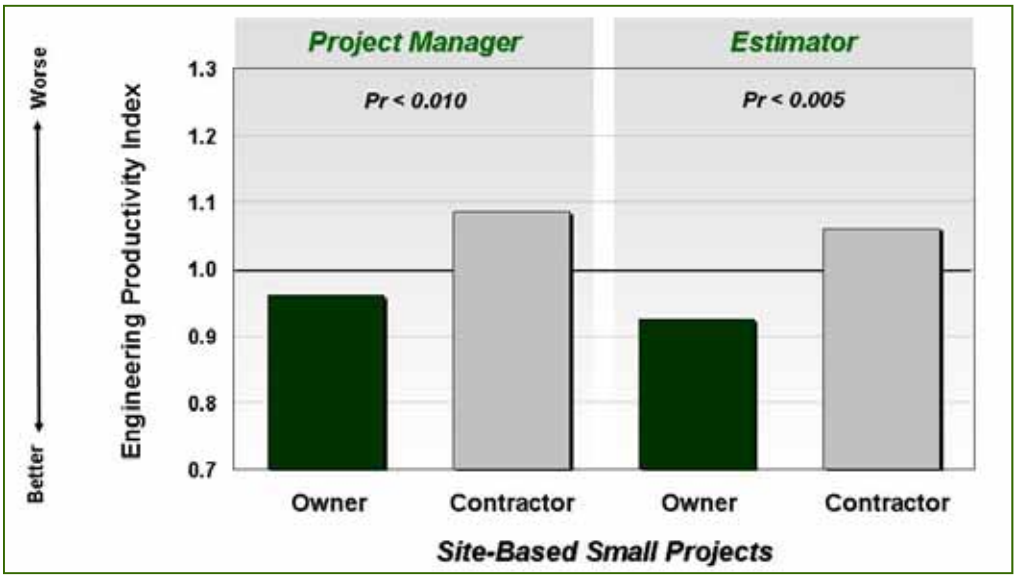

Figure 1. **Contractor Project Manager/Estimator Has Negative Effect on Engineering Productivity**

Contractor-led projects tend to be more expensive than owner-led projects.

Cost competitiveness is affected because (1) contractor-led projects do not use the same level of Best Practices as owner-led projects and (2) contractor-led projects tend to use more engineering hours to accomplish the same scope of work. These discrepancies translated to a ***14 percent difference in cost performance*** for the sites IPA benchmarked in 2009. The sites with a greater proportion of owner project managers achieved an average cost index on their small projects of 0.93 (in other words, they spent 7 percent less than industry average) versus an average of 1.07 for the sites with a greater proportion of contractor project managers.

We recognize that it may not be practical for some sites to routinely staff key functions with owner personnel. Furthermore, some of the best sites in Industry—sites that consistently pay 10 to 15 percent less for their small projects than industry norms—have an alliance contractor that is heavily leveraged to support their small project portfolio. How do these sites achieve excellent performance despite filling many roles with contractor personnel? The role of the owner and the owner process is crucial; these are some key practices that help drive excellence when sites rely on contractor personnel:

An owner cost specialist performs a quantitative validation of each cost estimate.

The validation process helps push back against any over-estimating by the contractor, and ensures that the project targets set at authorization are competitive.

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The gatekeeping process is strong and is followed rigorously.

The best sites all have strong small-project processes oriented toward achieving comprehensive use of Best Practices. At each gate, owner management (usually the site projects director) evaluates each project's level of Front-End Loading (FEL), team development, project controls, and other key practices and deliverables. Small projects that do not meet the site's standards for use of these Best Practices are recycled until they comply.

The owner provides clear business objectives for all small projects.

Contractor-led projects sometimes struggle to obtain clarity of objectives from the owner and, as a consequence, suffer more churn and recycle in the definition phase than owner-led projects. This can drive up the amount of engineering hours used. Consistently providing and documenting clear objectives helps mitigate the delays that often occur when objectives are not understood. Owner leadership can also be instrumental in assisting contractor-led projects in obtaining input from other key functions at the site.

In summary, all sites, regardless of their contracting approach, have the opportunity to achieve excellent performance. The best sites make consistent use of Best Practices, often have more owner project managers than contractor project managers, and retain key functions such as cost estimating and validation. Even when they delegate project management to a contractor, best sites maintain strong gatekeeping processes, and site leadership helps projects succeed by giving them clear objectives and promoting team development. In contrast, poorly performing sites have turned over key functions (particularly cost estimating and validation) to the contractor with little or no owner oversight. The owner's "hands off" approach can undermine small project performance even when Best Practices are employed.

For more information, contact **Phyllis Kulkarni**, Manager Plant-Based System, by e-mail at ***pkulkarni@ipaglobal.com*** or by phone at **+1 (703) 726-5472**.

Professional Profile: *Phyllis Kulkarni, Manager Plant-Based Systems*

As Plant-Based Systems Manager, Phyllis oversees the worldwide business and technical development needs for the Plant-Based Systems business sector. Plant-Based Systems encompasses small project benchmarking, turnaround benchmarking, and licensing of IPA's FEL Toolbox.

Previous to her promotion to a managerial position, she served on IPA's Review Board for two years, reviewing projects for multiple IPA business areas. Before her position as a Reviewer, she was a Senior Project Analyst with IPA's Latin American Project Center (Centro de Proyectos Latinoamericanos) and was involved in the analysis of petroleum, chemical, and mining projects in Latin America, the U.S., and Spain. In addition, Phyllis has led megaproject assessments, site benchmarkings, turnaround evaluations, and analyses of exploration and production projects. In 2003, Phyllis presented the results of a research study that she led on Joint Venture projects at IPA's annual Industry Benchmarking Consortium (IBC). Phyllis was the Coordinator for IBC 2010.

Prior to joining IPA in 2002, Phyllis interned as a translator for Repsol YPF in Buenos Aires, Argentina. Phyllis holds a B.S. in Languages and Linguistics from Georgetown University, Washington, D.C.

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To be kept informed regarding upcoming IPA Institute programs and courses being developed for capital project improvement, join our mailing list at www.IPAInstitute.com

Advances in Understanding Mining and Minerals Project Cost and Operational Performance: *A Summary of Recent IPA Research*

Sally A. Glen

Over the last several years, IPA has invested in developing a better understanding of the cost and operational performance of mining, minerals, and metal (MMM) projects. This article discusses our recent research results in the areas of mine definition, mineral processing project operational performance, heavy haul railroad cost analysis, hydrometallurgical plant cost per tonne analysis, and coal handling and preparation plant cost curves.

The Database

IPA's MMM project database has grown from 300 projects in 2005 to 700 projects and now contains more than 35 owner organizations. Since 2005, approximately 65 mine development projects have been evaluated by IPA, including data from 25 completed mine development projects. The database has worldwide coverage across remote and diverse locations, containing both open pit and underground mine developments. The primary commodities represented include bauxite, coal, copper, diamonds, gold, iron ore, nickel, and oil sands.

Mine Definition and Cost Growth

Since 2005, IPA has been assessing the level of mine definition for projects containing a mine development at the time the project is authorized. The Mine Front-End Loading (MFEL) Index is made up of four categories: orebody and waste definition, site factors, design status, and project execution planning. A rating is assigned to each of the 16 sub-components, and an overall MFEL rating is then calculated.

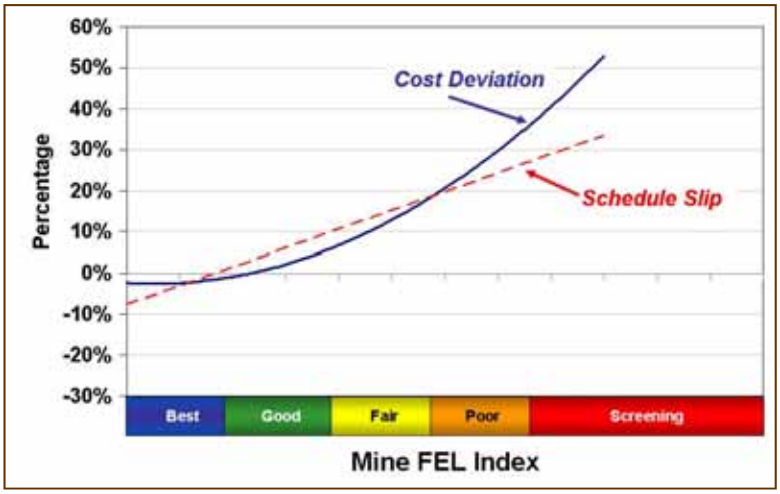

Figure 1. **Mine Definition Drives Predictability**

Our data analysis shows a strong relationship between the level of mine definition and cost growth. Better-defined mining projects, as measured by the MFEL Index, have less cost growth. As shown in ***Figures 1-3***, better MFEL helps to improve project cost and schedule predictability, eliminate cost growth, enhance startup and early operability performance, and achieve better safety results. Well-defined mine development projects are also more likely to experience fewer late changes after authorization.

A mine development project is characterized as being capital intensive, having a long cycle time from concept to an operating facility, and having a large environmental and community impact. Project economics are sensitive to product prices and frequently require modification because of poor predictability of the far-future commod-

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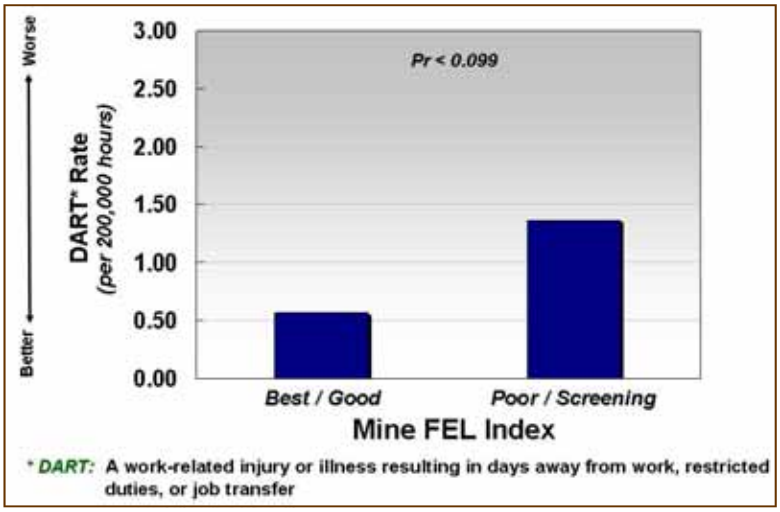

Figure 2. **Better Mine Definition Correlates With Better Safety Results**

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ity and currency market, placing the project definition phases at risk of extreme business pressure.

Common problems in Industry include costly commissioning problems and delays in startup, poor recoveries, and cost growth and associated poor profitability. A review of the key drivers of poor performance frequently points to gaps in basic data knowledge related to mine definition. Inadequate drilling to support geological interpretations, misunderstanding of grade variability, and insufficient metallurgical testwork are some of the technical data gaps. Team alignment and project execution planning are also areas of opportunity for many projects, with delinked mine and facilities teams and a lack of joint mine and facilities project execution planning evident in many projects.

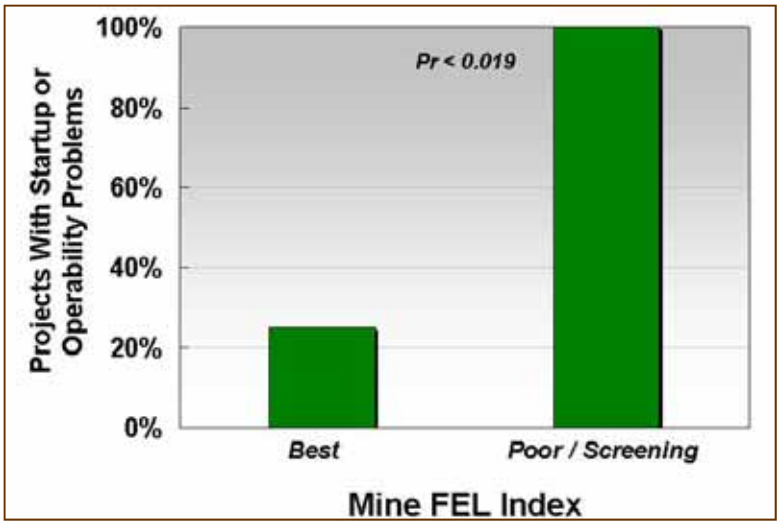

Figure 3. **Better Mine Definition Drives Reduced Startup/Operability Problems**

IPA's MFEL data are showing strong links to key project outcomes and IPA's MFEL Index is a tool that can be used in Industry to enable more successful mine development projects and enhance shareholder returns through competitive and predictable project outcomes.

Understanding Operational Performance Deviation

The early attainment of operability performance consistent with the promise to an organization's Board of Directors is crucial to the cash flow in the first year of operations and the ultimate return on investment. IPA's measure of operational performance for projects is the percentage of nominal planned or actual design nameplate capacity, depending on whether the project is completed or just authorized, during months 7 through 12 following mechanical completion.

To capture and discuss differences between the planned early operability targets and actual early operability performance, IPA will now report early operability performance deviation, which, by definition, is the difference between planned and actual design nameplate capacity expressed as a percentage of the target, for all MMM projects containing a processing plant and for mine production shortfalls.

Heavy Haul Railroad Cost Analysis

During 2009, IPA conducted research into heavy haul railroad costs. These railroads are typically constructed to transport sea-borne commodities from mine to port. Not surprisingly, we found a strong relationship between length and capital cost. Scope included in the benchmark cost analysis includes tracks, bridges, crossings, the main line, spurs, switches, signaling, typical site preparation and embankment, and typical access road requirements. IPA is now providing benchmarks for railroad components of mining projects and this cost analysis tool can be applied in cases in which the railroad length is between 5 km and 865 km.

Hydrometallurgical Plant Cost per Tonne Analysis

Recent work has been completed on a cost regression for hydrometallurgical processing plants, relative to throughput in tonnes per year. The dataset includes projects installing greenfield and expansion gold, copper, and nickel plants and involves 12 owner organizations from the world's key mining districts.

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The research found a strong cost relationship between cost and throughput, which can now be applied in cases in which a project contains a hydrometallurgical processing plant. Capacity ranges up to 150,000 tonnes per day of throughput are contained within the regression.

Coal Handling and Preparation Plant Cost Curves

In late 2009, IPA completed a preliminary study of the relationship between the total installation cost and plant design capacity and other process parameters in millions of Run of Mine (ROM) tonnes for greenfield coal handling and preparation plants (CHPPs). For the study, the CHPP scope included the process facilities between the ROM tip and product stacking. Scope exclusions included ROM conveyors, ROM material and product stockpiles, and tailings transport and disposal facilities. The study involves a database of completed and ongoing greenfield CHPP projects, executed by four different companies in South Africa and Australia. More observations are required and IPA plans to capture additional data from projects as they are completed.

The study found that the plant design ROM capacity (expressed in millions of tonnes per annum [MMtpa]) is a significant driver of CHPP total installation cost, with the statistical model explaining a majority percentage of the cost variation in the dataset. This preliminary cost analysis tool can be applied, with limitations, to both coking and thermal CHPPs with capacity ranges of between 5 and 18 ROM MMtpa.

Future Research

The next generation of cost relationships is now being tested on the following scopes: residue and tailings ponds, port/marine facilities, materials handling, and copper/gold and iron ore plant cost regressions.

For additional information regarding IPA's mining and minerals project cost and operational performance research, please contact:

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Professional Profile: *Sally Glen, Australian Office Director*

Sally heads the Australian operation for IPA and is based in Melbourne. Since joining IPA in 2003, Sally has held project analyst positions and has been a Business Area Manager for the Mining, Minerals, and Metals (MMM) industry sector, responsible for developing the clients and project analysts that are involved in the industry sector.

As a project analyst, Sally has evaluated more than 100 petrochemicals, refining, mining and minerals, and oil and gas projects, ranging from small projects to megaprojects. Sally has been a facilitator at several of IPA's Front-End Loading and Lessons Learned workshops, and in 2004, spent two months in Brazil and the United States co-facilitating a capital project system redesign for a major minerals client.

Sally rolled out the Mine Front-End Loading Index at the Industry Benchmarking Consortium (IBC) 2005, and researched and presented IPA's Hot Spot Research for Western Australia at IBC 2006. Sally has been client coordinator for three of IPA's clients from the MMM and Oil and Gas industry sectors, and has taught a range of capital effectiveness-related topics for the IPA Institute. Sally has also been a guest lecturer at the University of Western Australia since 2007 for fourth-year mechanical engineering students. Sally holds a B.E. (Hons) in Civil Engineering from the University of Melbourne.

Upcoming IPA Events and Presentations for 2010

June 21

Best of UIBC 2009 Road Show in Houston, Texas

The Upstream Industry Benchmarking Consortium (UIBC) 2009 Road Show will be hosted by Marathon. The UIBC Road Show is open to all UIBC companies, and provides an opportunity to extend the UIBC metrics and research to company participants that were unable to attend the main UIBC 2009. For more information, please contact Rolando Gächter at **rgachter@ipaglobal.com**.

June 22

Best of IBC Roadshow 2010 in Kuala Lumpur, Malaysia

The Asia Pacific IBC 2010 Road Show will be hosted by Petronas. This Road Show is open to all IBC companies and provides an opportunity to extend the IBC metrics and research to company participants that were unable to attend the main IBC. Both large and small (site-based) project Best Practices and outcomes will be presented at the Road Show, and opportunities for discussion and networking will be provided. In addition, keynote presentations from PETRONAS and DOW will highlight specific Best Practices and opportunities for projects executed in Asia. The Road Show is highly recommended for project and business professionals directly involved in the management of capital projects and turnarounds. For more information or to register, please contact Loretta Tan at **ltankimhoon@ipaglobal.com** or Yvonne Tay at **apbestofibc@ipaglobal.com**.

June 22

Upstream Cost Engineering Committee (UCEC) 2010 in Houston, Texas

The purpose of the Upstream Cost Engineering Committee (UCEC) Annual Meeting is to improve upstream project and business results by providing metrics for better cost engineering. The UCEC metrics provide asset evaluation and concept development functions with a better understanding of costs and schedules. For more information, please contact Carlton Karlik at **ckarlik@ipaglobal.com**.

September 14 - 16

Cost Engineering Committee (CEC) 2010 in Dulles, Virginia

The purpose of the Cost Engineering Committee (CEC) is to extend the IBC forum to cost engineering practices with a focus on cost and schedule metrics. By using these cost and schedule metrics and research findings, companies can improve their project and business results. For more information, please contact Robert Brown at **rbrown@ipaglobal.com**.

November 8 - 10

UIBC 2010 in Tysons Corner, Virginia

The UIBC 2010 provides an independent forum for each participating company to view its performance against the performance of other companies. The consortium highlights Best Practices, reinforcing their importance in driving improvements in asset development and capital effectiveness. For more information, please contact Rolando Gächter at **rgachter@ipaglobal.com**.

THE IPA INSTITUTE
ADVANCING PROJECT KNOWLEDGE

2010 IPA Institute Program Schedule

To view full course descriptions, pricing, up-to-date registration details, and special discounts, please visit our website at www.IPAInstitute.com

Practices for Shorter, More Cost Effective Turnarounds (14 Professional Development Units)

June 16 - 17: São Paulo, Brazil
October 12 - 13: The Hague, The Netherlands

Project Management Best Practices (22 Professional Development Units)

June 22 - 24: Chicago, Illinois
July 27 - 29: Denver, Colorado
August 17 - 19: Lima, Peru
August 24 - 26: Calgary, Canada
September 7 - 9: Buenos Aires, Argentina
October 12 - 14: Singapore, Singapore
October 26 - 28: Rio de Janeiro, Brazil
November 10 - 12: Reading, England
November 24 - 26: Johannesburg, South Africa

Project Management for National Companies (21 Professional Development Units)

June 22 - June 24: Abu Dhabi, United Arab Emirates

Gatekeeping for Capital Project Governance (12 Professional Development Units)

June 23 - 24: Kuala Lumpur, Malaysia

Best Practices for Mining Projects (16 Professional Development Units)

June 30 - July 1: Lima, Peru
September 28 - 29: Perth, Australia

Best Practices for Small and Plant Projects (22 Professional Development Units)

July 13 - 15: Shanghai, China
August 3 -5: Houston, Texas
September 14 - 16: Dusseldorf, Germany
September 21 - 23: Singapore, Singapore
November 16 - 18: Beijing, China
November 23 - 25: Sydney, Australia

Executing Successful Complex/Megaprojects (18 Professional Development Units)

July 13 - 15: Santiago, Chile
October 5 -7: Houston, Texas
December 6 - 8: Reading, England

Establishing Effective Capital Cost and Schedule Processes (16 Professional Development Units)

August 24 - 25: São Paulo, Brazil

Exploration and Production Project Best Practices (22 Professional Development Units)

September 6 - 8: Reading, England
September 14 - 16: Anchorage, Alaska
November 23 - 25: Rio de Janeiro, Brazil

Contracting in the Changing World of Projects (12 Professional Development Units)

September 29 - 30: São Paulo, Brazil
October 13 - 14: Santiago, Chile

IPA

Independent Project Analysis, Inc.

Dear Friends of IPA,

On June 1st, I left for my very first sabbatical. I left UCLA the year before I was eligible for sabbatical and there have always seemed to be reasons for not taking one at IPA. We started our sabbatical program 12 years ago to provide a break of four months or so for analysts to recharge and gain perspective. I believe it has been an unqualified success. One becomes eligible after six years of unbroken service. The only requirement is that the time be planned; sitting in front of the TV is not an option.

My plan is to do something I have wanted to do for some time now: write a comprehensive book on what goes wrong with megaprojects and what to do about it. I am writing in the morning and then fishing in the evening--not the ideal order but the one that is most likely to get the book done. While I am away, the corporate managers and regional directors will mind the store and I expect my absence will be hardly noticed.

My best to all of you for a safe and healthy summer.

President, and CEO,
Independent Project Analysis, Inc.

IPA
Excellence through measurements

www.ipaglobal.com

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

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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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