Independent Project Analysis, Inc. | Volume 15, Issue 3 | September 2023

IPA Newsletter

IN THIS ISSUE:

CCUS Industry Insights Provide a Foundation for Future Projects

By Ashling Neary, Research Analyst

More than ever, capital projects are being implemented with emissions reductions at the forefront. Among the most impactful options for reducing greenhouse gas emissions is Carbon Capture, Utilization, and Storage (CCUS). CCUS projects allow for a reduction of CO_2 emissions from both new and existing assets across a wide variety of sectors, including hard to abate sectors, such as steel and cement manufacturing. As regulatory entities, investors, and shareholders further drive the demand for emissions reduction, CCUS projects are poised to play an important role for decades to come. IPA's recently established CCUS industry insights and performance metrics will help companies prepare for the challenges that lie ahead.

Relatively few CCUS projects have been completed to date, with many projects canceled or put on hold after they have been announced. Sponsors stop projects because they cannot reduce risks to an acceptable level before full-funds authorization. Contributing to this risk is CAPEX and technology performance uncertainty. There is a lack of CCUS project data and corresponding CCUS industry insights from early facility operations. This hinders decision making at all steps—from early opportunity screening to shaping project development strategies that effectively reduce risk and uncertainty.

Although a handful of CCUS cost studies have been executed,[1] these studies rely heavily on assumptions and idealized scenarios rather than data that exist from real-world examples of CCUS projects. To address the limitations posed by having a small number of completed CCUS projects, IPA has aggregated available CCUS project data to establish cost and schedule norms across the core scope elements of CCUS projects.

The cost and schedule norms help avoid the sunk costs from projects that are canceled late in the project development cycle. Clients can use the results to develop conceptual estimates for different options in the CCUS

IPANewsletter

Independent Project Analysis, Inc.
Volume 15, Issue 3
September 2023

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value chain in a project or they can validate their own cost and schedule estimates. Both activities allow companies to screen out projects for which the CAPEX is too high or uncertain to justify additional investment.

IPA's CCUS Database—IPA's recently completed CCUS Performance Norms Study aggregates data from 26 CCUS projects, accounting for over 70 MTPA of CO_2 from completed projects and those in development. These data are used to provide cost and schedule metrics and a technology assessment for CCUS projects that can empower decision makers with the knowledge they need to drive the successful development of CCUS projects.

The database from this study, shown in **Figure 1**, encompasses many of the characteristics that make CCUS such an important abatement option. Among the advantages of CCUS is the ability to retrofit CCUS to capture emissions from existing facilities, which accounts for two-thirds of the projects in our dataset. In addition, the International Energy Agency (IEA) has highlighted CCUS as an enabler of low-cost, low-carbon hydrogen production. The importance of CCUS in hydrogen production is evident in IPA's CCUS study; over one-quarter of the dataset projects have hydrogen production as the CO_2 source, accounting for a total of 18 MTPA of captured CO_2.

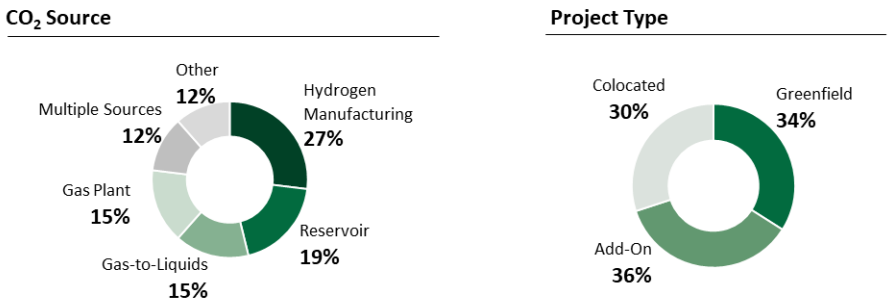


Figure 1

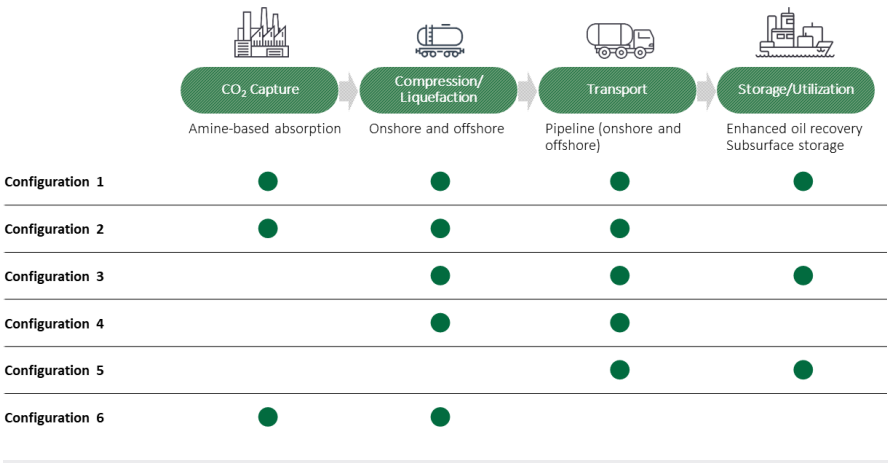


Figure 2

[1]Global CCS Institute, Global Costs of Carbon Capture and Storage 2017 Update, June 2017, Accessed July 26, 2021, https://www.globalCCSinstitute.com/archive/hub/publications/201688/global-CCS-cost-updatev4.pdf; National Petroleum Council, Meeting the Dual Challenge: A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage, December 19, 2019, Accessed July 23, 2021, https://dualchallenge.npc.org; Electric Power Research Institute, Towards Improved Guidelines for Cost Evaluation of Carbon Capture and Storage, April 2021, Accessed July 27, 2021, https://www.epri.com/research/programs/0TIZ12/results/3002021990; Global CCS Institute, Technology Readiness and Costs of CCS, March 2021, https://www.globalccsinstitute.com/resources/publications-reports-research/technology-readiness-and-costs-of-ccs/.

The scale of CCUS projects varies widely; the smallest projects in our database are designed to deliver less than 0.5 MTPA and the largest almost 10 MTPA. IPA's study found that a typical CCUS project requires a CAPEX investment of about $500 million (2023 U.S. dollars) to build the capacity to capture, compress and dehydrate, transport, and inject 1 MTPA of CO_2. However, the costs vary and are driven by several factors, including location and the technology used for each component of the value chain.

IPA breaks the CCUS value chain into the four components show below: capture, compression and dehydration, transport, and storage. Metrics are presented for both the overall CCUS asset and individually for each component for the study. Asset-level metrics apply to projects with all four components, encompassing the entire CCUS value chain. The breakdown into component-level metrics is of particular value as not all projects have all components. About one-quarter of the projects in the study include all four components, half include three of the four components, and the remainder include two of the four. The different configurations of components for the projects in the study are shown in **Figure 2**.

CCUS Metrics—The capture and compression of CO_2 makes up about three-quarters of the total cost of the full CCUS value chain, making it crucial to understand the drivers of the costs of these components when considering the overall asset. Both components benefit from economies of scale for higher capacities of CO_2. As expected, the percentage of CO_2 in the feed gas (a factor determined by the source of CO_2) is an important driver of CO_2 cost. The current industry standard for CO_2 capture is amine absorption; all projects in our study dataset used such. However, many capture units—both amine absorption and other technologies—are being touted as "off the shelf," despite not having been tested in the specific setting they are proposed for. Indeed, guarantees of progressively higher CO_2 capture rates have been made, despite a lack of supporting evidence. The current lack of completed CCUS projects prevents a better evaluation of these claims, and the industry will greatly benefit when the performance results of these new technologies are known.

For CCUS projects with all four scopes present, transport and injection costs tend to represent the smallest portion of CCUS costs; typically, less than 20 percent of the combined CO_2 pipeline costs are driven by typical pipeline drivers (i.e., length, diameter, and wall thickness). The injection well costs, although correlated with CO_2 injection capacity, are more closely associated with program characteristics, such as the number of wells and well depth, as shown in this study.

Challenges in Development of CCUS Projects— Like any other project, CCUS projects face challenges, including new technology performance and/or new integrations of existing technologies. As a rapidly developing sector, it may be difficult to judge how much the cost will decrease as the capture technologies continue to be implemented in CCUS projects. IPA's technology assessment of capture technologies focuses on amine absorption and cryogenic separation. Learning curves developed from analogous technologies are used to provide an outlook on how costs may change in the future.

Outlook for the Future of CCUS Projects—The CCUS sector is in the early stages of a dramatic expansion and project teams and systems across the world are looking for real CCUS industry insights and project data to inform strategic decision making and support project planning. The metrics established in IPA's study build a foundation to meet this need. Each metric reflects the cost and schedule performance and technical characteristics of today's projects and their constituent components.

The success of future CCUS projects depends on understanding the actual performance of completed projects. As more projects are executed, this database—and the depth and breadth of the metrics at our disposal—will grow commensurately, allowing for updates to the CAPEX, schedule metrics, and operational performance. We will also add to our current suite of metrics, including data like operating costs, and identify practices that promote successful outcomes of CCUS projects.

CCUS Project Cost & Schedule Norms

The complexity of CCUS projects presents many challenges. Any company involved in CCUS projects needs unbiased data to successfully navigate the complexity. With industry-level data from IPA, you can validate your early CCUS project estimates and establish a baseline for performance improvement.

Contact Adi Akheramka at **aakheramka@ipaglobal.com** for more information.

Setting Up Projects Early Is Critical to Business Success

By René Klerian-Ramírez, IPA Product Development Leader, Project Evaluation System

No matter where owner companies are in their capital improvement journey, they increasingly realize critical decisions must be made early in a project's life cycle, and, consequently, those companies have started to shift their focus from *doing the project right* to *doing the right project right*. Companies realize that to develop a successful project it is essential to make the right critical business decisions early in the project life cycle (in the business planning phase). Many factors go into making project decisions early on.

These factors include the availability of business and financial information, basic and contextual project data, use of new technology, staffing requirements, and developing reasonably accurate early cost and schedule estimates. The robustness of a project's business case depends on this information and these decisions, and if key elements have not been properly evaluated, then the project's business objectives are likely unrealistic.

Challenges of the Business Phase

A weak business case can cause a great deal of harm to a capital project. Unfortunately, projects with less than robust business cases are not at all uncommon. More than other decisions points, there is no agreed upon standard of what constitutes an adequate—much less ideal—business case for new projects. There is considerable variability not only from company to company but also from project to project within a company. Finally, assurance processes tend to focus on technical case development rather than business case development (but again with lots of variability across and within companies).

Determining Project Viability

Once a company decides a capital project is appropriate to address a need or take advantage of an opportunity, critical issues must be considered to determine if the proposed solution has a viable business case:

- **Business Basics (Planning Process and Deliverables)**: the business case defines the assumptions and knowledge necessary to develop a financial case to support investment in a particular project. Although there are slight differences between owner companies regarding the type of business information required to justify a project, a few attributes must be included in some manner because of the structure of the economic return analysis. Project aspects that need to be assessed include comparative advantage, strategic fit, technology, financing, and commercial terms.
- **Financials**: the financials cover the various assumptions and principles driving the business case and the understanding of the business phase estimate. These attributes include revenue and cost projections, estimates

of the required investment, assumptions regarding the economic life of the asset, and an estimate of the cost of capital required to support the business opportunity. The integrity and quality of these attributes have a large effect on the probability of project success.

- **Location Factors**: the level of understanding of local requirements, site characteristics, and local operating procedures influences the outcomes of an opportunity. Location factors explore the context in which the new opportunity will be executed (environmental and regulatory requirements, local labor market, existing site issues, plant operations acceptance issues, etc.).
- **Scope Framing**: IPA research has found that certain practices followed (or omitted) in the process of determining project viability are causally related to project results. Poor conceptual engineering can harm a business case by making a project lose its competitive advantage over the long term. The project may meet the objectives but may not yield the maximum return possible without effective conceptual engineering. That is, activities that are not fully completed or exhausted during conceptual engineering cannot be made up during detailed scope definition. For example, failure to adequately consider OSBL, utilities, and/or offsites; risk management plans; work scopes; and so on will likely end up harming the business case.

How IPA Improves Projects in the Business Development Phase

IPA analyses early in the project life cycle can be tailored to the company's specific needs by assembling the right combination of IPA products. For example, after completing an Early Cost and Schedule Benchmarking study for a major new-to-region low-carbon project, IPA conducted a Project Viability Assessment to identify key shaping gaps and recommendations to strengthen the project's business case and minimize execution risk. Examples of available products that may be combined to address a company's specific needs include:

Business and Engineering Alignment Meeting (BEAM) is a structured and repeatable process, usually done as a workshop, that brings together the business sponsor and core project team members to align on project parameters.

Product Unit Cost Benchmark (PUCB) provides a realistic cost comparison basis for your early estimate. It represents how much capital Industry has paid, on average, per unit of product.

Project Viability Assessment (PVA) assesses the strength and feasibility of your project's business case.

Cost & Schedule Risk Analysis (CSRA) provides probabilistic cost and schedule outcomes and most likely range of results based on the quality of the estimates and other project characteristics.

Project Team Staffing provides optimal headcount by function for an effective project team and guides companies in setting up their project teams to serve as the foundation for project success.

For more information, please contact **René Klerian-Ramírez**, Product Development Leader for IPA's Project Evaluation System, at **rklerian@ipaglobal.com**.

Project Viability Assessment (PVA)

The Project Viability Assessment (PVA) measures the strength of your project's business case, shares insights into the likely outcomes, and provides actionable recommendations for improvement. Use the PVA determine if your business case is strong enough to set your project up for success.

Contact René Klerian-Ramírez at **rklerian@ipaglobal.com** or Swati Bhat at **sbhat@ipaglobal.com** for more information.

Members Gather for **CEC 2023 Meeting**

The annual meeting of the Cost Engineering Committee (CEC) took place September 19-20, 2023 in McLean, VA, with 37 member companies in attendance. The annual meeting is an opportunity for members to gather and discover the latest IPA research and industry trends; receive cost engineering tools, models, and metrics; and network and exchange practices with fellow cost engineering professionals.

IPA established the CEC in 1998 to advance the owner cost engineering and project controls capabilities of the world's leading industrial companies in capital-intensive sectors. As part of the CEC 2023 meeting agenda, new research was shared on the following topics in support of this objective:

Market Trends in Capital Projects

IPA provided a state of the industry in terms of the overall macroeconomic conditions and observed escalation on capital projects. We also discussed procurement trends based on IPA's proprietary database and we shared the industry perceptions on supply chain and escalation trends from the IPA Bi annual Market Trend Survey.

Project Control Organizations

This study, entitled Structure and Staffing of Project Controls Organizations, characterizes industry norms for Project Controls Organizations (PCO) with data collected directly from interviews with PCO teams, as well as insights gleaned from IPA's proprietary database. Past IPA research has shown the effects of PCO quality, and this presentation provided guidelines on the strengths and weaknesses of different organizational structures, staffing strategies, and hierarchies.

Estimate Quality

A strong basis of estimate (BoE) is critical to ensure the cost-efficiency of capital projects. IPA conducted a study in 2017 that established some Best Practices to achieve ±15 percent accuracy for Class 3 estimates. This study is an extension of the previous study that uses data collected at FEL 2 stage and FEL 3 stage evaluations. The study provides accuracy norms observed in the industry as well as the robustness of BoEs at FEL 2 and FEL 3 stage estimates.

Schedule Quality

This study provides a more robust measurement of schedule quality by quantifying the effects good schedule practices have on project outcomes. In our research, we have aggregated individual schedule quality metrics into an overall Schedule Quality Index (SQI) that links to improved schedule predictability and competitiveness.

Early Estimating & Scheduling: Past Study

IPA has received feedback from owner companies about their struggles with early (conceptual) estimating, especially for FEL 1/AACE Class V estimates. These estimates are generally prepared based on very limited information and subsequently have wide accuracy ranges. These FEL 1/Class V estimates are prepared for any number of strategic business planning purposes, such as market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs & budgeting, long-range capital planning, etc. This CEC 2023 study focuses on building tools that Industry can use in developing more centered estimates for cost and schedule as well as a better characterization of the estimate ranges, with the ultimate purpose of giving businesses the best information to make more effective decisions.

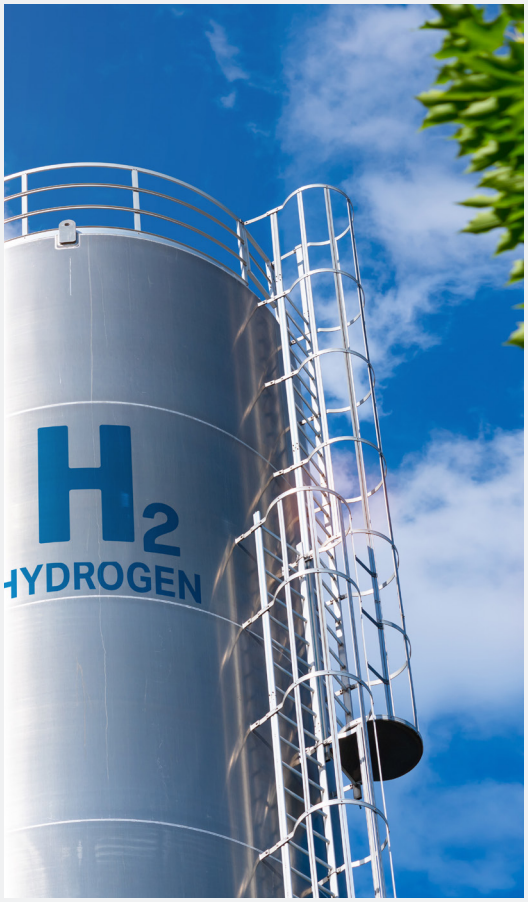
CEC Metrics & Tools

Additionally, IPA reviewed the latest cost and schedule metrics packages and tools, including focused sessions on each of the following:

- Schedule Duration Metrics & Tool
- Schedule Practice Metrics
- Cost Predictability Metrics
- CEC Cost Tools & Framework
- CEC Web Applications

How to Join the CEC

The CEC is open to owner companies interested in improving the cost engineering function within their organizations to ultimately improve business results. Contact Shubham Galav at **sgalav@ipaglobal.com** to request information on how to join the CEC.



Early Estimating Metrics for Green Hydrogen Projects

At the request of several owner companies, IPA is launching a multi-client research study to establish a suite of metrics to support early estimating for green hydrogen projects. Participating companies will be able to use the metrics for conceptual and feasibility estimate development, plus detailed estimate validation.

Contact Emily Nott at **enott@ipaglobal.com** to join the study!

Update to IPA's Project Data Portal Software Focuses on Improving User Experience

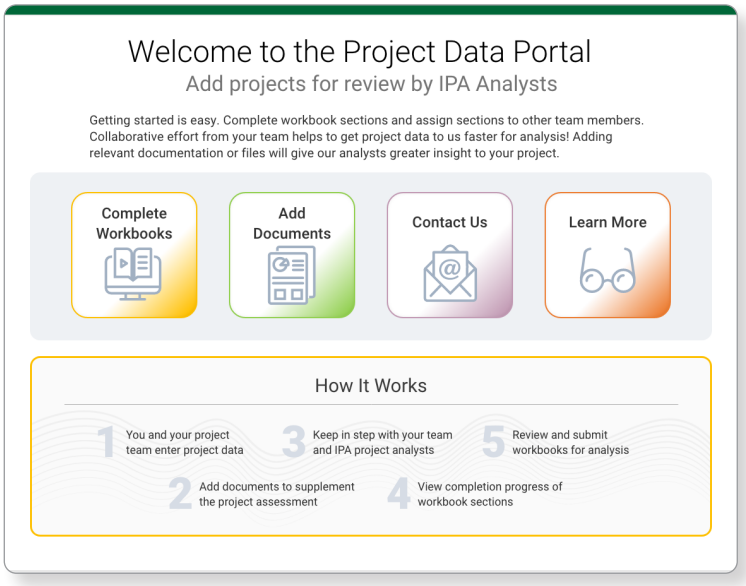
Independent Project Analysis (IPA) is in the process of updating its Project Data Portal (PDP), the online data capture tool that enables project teams to securely and easily submit project data to IPA for Project Evaluation System (PES®) assessments. The latest update aims to improve user experience and further reduce the effort for clients when providing project-specific data. IPA clients can expect to begin using the updated software in the first quarter of 2024, following testing with a selected group of projects during the fourth quarter of 2023.

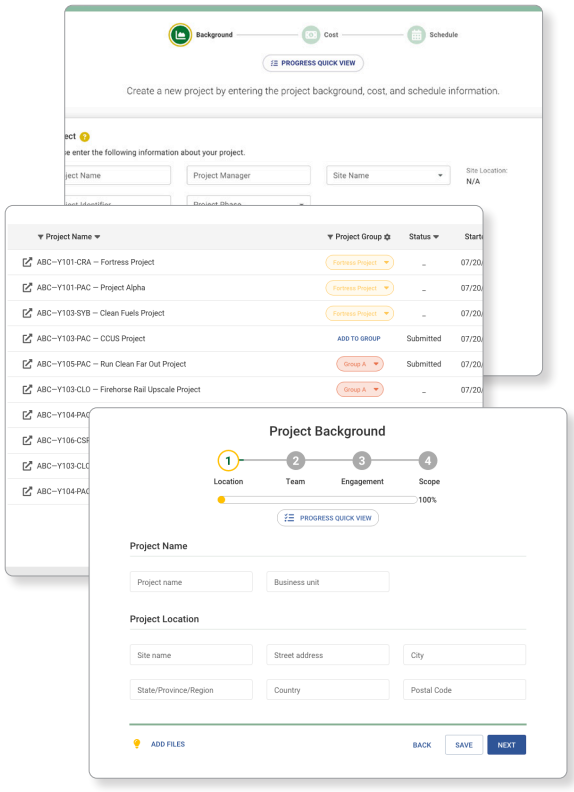
The PDP was launched in 2020 to streamline the data provision process for IPA clients. The web-based application captures project information all phases of a project's development, enabling for IPA to analyze the data multiple times across the project's life cycle. Existing functionality will be maintained for this update and some functionality will be added, including:

- Greatly enhanced user experience featuring an easy-to-use and intuitive interface and improved organization of workbooks designed for easy consumption
- Improved security, including two-factor authentication (2FA) log-ins
- Continued user capability to appoint and delegate completion of workbook modules to different team members
- Continued user capability to securely transmit supporting documentation files to IPA

Industry-leading owner companies have relied on IPA for decades to better understand their projects' risks, readiness, and performance. The PDP has proven to be an essential tool for our clients over the last several years by maximizing efficiency during the data gathering phase.

For more information, please contact René Klerian-Ramírez, Product Development Leader for IPA's Project Evaluation System, at **rklerian@ipaglobal.com**.





IPA News Highlights

Ed Merrow Talks Contracting Strategies on *Manage This* Podcast

Ed Merrow was the guest on a recent episode of the *Manage This* podcast. The twice monthly podcast is billed as a "podcast by project managers for project managers" and is hosted by Wendy Grounds and Bill Yates of Velociteach. This episode provided an opportunity for Ed to share insights into successful contracting strategies as outlined in his most recent book, *Contract Strategies for Major Projects*.
You can listen to the full 45-minute episode here.

Paul Barshop Steps Into New Global Director of Sustainability Role

Paul Barshop has returned to an IPA corporate role as Global Director of Sustainability, after spending the last several years in Singapore leading IPA's Asia-Pacific region. In this role, Barshop will lead IPA to adopt bold approaches to helping clients solve their sustainability challenges. He will work with clients to understand their vision of carbon management and provide leadership on IPA's research and development efforts to provide strategies and measurable performance indicators for sustainability and carbon reduction on capital projects.

Sally Glen Promoted to Director of IPA's Asia-Pacific Region

In her new role as Regional Director of Asia-Pacific, Sally Glen will oversee client engagements across the region and supervise capital project analysts, researchers, and support staff working from offices located in Singapore and Melbourne, Australia, where she is based. Having originally joined IPA in 2003, Glen has previously held the roles of Senior Project Analyst, Australia Director, and Mining, Minerals & Metals Business Area Manager.

Manoj Prabhakar Promoted to Singapore Office Director

Manoj Prabhakar will oversee the growth of staff and clients and a significant advancement of research and intellectual property innovation from IPA's Singapore office. He will support Sally Glen, IPA's Asia-Pacific Regional Director based in Melbourne, Australia. Since joining IPA in 2011, Prabhakar has held the roles of Associate Analyst, Senior Project Analyst, and Asia-Pacific Business Development Manager.

Adi Akheramka Assumes New Role as Carbon Management & Sustainability Manager

Adi Akheramka has been appointed to the role of Manager, Carbon Management & Sustainability, and has relocated from the United States to IPA's United Kingdom office in Reading. Akheramka will work with Global Director of Sustainability Paul Barshop and a strong and diverse team of analysts to continue progressing our mission to drive capital efficiency improvements for our client organizations as they advance their low-carbon and sustainability agendas.

Case Study: **Putting the Capital Project Process to Work**

The Problem

After working with IPA to develop a unifying project process across all its sites, a pulp and paper company returned to IPA for help with its implementation. This IPA client recognized that its newly developed capital project process would not improve project outcomes if it was not used properly. Seeking a company-specific plan, the client also came back to IPA for training that was tailored to the client's needs.

IPA's Solution

IPA had previously worked with this client to develop a fit-for-purpose process for capital project implementation across its sites. The sites had functioned independently in the past, without a common company process, leading to uneven project outcomes that relied heavily on team member experience rather than standardized guidelines based on Best Practices. The first goal was to devise fit-for-purpose guidelines for capital project development and execution that were aligned with the client's business needs, organizational structure, and competency framework. IPA developed a series of instructional guides to explain the main elements of the new capital project system.

After working with IPA to develop a robust and disciplined process for planning and executing capital projects, the next step was to implement that process and then maintain and improve it. IPA again partnered with the company to design and facilitate the roll out and upkeep of the process. IPA worked with client personnel to tailor the Best Practice project process to the company's needs. Training was done through jointly developed sessions that were intended to empower employees with the required knowledge and skills to apply the process.

To achieve these goals, IPA, in partnership with client management, delivered a 3-day training program designed to enable the participants to be able to:

- Describe the company's capital project process and explain the overarching theory that underpins it
- Locate the supporting documents and tools that provide detailed support in implementing the process

- Evaluate and select the most appropriate Best Practices for a given situation
- Contact subject matter experts within the company who can help with implementing specific tools
- Follow the process to schedule reviews, prepare deliverables, and schedule gate meetings

The ultimate goal for the participants was for them to be confident in their role as a project leader or team member. Both IPA and company personnel led the sessions and were available to answer questions.

What Did the Workshop Participants Learn?

The program is ongoing. It is updated periodically and all new employees go through the program as they join the company. The program allows company project personnel to both look at the process from a high-level view of how it is set up and what Best Practices it seeks to implement and then learn who to go to and how to carry out the process, down to specific information such as where the needed forms are located online and how to fill them out.

Participant Feedback: What Did You Learn?

Why we do certain things. I was exposed [to] and have done 90% of [the] course content, but [the] context of the value to schedule and cost was new and helpful.

Knowing the expectations at each FEL stage will help me better understand what my expectations should be.

The flow of work from FEL 1 to Gate 3. [I] Have not had a project go through this process yet but have 2 coming. I better understand the expectations and steps necessary.

This was my first exposure to the [company] project management FEL stage gate process.

The importance of taking more time up front with projects to avoid mistakes and promote project success. It will also speed up the remaining parts of the project.

Understanding of the background and intent of the FEL process and elements.

Contact Andrew Griffith at **agriffith@ipaglobal.com** for more info.

Partner With the IPA Institute to Address Your Organization's Training Goals

The IPA Institute partners with owner organizations to develop private training seminars that directly address company-specific goals. Our in-house courses are company-focused, customizable, more cost-effective for training large groups, and can be delivered at the location of your choice—whether in a traditional classroom setting or online.

Contact Andrew Griffith at **agriffith@ipaglobal.com** to request more information!

THE IPA INSTITUTE

Advancing Project Knowledge

Risk Identification Lessons for Capital Projects

By Swati Bhat, Deputy Director, Project Evaluation

All capital projects face risk—and some face risk of events that can derail the whole effort, leaving the company worse off than if it had done nothing in the first place. Why is the consequence of these risky events—catastrophic or not—so hard to foresee? Why is it so difficult for companies to plan for and mitigate against capital project risks? What should the risk identification process look like?

What Are Project Risks?

Before we can answer those questions, let's look at what risks are in the context of capital projects. Project risks come in many forms. Risks can be technical or non-technical. They can be political, driven by new or existing rules and regulations, or the result of supply chain breakdowns or skilled labor shortages. Some are easily anticipated—like the risk of implementing new technology—though the magnitude of what can go wrong is often underestimated. Others are hard to foresee—like a global pandemic.

Projects face different risks as they progress from business idea to definition to execution and startup. Risks in the business planning phase might involve getting on the same page as other participants in a joint venture or securing a buyer for the intended end product. During project definition, failing to identify the project scope and fully define it raises the risk of errors and changes later in detailed engineering and construction. When a project moves into construction, it faces risk of lack of skilled labor, strikes, and adverse weather events, among many others.

Why Do We Fail to Identify Project Risks?

Identifying risks—at all stages of the project lifecycle—is difficult for many reasons. In the business planning phase, early in project lifecycle before the execution team is assigned, it is hard to anticipate what problems the project might face in execution—or even later in startup. In addition, at this early stage, we tend to dismiss future risks, thinking they won't happen to us or to our project. In the absence of data, humans do err on the "we can manage it" side—a phenomenon known as optimism bias. However, this is the best time to identify showstopping risks the project may face in future phases. The earlier these risks are identified, the sooner companies can determine whether the project is in fact viable. Discovering them later in the project life cycle leads to higher sunk costs.

In addition, the risk assessment process itself is flawed. The focus of risk identification is often too narrow, does not involve the right people, and is done in the absence of solid data. Sometimes, team members lack the experience needed to fully identify risks. As a result, the process often does not identify show-stopping risks at the earliest possible opportunity to identify threats to the viability of the future asset or project.

Finally, few companies take the time to analyze their projects after they are completed to derive lessons learned that can be used to improve the outcomes of future projects in their portfolios. Often the team members have moved on to other projects before a lessons learned workshop can be conducted. For companies that do take the time to collect lessons learned, organizing them so they are easily accessible and useful for future projects often proves difficult.

New Technology Risk Analysis

New technology commercialization projects take longer to start up, require more contingency, and often take longer to reach steady operation than projects using proven technologies. If your project involves a new technology step-out, you need to understand the risks before it's too late. Make the New Technology Risk Analysis a part of your plan.

Contact Michael McFadden at **mmcfadden@ipaglobal.com** to start a discussion!

IPA's Approach to Risk Identification: Using Lessons Learned From Past Projects

To help companies identify risks that a planned project faces—independent of internally identified risks—IPA looks to the risks identified, and the risk outcomes, for similar projects. This is difficult for an individual company to do but possible for IPA given our extensive database of past projects, including detailed histories for the projects we analyze. Our projects database includes extensive information for each project we have analyzed, including critical driver metrics, execution plans, cost estimates, field development plans, and native schedules, as well as the detailed and sequential history. An IPA project risk evaluation uses those detailed case histories for completed projects, and related relevant research, to quantify the effects of certain incidents on outcomes.

Using IPA's database, we can investigate the frequency and effect of these actual project incidents on the project's cost, schedule, and ultimate success to understand how they affected similar projects and provide relevant mitigation strategies based on our historical experience with similar projects.

Case Example: Evaluating the Risks Similar Projects Faced to Assess Current Risk

An oil & gas client planning a complex onshore/offshore megaproject came to IPA attempting to avoid the poor outcomes that had occurred on its other past projects. The goal of this engagement was to identify the risks this planned megaproject might face to implement relevant mitigation strategies and achieve successful project outcomes. To support this company's effort, IPA looked at the lessons learned from similar projects to determine what risks they faced, how they did (or didn't) mitigate against those risks, and what effects these risk incidents had on the projects.

To start, we drew a sample of similar projects from our vast database of projects to understand the risks similar projects experienced and the effect those risks had on project outcomes. From this group of similar projects, we created a register of incidents, which included the incident description, cause, quantified incident effects, and mitigations. We used the detailed information we have for each project in our database (collected as part of every project analysis) to support this effort.

IPA then sorted the incidents and their causes into themes and analyzed the distribution and frequency and the cost and schedule effect of each incident theme (see **Figure 3**).

Overwhelmingly, the most frequent incident types historically applicable to this type of megaproject were quality-related, followed inspection. On average, the effect of quality-related issues was schedule slip of 8 months.

One example of a quality incident is construction delays that arose because rigorous equipment quality assurance was not done. The team depended heavily on contractors for factory acceptance testing (FAT) and quality assurance/quality control (QA/QC) inspections, lacked an owner quality process, and relied on inexperienced contractor personnel. Having dedicated FAT personnel who can create structured, owner-led equipment testing regimes mitigates against this risk. These personnel must ensure QA/QC expectations are understood and that the FAT outcomes are addressed in the contingency plans.

For more information about how IPA can help your company with risk identification for capital projects, contact Swati Bhat at **sbhat@ipaglobal.com**.

Megaproject Dataset Incident Frequency

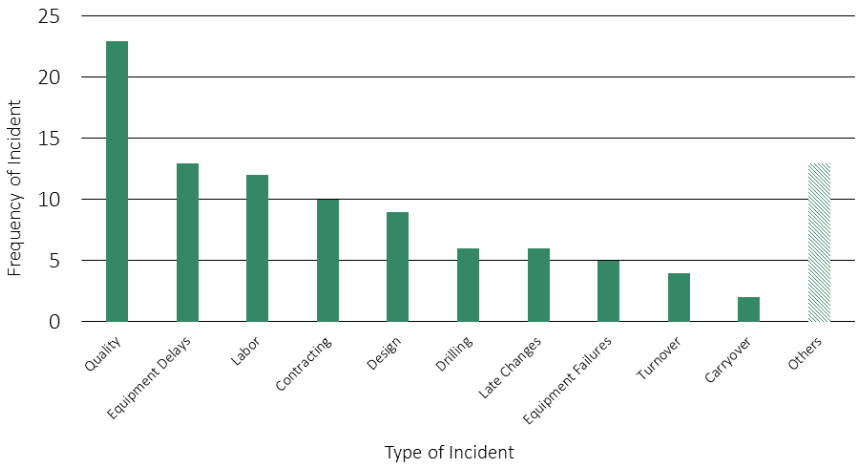


Figure 3

IPA Events and Presentations

Upstream Industry Benchmarking Consortium (UIBC)
November 13-15, 2023
McLean, VA

The UIBC provides an independent forum for each participating exploration and production (E&P) company to view key metrics of its project system performance such as cost and schedule, Front-End Loading (FEL), and many others against the performance of other companies and share pointed and detailed information about their practices. The consortium highlights Best Practices, reinforcing their importance in driving improvements in asset development and capital effectiveness.

Industry Benchmarking Consortium (IBC)
March 18-20, 2024
Lansdowne, VA

The IBC is a premiere group of the world's leading industrial companies in the processing, refining, infrastructure, and mining and minerals sectors. IBC member companies receive exclusive insights into how their capital project systems and outcomes stack up against their industry peers with respect to safety, cost, schedule, and operational performance. IPA helps each company to assess the strengths and weaknesses of its project system and map out a plan for improvement.

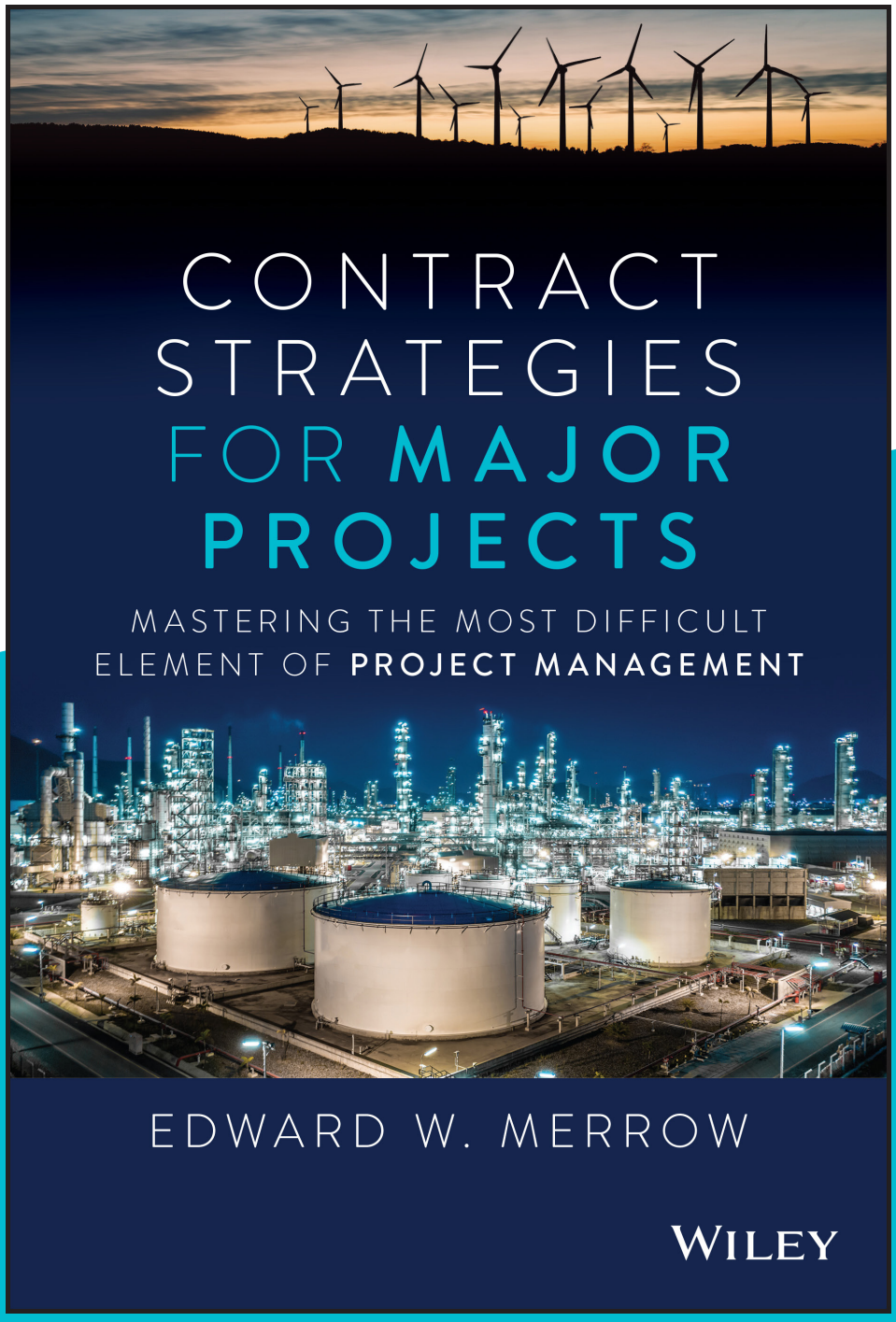
2023 IPA Institute Course Schedule

In-Person Courses	Dates	Language	Click to Register
Contracting Strategies for Major Projects **Abu Dhabi, United Arab Emirates**	October 9 & 10	English	REGISTER
Best Practices for Site-Based Projects **New Orleans, LA, USA**	October 17 & 18	English	REGISTER
Megaprojects: Concepts, Strategies, and Practices for Success **Houston, TX, USA**	December 5–7	English	REGISTER
Virtual Courses	**Dates**	**Language**	**Click to Register**
Front-End Loading and the Stage-Gated Process	September 27 & 28	English	REGISTER
Project Management Best Practices*	October 2–6	English	REGISTER
Capital Project Execution Excellence and Project Controls	October 11 & 12	English	REGISTER
Establishing Effective Capital Cost and Schedule Processes*	October 23–27	English	REGISTER
Front-End Loading (FEL) and the Stage-Gated Process	October 24 & 26	Spanish	REGISTER
Project Stakeholder Alignment Through Successful BEAM Implementation	November 1	English	REGISTER
Gatekeeping for Capital Project Governance	November 7–9	English	REGISTER
Capital Project Execution Excellence and Project Controls	November 28 & 29	English	REGISTER
Project Management Best Practices*	December 4-8	Portuguese	REGISTER
Project Management Best Practices*	December 11–15	English	REGISTER

***Group Discount Available:** Register 3 and send a 4th for free!*

THE IPA INSTITUTE
Advancing Project Knowledge

About the IPA Institute The IPA Institute is the training and education division of Independent Project Analysis (IPA), the world's leading advisory firm on capital projects. Our courses equip industry leaders and capital project practitioners with Best Practices for projects, portfolio, and project system management/delivery. All course instruction, presentations, and supplementary course materials are rooted in IPA's unparalleled capital project knowledge and research, and based on data from IPA's proprietary project database.



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