



White Paper

The 4-Step Guide to Mitigating Top 10 Risks in Power Projects

By Ray Williams and Pete Ruestman, ICF

Shareables

- ICF has identified the top ten most common risks to project completion grouped by: Engineering and Construction Risks, Equipment Risks, and Fuel Quality and Delivery.
- Liquidated Damages for gas turbine and combined cycle projects will be in the \$100,000 to \$300,000 per calendar day range.
- An understanding of which party is responsible for what parts of the project, as well as, which parts are negotiable is key to mitigating future risks for all parties aside.

Executive Summary

Every project risks potential pitfalls that can dent the budget and portfolio of any developer/financier. These risks to timelines and budgets are prevalent across generation technologies, geographical regions and sizes of projects. While these risks cannot be entirely avoided, there are four simple and proactive actions that project developers can take to mitigate or avoid risks. While they may seem rudimentary, taking into account the intricacies that underlie these steps will provide immediate long-term project benefits.

Substantial Completion Criteria

The Plant will be deemed ready for Substantial Completion when all of the following have occurred:

1. The Plant is substantially and materially complete and has been fully designed, constructed and equipped
2. All Governmental Approvals can be assigned or transferred
3. All Equipment and systems are operational
4. All Owner-specified Performance, Commissioning and Functional Tests have been successfully completed.

Four Proactive Actions

1. Selecting the Right EPC Contractor

Selecting the right Engineering, Procurement and Construction (EPC) Contractor with the appropriate engineering provider and construction entity is the most important action a developer will take to benefit the project. The developer must ensure the EPC entity is well-qualified for the specific type of project and this requires going beyond

- Review of resumes and qualifications
- Review products from past projects provided by the EPC entity
- Thorough vetting of past schedules of projects and success rate of meeting schedule
- Interviewing former clients/partners

2. Selecting the best generation technology from the right Original Equipment Manufacturer (OEM) for the project

The best generation technology solution for every project is unique. Selection will be based on numerous considerations and the developer's objectives. Selecting generation technology for your project that is a prototype or first of a new or scaled up technology would bring unnecessary risk to the developer and project.

- Holistic review of pricing, supply, equipment and schedule options from the right OEM
- Identifying value differentiators from top OEM's
- Documented successful long-term performance

3. Prepare EPC & Equipment Purchase Agreements with appropriate liquidated damage provisions

It is of critical importance for the developer to include appropriate liquidated damage (LD) amounts and caps in agreements with EPC contractors or OEM's. Liquidated damage amounts and caps provide the developer with an important risk mitigation tool for EPC project schedule delays. The developer should include in the EPC agreement a daily liquidated damage amount and a total cap amount for EPC responsible delays beyond a very well defined and specific milestone.

- Develop a sound "Reaching Substantial Completion" milestone to develop Liquidated Damages (LDs) around
- Additional LDs will be prepared for generation equipment delivery delays, performance shortfalls and not meeting guaranteed emission limits
- Identify the OEM's specified period to remedy the performance or emissions issue before LD's are applied



4. Preparing contingencies and resources to mitigate problems when they arise

A developer who has his/her financial resources set aside and industry experts identified and available will be in a good position to begin mitigation of common risks such as the ten common risks identified below. Developers should include an appropriate contingency amount in project financials for possible risks that can develop during the EPC of the power generation facility. The contingency amount will depend on many factors but mainly on project financing requirements such as:

- Develop an appropriate contingency amount in project financials for possible risks
- Developers should also have plans to obtain experts across a broad range of specialties to ensure the project keeps moving forward
- Agreements and contracts with outside experts should be completed before construction begins

Ten Common Risks in EPC

Risks are inherent throughout the EPC stages of a power generation facility. The risks can be grouped together by the responsible entity for mitigation and resolution. Typically, the EPC contractor will be responsible for resolution of engineering and construction issues, the OEM will be responsible for resolution of equipment issues and the fuel supplier for fuel delivery and quality issues. By following the four proactive actions above, you can reduce the possibility for negative outcomes from the following ten common EPC risks.

Engineering and Construction Risks – EPC Contractor Responsibility

- 1. Late Engineering Deliverables** – Prior to execution, the developer needs an EPC contractor with the right experience on the specific type of project and technology. The EPC must provide a defensible schedule of activities to the developer before breaking ground and the schedule for engineering deliverables should be tracked and updated regularly. Critical deliverables should be assigned LDs for later than scheduled deliveries.
- 2. Engineering Errors and Omissions** – The EPC is responsible for engineering errors and omissions ("E&O") to which they, or their consultants, commit. When an error or omission is discovered during the project, the engineering entity will be required to provide a recovery plan to resolve. The EPC or engineering provider should provide E&O liability coverage as part of the agreement.
- 3. Out of Ordinary Weather Events** – Project construction can be greatly impacted by severe weather conditions. Thus, it is important that the EPC contractor be experienced enough, and have some alternative plans and procedures to mitigate these effects. Additionally, an EPC contractor that has an experience of "bouncing back" from an act of nature that forced changes in the schedule are valuable partners to have.



- 4. Labor Productivity Shortfalls** – If labor productivity falls below the acceptable rate of performance, having an experienced EPC contractor that can provide improvements and adjust the schedule to make up for the time lost becomes necessary. Look for an EPC contractor that utilizes quantity installed reporting and earned man-hours progress tracking that will be able to monitor labor productivity and make timely corrections to improve productivity.
- 5. Changed/Differing Site Conditions** – Either the developer or the EPC contractor can contract for the geotechnical investigation and report. From a developer's perspective it is preferable for the EPC contractor to take the responsibility and risk. Occasionally, the geotechnical investigation and report does not accurately reflect the actual soils or subsurface conditions discovered which can lead to a claim for changed or differing site condition. When a changed or differing site condition is found, it can create major delays during the project. Selecting the right EPC contractor and tasking them with the geotechnical investigation will help mitigate the effects of changed or differing site conditions.
- 6. System Cleanliness Issues** – Acceptance criteria for internal piping and equipment system cleanliness is defined by the rotating equipment and power generation equipment OEM. Since the EPC contractor typically will not have the capabilities to perform these requirements it is common for the EPC to subcontract with a third-party specialty cleaning contractor acceptance to the OEM.

Equipment Risks–Original Equipment Manufacture – Oem Responsibility

- 7. Late Equipment Deliveries** – Lead times of 18 months aren't very uncommon for some project generation and process equipment. A good EPC contractor will provide appropriate durations in the schedule for the submittal of approvals and manufacture hold points for OEM manufacture, approvals and delivery of equipment. The EPC contractor should have dedicated personnel to expedite and "shop" inspect schedule sensitive equipment.
- 8. Equipment Performance Shortfalls** – Either the developer or the EPC contractor will contract for the major generation equipment. Typically, the EPC contractor procures directly from the OEM or is assigned the purchase agreement that the developer has entered into with the OEM. The equipment purchase agreement will include guaranteed performance standards for the equipment backstopped with LDs. When a performance shortfall is identified it is most often at the end of a project when it can have significant impact to both cost and/or schedule to remedy.

9. Emissions Limits Shortfalls – The equipment purchase agreement between the EPC contractor or developer and the OEM will have emission guarantees backstopped with LDs. Typically, emissions testing is one of the last activities before reaching a substantial or final completion and therefore is critical for successful completion. A developer who works with their EPC contractor to ensure the right equipment is purchased, installed and maintained correctly and has appropriate LD guarantees can effectively avoid these risks.

Fuel Quality and Delivery – Fuel Supplier Responsibility

10. Out of Specification Fuel – In the case of hydrocarbon fired assets and prior to financing, a fuel-supply agreement will be reached with one or several hydrocarbon fuel (natural gas, fuel oil, coal) suppliers. Fuel agreements should define minimum specifications and delivery conditions for the fuel source that meets minimum requirements defined by OEM. If fuel does not meet OEM and fuel supply agreement requirements, the supplier should have a defined remedy period to correct before LDs are applied. Having the appropriate fuel specification provided by the generation equipment OEM adopted in the fuel supply agreement is of critical importance to the project's success.

Consequences of Not Mitigating EPC Risks

The results of not mitigating EPC risks by developers can be costly even if backstopped by LD's to the EPC contractor or OEM's. Typical LD amounts in EPC agreements between developers and EPC contractors for gas turbine and combined cycle projects will be in the \$100,000 to \$300,000 per calendar day range and often there will be no limit to the total damages. Developers and owners are at risk with similar damage amounts in their agreements with financiers, and power sales and marketing entities. Project pro-forma will be based on being able to generate and sell electrical output from the facility starting on a specific commercial operations date. Delays to the completion schedule caused by any of the above risks which delay selling of energy or capacity from the facility will have serious financial consequences to both the developer and the EPC contractor. By taking the four proactive actions noted above, power developers will be able to mitigate the damage and consequences of common risks encountered in the EPC of Power Generation Projects.

About ICF

ICF (NASDAQ:ICFI) is a global consulting and technology services provider with more than 5,000 professionals focused on making big things possible for our clients. We are business analysts, policy specialists, technologists, researchers, digital strategists, social scientists, and creatives. Since 1969, government and commercial clients have worked with ICF to overcome their toughest challenges on issues that matter profoundly to their success. Come engage with us at icf.com.

About the Author



Ray Williams is a Technical Director providing expertise in the Engineering, Procurement and Construction (EPC) for Power generation facility development and financing in the Independent Engineering and Owner's Advisory role. Ray has over 39 years of experience in energy facilities engineering, procurement and construction in increasingly more responsible technical and management roles. Ray has worked for both owner/operators and for construction contractors on various technical challenging EPC projects. Mr. Williams obtained a Bachelor Degree in Civil Engineering Technology from Colorado State University-Pueblo.



Pete Ruestman has over 32 years of experience in power generation including Testing and Troubleshooting, Operations and Maintenance, Rate Cases, Construction, Commissioning, Research and Development, Product Development, Performance Improvement, and Independent Engineering. Given his diverse background, Pete supports projects in all phases of due diligence from the pre-financing support to financial close, construction monitoring, commissioning and annual budget/performance monitoring over the term of debt. He has spent a good portion of his career pursuing and developing international markets. He holds a Bachelor of Science in Mechanical Engineering received from the University of Missouri - Rolla and a Master in Business Administration from Southern Methodist University. He is a registered Professional Engineer in the states of Texas and Missouri.

For more information, contact:

Ray Williams

raymond.williams@icf.com +1.970.372.3932

Pete Ruestman

pete.ruestman@icf.com +1.970.372.3939

- facebook.com/ThisIsICF/
- twitter.com/ICF
- youtube.com/icfinternational
- plus.google.com/+icfinternational
- linkedin.com/company/icf-international
- instagram.com/thisisicf/

Any views or opinions expressed in this white paper are solely those of the author(s) and do not necessarily represent those of ICF. This white paper is provided for informational purposes only and the contents are subject to change without notice. No contractual obligations are formed directly or indirectly by this document. ICF MAKES NO WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, AS TO THE INFORMATION IN THIS DOCUMENT.

No part of this document may be reproduced or transmitted in any form, or by any means (electronic, mechanical, or otherwise), for any purpose without prior written permission.

ICF and ICF INTERNATIONAL are registered trademarks of ICF and/or its affiliates. Other names may be trademarks of their respective owners.

