

# Guidelines for Performance-Based Contracts for Fossil Fueled Power Plants

*Technical Report*





# **Guidelines for Performance-Based Contracts for Fossil Fueled Power Plants**

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# REPORT SUMMARY

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Contracts, which enable a plant to outsource work, are an important component of the economic and operational success of a power plant. Traditional contracts embody an agreement between contracting parties wherein a contractor performs a scope of work, within a prescribed timetable, and typically for monetary compensation. Performance-based contracting, on the other hand, rewards good results with bonuses and punishes bad results with liquidated damages. This report specifically focuses on performance-based contracts and offers guidelines for negotiating and administering performance-based contracts for outage and maintenance work at fossil fueled power plants.

## Background

Performance-based contracts are a win-win undertaking for both parties involved in the negotiation. These contracts ensure that required performance quality levels are achieved and that total payment is related to the degree to which the services performed meet or exceed contract standards. Performance-based contracts specifically describe the expected and required results of the work to be performed. They use measurable performance standards and quality assurance plans to oversee and evaluate the work. Familiarity with and the use of performance-based contracts can lead to the creation of business relationships that recognize the efficient and effective nature of these arrangements and build an atmosphere of trust, which may lead to mutually beneficial teaming arrangements, alliances, or partnerships.

## Objectives

- To provide power plant personnel with a definition, overview, and understanding of the advantages of performance-based contracts versus traditional types of contracts
- To provide guidelines for power plant managers to use in negotiating and administering performance-based contracts for outage and maintenance work at fossil fueled power facilities

## Approach

Based on research compiled by Framatome ANP, Inc., this report provides a thorough description of the key elements and importance of performance-based contracts.

## Results

This report provides a general definition of performance-based contracts versus traditional contracts. It further defines the various elements of any contract, such as the scope of work, schedule, cost, quality of work, and a statement of the safety program in place for the work. Different types of contracts are outlined and defined as are types of services that might be outsourced. Finally, an overview of performance measures used to determine the success or

failure of the contracted work, a description of incentives, and guidance for overseeing a contract are included. All of this information will serve as a blueprint for power plant management to effectively negotiate and administer performance-based contracts for outage and maintenance work.

### **EPRI Perspective**

It is EPRI's goal to assist power plants in more effectively and efficiently operating their facilities. With this report, EPRI is assisting power plant managers in gaining a better understanding of when and under which circumstances performance-based contracts are most effectively used. Most importantly, the information provided also helps power plant managers to outsource work through a contractor with the overall goals of encouraging and rewarding excellence, providing for continuous improvement, and ensuring the timely completion of necessary work.

### **Keywords**

Outage

Contract

Performance-based

Contractors

Vendors



# ABSTRACT

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As companies continue to do more with less, outsourcing of work is becoming more frequent in power plants. This report focuses on establishing contracts to outsource work and, in particular, it describes the inherent advantages of negotiating and establishing performance-based contracts. Performance-based contracts ensure that required performance quality levels are achieved in the contract work being performed and that total payment for the work is related to the degree to which the services performed meet or exceed contract standards.

Performance-based contracts specifically describe the results required of the work, and they define measurable performance standards and quality assurance oversight plans for the contracted work to be performed. A performance-based contract also specifies procedures for reducing fees or pricing when services are not performed or do not meet the contract requirements. When appropriate, performance incentives can also be included and defined.

This report outlines the elements of performance-based contracts such as the scope of work, scheduling, cost, quality of work expected, and safety provisions that are to be in place. Different types of contracts are defined as are types of services that are favorable for outsourcing. The final sections of the report describe how to measure the level of performance quality in the work being performed, ascribe incentives, and assign responsibility for contract oversight. All of this guideline information can be used as a blueprint for power plant management to effectively negotiate and administer performance-based contracts.



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# 1

## INTRODUCTION

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### **Purpose**

The purpose of this report is to provide guidelines for management in negotiating and administering performance-based contracts for outage and maintenance work at fossil fueled power facilities. These guidelines will help the management team to better understand when and under what circumstances performance-based contracts are best used, and how to establish a contract with the overall goals of encouraging and rewarding excellence while providing for continuous improvement and ensuring the timely completion of work.

### **General**

Performance-based contracting differs from traditional contracting methods in significant ways. It is worthwhile to consider some of the key differences.

Traditional contracting calls for an agreement between contracting parties wherein the contractor performs a scope of work within a prescribed timetable and typically for monetary compensation. If the price is fixed, the contractor has an incentive to perform the work as inexpensively as possible to improve the contractor's profit. If the price is a variant of a "cost plus" contract, the contractor does not have the same incentive to perform the work as efficiently or as timely as they might otherwise. In the latter case, the owner has to take more control over quality and schedule outcomes; otherwise, costs may escalate beyond budget.

The traditional approach encourages an adversarial relationship between owner and contractor, especially if the price is fixed and competitive bidding has taken place. Contractor claims of additional compensation, overpriced extras, and delays are frequent issues. In the worst cases, these contracts wind up in arbitration or in the civil courts. In cases that are settled, one party or the other often feels that they have been taken advantage of.

In contrast, performance-based contracting is intended to create a non-adversarial contracting relationship by rewarding good results with bonuses and punishing bad results with liquidated damages.

Performance-based contracting methods are intended to ensure that required performance quality levels are achieved and that total payment is related to the degree that the services performed meet or exceed contract standards. Performance-based contracts describe in specific terms the results required of the work. They use measurable performance standards and quality assurance surveillance plans. The contract specifies procedures for reduction of fees (for time and material

contracts) or reduction to the price (of a fixed-price contract) when services are not performed or do not meet contract requirements. It also includes performance incentives where appropriate.

Plant and contractor personnel should receive training so that each is familiar with performance-based contracts and how they are a win-win proposition for both parties. Supervisory and managerial personnel of contracting parties need to be familiar with the requirements in order to work together and accomplish their goals.

Familiarity with and use of performance-based contracts may lead to the creation of business relationships that recognize the efficient and effective nature of these arrangements. They may also build an atmosphere of trust that can then lead to teaming arrangements, alliances, or partnerships to the mutual benefit of the contracting parties.



# 2

## TERMS AND DEFINITIONS

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**Contingency** – A dollar amount or percentage added to the cost estimate or contract value to cover unforeseen costs.

**Cost Plus Contract** – Contract that pays the contractor for their incurred cost, plus profit and overhead at a fixed rate or fixed sum.

**Cost Report** – Financial report submitted by the contractor that lists the costs incurred for each cost account item, typically work breakdown structure (WBS) items. Generally, such a report will include a forward-looking cost estimate based on the actual costs incurred, completion status, and the projected completion schedule.

**Critical Path** – The sequence of activities upon which the overall completion date of the project is dependent. A delay in the critical path has a direct impact on the entire project's schedule.

**CPM Schedule** – A schedule based on the Critical Path Method (CPM) of analysis. A CPM Schedule is used to plan the work, schedule time and resources, track progress, and calculate effectiveness.

**Earned Value Analysis** – Method of calculating the progress of a project or amount payable to a contractor based on measurement of work task and schedule completion.

**Escalation** – A rate, expressed as a percentage, by which future costs or payments will be increased. The escalation rate is generally fixed to a financial index related to the cost of money, labor, or materials in future years.

**Front End Loaded Costs** – Costs charged or payments made at the outset of the work. When on a percentage basis, costs of project startup are high as compared to total project costs.

**Hold Point** – A point defined in the schedule at which a work activity is suspended so that a quality assurance activity can be performed or validated.

**GMP** – Guaranteed Maximum Price.

**Level 1 Schedule** – The outage Level 1 Schedule provides an overall view of the outage plan, schedule, and key milestones, including shutdown and startup. This schedule provides baseline versus current projection capability and serves as the basis for periodic management reviews. This schedule shows start dates and ending dates for major activities planned for the outage.

**Level 2 Schedule** – The outage Level 2 Schedule is a summary of outage work activities. It includes sufficient detail to define the critical path and to provide a basis for monitoring and controlling actual versus planned work performance.

**Level 3 Schedule** – These schedules are detailed logic-based schedules developed for projects or other complex work evolutions in support of summary work activities in the Level 2 schedule. Their purpose is to provide the project manager or outage project lead with sufficient understanding of job interrelationships and requirements of day-to-day management to enable anticipating and avoiding potential problems. Detailed schedules are generally developed independently and later merged to form the integrated outage schedule.

**Liquidated Damages** – A financial penalty for failure to complete an activity in accordance with the contract terms.

**Loaded Payments** – see Front End Loaded Costs.

**Milestone** – A significant or important event of zero duration that summarizes the start or completion of one or several related activities or decisions.

**Overruns** – Costs or schedule time usages in excess of what is specified in the contract.

**Performance-Based Contracts** – Contracts designed to ensure that a specified level of performance quality is achieved and that payments for work are keyed to measures of performance of the work. Performance-based contracts provide the contractor incentives for a specified work result and penalties for failure to achieve the specified work result.

**Punch List** – A checklist itemizing activities that require completion and generally used to measure remaining work when the overall project nears completion.

**Qualitative Measure** – A measure that expresses a categorization of performance, such as the terms *satisfactory* and *unsatisfactory*.

**Quantitative Measure** – A measure that expresses an explicit quantity of performance, such as a measure of actual man-hours or dollars expended.

**Resource Leveling** – A method of analysis in which scheduling decisions are based on resource management concerns.

**Retainage (or Retention)** – An amount withheld from a contract payment until such time as completion is fully verified. A retainage is used as a financial incentive for the contractor to fully complete the work.

**Substantial Completion** – A level of completion wherein the component or system is installed, tested, and operationally ready for service.

**Target Man-Hours (MH)** – Allotment of man-hours set forth in the contract. A performance-based contract provides incentives for the contractor to complete the scope of work within the allotted man-hours or incur a penalty for man-hour expenditures in excess of the allotment.

**Target Price** – Price set forth in the contract. A performance-based contract provides incentives for the contractor to complete the scope of work within the target price or incur a penalty for costs in excess of the target price.

**Underruns** – Costs or schedule time usages less than what is specified in the contract.

**Work Breakdown Structure (WBS)** – Chart used to list tasks for each project that separates tasks and shows time and resources required to complete. The chart is then used to develop a schedule.

**Work Authorization** – A contract addendum that is used to authorize the scope of work to be performed in accordance with the requirements, terms, and conditions of the contract. Work authorizations are generally used to authorize a contractor to perform additional work under a previously executed contract.



# 3

## CONTRACT OBJECTIVES

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### General

A contract is needed when a plant wants an outside organization to perform work. The contract is a legal document that states the technical requirements, general terms and conditions, what is expected from each party to the contract, and remedies for non-performance.

The technical requirements will include major sections that define the scope of work and technical specifications that determine the quality of work expected to be produced. A timetable of key milestone dates must be included as well as the contractors' pricing and payment details. Each of these sections has to be clearly stated and defined so that there is no question of what is contracted for and expected. While there are almost always ambiguities, changes, and clarifications needed, the goal is to minimize these problems. All of this relates to a traditional contract as well as forming the core of a performance-based contract.

The performance-based contract goes a step further by promoting in several ways superior performance by the contractor. Financial incentives may be offered for or based upon several different milestones. These may include the following:

- Early completion of work
- Outstanding technical performance of key equipment
- Minimal re-work required of key operations (for example, welding)
- Smooth and orderly startup
- Few, if any, lost-time or more serious accidents
- Dollar volume of cost savings initiated by the vendor

Alternatively, if the contractor fails in these areas, they may be subject to a financial penalty or sanctioned from doing further work. For example, should the plant not be returned to service on schedule due to the fault of the contractor, the contractor may be required to pay liquidated damages that could amount to many thousands of dollars for each day of delay.

The following sections discuss major areas of the contract documents.

## **Scope of Work**

Generally, the scope of work identifies the specific work to be completed and defines the requirements in clear, concise language. In addition, drawings and detailed lists may be used to help define the scope. Multiple scopes under one contract for the same contractor need to be itemized and detailed individually for clarity of the requirements for each scope, particularly if they are set up with individual incentives. A division of responsibility (DOR) document is suggested in cases of multiple overlaps and interfaces. In the case of a scope of work having several tasks that are required, the expectation and deliverable for each task must be defined.

When preparing a scope of work, it is preferable to describe and detail the required deliverables or work product rather than the means and methods of how the work should be performed. It should enable assessment of work performance against measurable performance standards or expectations. It should rely on the use of these measurable performance standards and financial incentives in a competitive environment, encouraging competitors to develop and institute innovative and cost-effective means and methods of performing work. The requirements need to be defined as precisely as needed so that they are not combined into too few groups or into a single category that is too broad for the plant or contractor to understand and manage effectively.

## **Schedule**

The required schedule should be clearly shown in the contract.

Schedules for work other than outages may need to be defined as regular work hours or when work can be accomplished. At times, work may be required off-shift or off-site. It must be clear what the schedule requirements are for the plant's operation so that the contractor can plan the resources required to meet that schedule.

If the contract is for an outage, the duration of the outage and the duration of specific tasks should be stated. In the case of an outage, there may be several other projects or tasks that are tied to what a contractor may be doing. These should be shown on the schedule as prerequisites, and the ties to other tasks should be clearly shown. The consequences of not completing certain key tasks on schedule should be defined as well as any bonuses earned for early completion. These will be discussed more fully in Section 7.

On large outages, a critical path method (CPM) schedule should be prepared. A Level 1 schedule should be issued to the contractor for review. The owner and the contractor should work together on the outage team to further develop the Level 2 schedule. The contractor and the owner should then further refine the schedule to show work at the work-package level (Level 3) [1]. The use of work breakdown structures (WBS), resource leveling, cost reporting, and earned value analysis reporting is encouraged on large outages but may not be practical on smaller outages. These schedules, acting as tools available to the outage and project teams, are a part of the overall outage planning process that the owner and the contractor should use to make the outage successful.

## Cost

The contractors' cost breakdown generally determines the cost of each specific task of the work and a way of providing for progress payments. This must be reviewed carefully to avoid unnecessary "front end loading" of costs. On the other hand, some up-front "loaded" payments for certain activities, such as production of shop drawings, is a good way to provide an incentive to the contractor to produce engineering and other documents early when they are needed to complete other technical work (for example, if instead of an incentive 10% payment for shop drawings submitted on time, the contractor is offered an incentive of 20% payment to encourage the submission of drawings on or ahead of schedule).

In addition to typical retainage (sometimes called *retention*), it is advisable to maintain additional holdback monies when the contractor is incurring penalties for missing performance incentives. Thus, it would be good to place language in the contract referring to bonus/penalty holdbacks.

## Quality of Work

Quality of work is a function for specifying the technical requirements of the finished product. It should include inspecting the work in progress to determine if it meets the specified level as called for in the specifications, industry codes, industry standards, manufacturer's recommendations, and any federal, state, or local governing permit requirements.

The specification terms should be precise wherever possible. Vague terms such as "good quality" or "normal industry practice" should be avoided. Such terms will only encourage disagreement and discord. The following minimum guidelines are recommended:

- Tolerances should be specified where significant and open to interpretation. This is particularly important when there is an interface between contractors and when an out-of-tolerance situation by one contractor could require extra work by a successive contractor for which the contractor will want to be paid.
- Specification of materials is very important. For example, too often dissimilar materials are installed that invite galvanic corrosion. Sometimes, a general term like "mild steel" is used where specific ASTM-designated steel should be specified.
- Identify specific manufacturers and catalog numbers for certain parts. This helps in standardizing warehousing, minimizing investment in spare parts, and promoting interchangeability.
- Identify cases where certain critical components from one manufacturer work better and have fewer failures than other products on the market. This is especially important in the global marketplace business environment.
- Inspection requirements should be specified, such as visual inspection by competent inspectors or a nondestructive test done by appropriate personnel or a laboratory. Anything that can become a hidden defect after the work is performed needs to be inspected carefully beforehand. Concrete operations and heavy wall welding are two prime examples. Inspection "hold points" should be identified in the specifications for such critical operations.

- Quality Control audits also help to ensure quality. A high level of quality during installation always comes about because a properly planned Quality Control/Quality Assurance program has been put in place. Audits help to determine if the contractor is meeting the quality objectives across the board as contracted.
- Quality Control should also extend to off-site vendor facilities where assembly, testing, and documentation records can be examined. Operational tests of key components should be witnessed by the owner or their representative.

## **Safety**

The health and safety of everyone working in the plant is of paramount importance to the success of the work. The contract needs to spell out the owner's health and safety program and how the contractor will be involved. This is a vast topic that goes beyond the scope of this report to detail. However, there are three areas that are part of a Health and Safety program that should be addressed by the contract:

- Job rules – Job rules cover such topics as start and quit times, gates, parking areas, breaks, unacceptable activities or demeanor, response to fire drills, and medical facilities. These topics are covered in the planning process and in the contractor orientation that each contractor should attend prior to starting any work on site. The observations and contractor reviews will document contractor compliance with these requirements. Job rules should be prominently displayed on bulletin boards throughout the plant.
- Jobsite Safety – Jobsite safety covers personnel protective equipment (PPE) (including hard hats, eyewear, hearing protection, boots, and outerwear), safety practices, barricades, roping off, tying off, tag lines, trenching, and other safety practices as required by federal OSHA regulations, state safety regulations, and company policies. These topics are also covered in the contractor orientation prior to starting work on site.
- Fitness for Duty – The fitness for duty program identifies and removes from site any person who is in such a state that they could be a danger to themselves or to others. A fitness for duty program generally prohibits the use of controlled substances. It also prohibits the use of alcohol on the job and generally requires personnel who have been drinking heavily the night before or who have an illness or some other impairment that would interfere with doing the work to not report to the job site or be subject to disciplinary action if they do. It may also include requirements for personnel who are required to work in hazardous areas or in areas that require more than normal PPE, such as special clothing and protective suits and/or self-contained breathing equipment.



# 4

## TYPES OF CONTRACTS

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### **General**

There are several types of performance-based contracts that can be used for services. These can be for a one-time task performed on-site or off-site, or for long-term work lasting several years. The scope of work that is defined determines what type of contract is best. The following types of contracts are the most commonly used and are described in general terms. Specifics for each contract will vary with the requirements of each plant.

### ***Fixed Price***

A fixed price (that is, lump sum) contract is one in which a contractor agrees to perform a specific scope of work within a timeline and under the terms and conditions of the contract for a specified sum of money. Performance-based incentives (such as bonuses or penalties) will most likely relate to completion times of the outage or specific sub-tasks, plant output, and plant efficiencies. Other incentives could be offered for quality measures and safety achievements, such as no lost-time accidents and deaths.

The key to knowing when to use this type of contract is when the scope can be clearly and tightly defined. This type of contract will generally work to the detriment of the owner if the scope is not well defined or inspection is not practicable. An example of the latter is with painting. It is almost impossible to fully verify paint surface preparation or coat thickness of paint with a reasonable level of inspection.

A hybrid type of fixed price contract can be used when most but not all of the scope can be fully defined. As much as possible of the scope is defined, with unit prices for additions and deletions.

One problem with fixed price contracts is how to fairly cost out extra work items. Contractors have been known to bid fixed price work competitively with no profit, knowing that there will be changes on which they can earn higher margins. The contractor tries to anticipate where the scope of work is soft and where there most likely will be changes and then factors this into their final pricing.

### ***Time and Material***

Time and material (T&M) contracts (that is, cost plus or T&M) are best used when the scope is not defined in precise terms but time is an important factor in contracting for the work. This type of contract provides the contractor with reimbursement for labor, materials, construction equipment, and other items at their cost, plus a percentage for corporate overhead and profit. This diminishes the risk to the contractor but puts the responsibility with the owner's management team to make sure monies are spent wisely and not wasted waiting for instructions.

As with fixed-price contracts, incentives can be built into the T&M contract, but penalties may be much harder to enforce because the owner is the driver of the project.

### ***Straight Unit Price***

While commonly used in Europe, these are only scarcely used in the United States except on large civil projects such as road construction. As implied by the name, unit price contracts pay the contractor for the installation of measured units of work at a price established in the contract. This type of contract is not generally used in power plant work due to the diversity of units but is mentioned here in the event that a special project might call for its use. For example, a straight unit price contract would be used if an ash pond needed to be built and the engineering was not completed but the schedule was critical.

### ***Incentive***

A hybrid contract between the fixed price and the time and material contract types is the so-called incentive type contract. These contracts come in several different forms, including guaranteed maximum price (GMP) with sharing of underruns, target price with sharing of underruns and overruns, and target man-hour contracts with sharing of both underruns and overruns. The common features of these types of contracts are that the contractor's costs are an open book (subject to review and even audit by the owner). The GMP and targets are adjustable with scope additions and deletions; the contractor's profit can be a fixed sum or a percentage of costs with a final adjustment near the end of the project based on cost/schedule performance.

The sharing feature can also have limits. For example, the first 10% of the underrun/overrun may be shared equally between the owner and contractor, the next 5% may be shared 25% by the contractor and 75% by the owner, and any underruns/overruns over 15% might inure to the owner. Such a formula limits the contractor's profitability but, perhaps more importantly, limits the contractor's risk.

In establishing the GMP or target price, it is important that the owner has qualified estimators because there will generally be several meetings to negotiate costs. It is also important to establish at the beginning of the contract discussions the figures for escalation and contingency that will be used.

This type of contract makes sense when the owner has not finished defining the entire scope of work—meaning full, completed, detailed outage design drawings and specifications—but when sufficient scope has been defined or will be defined to allow an estimate of costs to be established with some degree of certainty.

Finally, a non-adversarial, collaborative team environment is essential to completing this type of contract successfully. When carried out professionally on both sides, this type of contract can result in a very favorable outcome for both owner and contractor.

Contracts can also be defined in terms of frequency of usage of the contractor, as described in the following paragraphs.

### ***Single-Time***

One of the biggest incentives for a contractor is repeat business. When a very specific scope of work is required that most likely will never be repeated and requires a very specialized contractor, the contract can be thought of as a single-time contract. Other than the general reputation and owner's possible recommendation or non-recommendation, there is little incentive for the contractor to perform in an outstanding fashion under this type of contract.

### ***Short-Term***

Some owners like to spread work among several contractors so that a competitive environment exists. This can be a good reason not to enter into long-term contracts. Short-term contracts that end with re-bidding of work may be a way to ensure good competition and best pricing. Contractors tend to bid with lower profit margins when they need work and there is competition.

### ***Long-Term***

Long-term contracts may be to the owner's and contractor's benefit. Certain maintenance work may be required every year or every few years, and if a contractor has proven to be reputable, provides excellent work and fair pricing, has an understanding of various plant constraints and conditions, and is easy to work with, a long-term contract may be an appropriate contracting method. Work can be authorized with separate work authorizations as needed and can be a fixed price or time and material contract, depending on the need. There are some large projects that keep a work force of contractor personnel working on site on a continuous basis. Again, a trusting, collaborative environment is the necessary ingredient to making long-term contracts successful. Performance-based incentives can also be built into long-term contracts as with other contracts.

### ***Partnership/Alliance [2]***

Another way around the adversarial contracting mode is for companies to form alliances, which is nothing more than two or more companies agreeing to work together in an "open book" fashion, offering each other favorable treatment. This type of arrangement affords the

opportunity for several organizations to blend together the best of their skills and resources into a synergistic entity that implements “best practices.” Alliances can be exclusive or non-exclusive. Owners may ally themselves with individual or multiple service providers to perform maintenance services as needed. Alliances are generalized agreements to work together, whereas partnerships are specific and defined for an identifiable group of tasks or scope of work.

Because the service providers’ marketing and bidding costs have essentially been eliminated, the service provider should be able to offer services at a very favorable rate. However, significant time and costs are expended up front in cementing the working relationship between the parties; this may offset the contractors’ marketing/bidding costs. In addition, team building efforts along with actual experience working together help to ensure good communications and generally smooth running operations. Clearly, the effort that goes into establishing a good partnership makes sense only if the relationship is long term, such as a period of several years.

Partnerships represent a formal arrangement whereby costs and profits are shared by an entity created for the purpose of carrying out work. In a partnership, each entity becomes responsible for the work of the whole group to the extent of their percentage share of the partnership.

This should be distinguished from joint ventures, whereby two or more companies join together to carry out work, but each entity remains responsible for its own costs and profitability. The joint venture works best where there are not many dependencies between the entities making up the joint venture; otherwise, one entity may be profitable at the expense of a second entity. There are few opportunities for joint ventures in maintenance, and, therefore, they will not be discussed any further.

In summary, there are many ways an owner can contract for work, and performance-based contracts can be used with any of the forms. The particular circumstances of the owner’s management capabilities, time constraints, availability of service providers, past experiences, scope definition, budgets, and other factors will enter into the decision as to which contract types are best suited for the individual situation.

# 5

## TYPES OF SERVICES

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### **General**

Today, the trend is for fossil power generators to maintain a small plant organization and utilize the contracted services of professional maintenance providers. While there will always be a need to have permanent maintenance staff at the plant, the staff level is generally maintained to respond to emerging problems and perform preventive maintenance between outages. The maintenance staff is also heavily involved in maintaining an inventory of spare parts and performing continuous improvement studies of equipment and systems. The central or core maintenance group is becoming more and more a managerial operation with much plant maintenance, repair, replacement, and overhaul being performed by contractors.

### **Routine Maintenance**

Routine maintenance describes those day-to-day maintenance activities that are performed by the core maintenance staff. These may include oil and grease additions, filter changes, and predictive maintenance activities such as a vibration test program, oil sampling and screening, or regular thermography scans. As plant equipment ages, routine maintenance activities tend to increase, and opportunities will arise to supplement core staff with outside sources. Routine maintenance presents an ideal situation for a partnering arrangement whereby staff may be seconded to the core staff as needed for a period of time.

### **Seasonal Maintenance**

Seasonal maintenance includes recurring maintenance activities related to seasonal changes in the way the plant facilities are operated. For example, heating systems that may have been shut down during late spring and through the summer need to be cleaned, inspected, and put back into service in the fall. Seasonal maintenance offers an opportunity to use outside resources to perform maintenance activities not normally performed during the rest of the year.

### **Projects**

Projects can involve the addition or replacement of a facility on the plant site or the maintenance and repair of equipment, such as retubing a section of a boiler during an outage. They may also include services on distribution lines and substations required for inspections and maintenance or the repairs needed after storm damage. Anything other than a small project generally entails the use of outside engineering and contractor services. Projects represent an excellent opportunity to implement performance-based contracting.

## **Planned Outages**

Planned outages are often an annual or semiannual occurrence at most plants and are scheduled during off-peak seasons of the year. Because several units may be scheduled to have an outage in sequence, it is important that plants meet their outage completion dates so as not to delay subsequent outages at other plants. In addition, because planned outages by definition are planned in advance, they represent a good opportunity to implement performance-based contracting. These outages require contractors to be a part of the outage planning team over an 18-month (or more) planning process. The outage may include stand-alone projects or additional labor for outage support. The milestones that are required to be met can be measured by the contractors' input where required.

## **Forced or Unscheduled Outages**

Forced or unscheduled outages occur when a key piece of equipment, a system, or a component fails to perform, resulting in a complete shutdown of operations or partial load reduction. In general, the plant operations and maintenance staff are challenged to fix the problem and get the unit back on line to support the needs of the electrical grid. Resources must be applied expeditiously and effectively to resolve the problem, determine the root cause of the failure, and take steps to correct the situation. In such cases, it is good for the plant to call upon known outside sources of assistance, if needed, which may be effected through partnering agreements or use of a time and material contract.

## **Housekeeping**

Housekeeping involves the cleaning of occupied spaces and trash removal on a regular basis. It may also include landscaping requirements. Cleaning services and landscaping services can be contracted on a short-term or long-term contract. Trash removal also can be contracted in a similar fashion. This is a good opportunity for performance-based contracting. Specific schedules should be developed showing how often these types of services should be performed and inspections and check lists developed to document job completion.

## **Environmental Services**

Most power plants either have an environmental engineer on site or use a central office environmental engineer to monitor waste generation and disposal, air emissions, and water discharges to ensure compliance with environmental permits. While the management of the environmental program should be part of the full-time core staff of the operating company's organization, environmental services can be contracted for performing studies, issuing reports, and advising on environmental law. There are some opportunities to use performance-based contracting in obtaining these services. There are also opportunities to contract disposal services that require special handling such as PCBs, asbestos, waste oil, ash disposal, and other hazardous or plentiful waste material. These can be performance-based contracts that are monitored for compliance with local, state, and federal regulations.

## **Engineering Services**

Most power plants will have a small engineering staff as part of their core staff to perform day-to-day engineering activities in support of operations and maintenance. As plants age, more and more engineering is required to replace outdated systems and equipment. Most plants will have an annual budget for capital expenditures to replace or add to the existing plant. Contracting for outside engineering services will generally be required either on a case-by-case basis or on a continuing basis. This represents an opportunity for partnering and using performance-based contracting methods for quality improvement purposes.





# 6

## MEASUREMENTS

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### General

Performance measures that determine the success of the contractor will be part of the performance-based contract. The plant should consider the objectives of the contract as the basis for defining and setting the performance measures. While the plant is looking for low costs and the contractor is trying to achieve a reasonable profit, there should ideally be mutual acceptance of a win-win formula. Having a good cost system tied to work orders through a WBS is helpful in tracking and benchmarking costs for repetitive maintenance work.

Measurements can be qualitative or quantitative. Quantitative measures are preferred where possible to obtain. In setting performance measures, the following points should be considered:

- Measurement points should be simple, understandable, and unambiguous.

Example: Measure – New pump installation

Not Good: New feed pump installed

Better: New chemical feed pump P-CF-03 installed, including piping connections, electrical, grouting, coupling alignment; tested and accepted for operation.

- Measurement points should be easy to obtain.

Example: Measure – Work orders completed

Not Good: Scheduled work orders completed on time

Better: Minimum 15 work orders completed and closed per week.

- Measurement points should be auditable and obtainable from existing information systems.

Example: Measure – Turbine overhaul labor

Not Good: Labor hours not to exceed 12,000

Better: WBS accounts 334.24.500 through 334.24.530 sum not to exceed 12,000 hours.

- Measurement points should be relatively few in number.

Ask what are the 5 to 15 most important items that need to be measured. Keep in mind that the contractor will concentrate efforts on the items that will pay a bonus or not result in a penalty.

- The measures should not be set at such a high level of achievement that they cannot be reached. They should be simple (as noted previously) and have sufficient financial weight to produce the desired motivation.

Stating the performance measures in terms of the contractor's scope of work will have the most direct effect. To keep the measurements to a smaller number and simple to understand, the measures should fall under these four general headings:

- Schedule
- Cost
- Quality
- Safety

## **Schedule**

All work activities should be prioritized by a simple system, for example:

- A – Must be completed
- B – Important and needs to be completed
- C – Would like but not necessary

Most of the schedule measures should come from Priority A work. Schedule measures should relate to completion dates rather than start dates, with the exception of plant re-start.

For planned outages and forced outages within projects, the schedule should also address the critical path and the consequences of not meeting it. The issues for a critical path may have greater impact on the operation and several other tasks that are planned and scheduled. It is critical that the contractor be aware of the requirements, rewards, and penalties for meeting the schedule.

Completion should also be understood to reflect what is legally referred to as *substantial completion*. For example, if a piece of equipment is installed, tested, and operationally ready, it is substantially complete. The fact that it may need a final coat of paint, a tag is missing, or some other minor punch list item remains open should not be a factor in determining completeness.

Because time is generally an important factor in outage work, schedule items should represent a third to half of the measures.

## **Cost**

What cost factors will be factored will depend largely on the contract type. While the owner is generally not privy to contractor cost figures for fixed-price contracts, they may have total visibility of costs under time and material and incentive type contracts. Another factor to consider is whether shift work or scheduled overtime is to be used during the work. Labor costs escalate quickly with shift work and overtime.

The owner might consider providing a bonus for completion under budget for a few large-ticket items or for the contractor's total hours as compared to the budget. This would pertain to partnered type contracts of either a time and material nature or an incentive-based open book contract, such as a target price arrangement.

## **Quality**

Quality is one of the most important things to measure. Because of strict licensing requirements designed to protect the safety of the public, nuclear power plants are much more stringent about meeting quality measures than fossil plants. However, fossil plants need to control quality of certain key functions, including high pressure pipe welding, nondestructive testing, concrete materials, concrete testing, structural steel bolt tensioning, fire protection systems, and wire and cable integrity. Each plant must define its own quality concerns based on any code requirements and its experience with construction, maintenance, and other contractors and develop measures that reflect the satisfaction of those concerns during maintenance operations.

## **Safety**

Safety can be measured in several ways:

- Number of lost-time accidents (zero is always the goal)
- Number of accidental deaths (zero is the only acceptable goal)
- Fires caused by unsafe work practices
- Housekeeping violations
- Number of safe work practice violations

## **Monitoring**

The size of the contract influences how plants monitor contractor performance. For large contracts, for which the contractor is responsible for providing supervision and management, periodic reports, management meetings, and plant quality assurance/quality control oversight are typically used. For smaller contracts, a variety of monitoring methods can be used. These may include some or all of the following:

- Technical supervision is provided.
- A daily report is given.

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*Measurements*

- A log book is kept.
- A supervisor is in charge of the contractor.
- For each task completed, an evaluation is prepared by the supervisor.
- Plant employees lead the work.
- The contractor prepares a detailed schedule, and the plant staff will periodically check the progress.
- A plant supervisor posts contract critiques with formal feedback and holds quality improvement meetings.
- The contractor's work leader is responsible for informing the plant coordinator about the status of work and notifies the coordinator to perform a final check at the completion of the task.
- A plant supervisor reviews the completed work orders.
- Costs are collected for work completed and posted to the cost reports.

# 7

## INCENTIVES

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### General

Performance incentives, both positive and negative, should be incorporated into the contract to encourage contractors to increase efficiency and ensure that the requirements are met as described in the scope of work and technical documents. It should be expected that contractors will emphasize those items that have been assigned incentives. There should be a number of specific incentives but also a few global incentives.

Incentives should be placed on those important items largely under the control of the contractor. These may include attending planning meetings and scheduled update meetings, complying with a schedule, completing milestones that have been established and agreed to, and examining results of testing after completion of work or to confirm improvements that were needed based on the work required.

Safety compliance is an important area that can have specific requirements. These may include required safety meetings, use of PPE, reduction in first aid issues, and reduction or goals of reduced reportable and non-reportable accidents.

### Pluses and Minuses

As noted earlier, care should be taken not to use too many incentives. If there are too many incentives, it may be impossible for the contractor to estimate the pluses and minuses available and determine the effect on profit/fee. In addition, it becomes more of an accounting task to track a lot of incentives. The incentives are usually paid at the conclusion of the contract work when a full accounting of the pluses and minuses can be sorted out.

### Difficulties

The question arises as to how to establish incentives and set target values for rewards and penalties that are fair and reasonable. This is the difficult part. Every plant is different, and every power market is different. Plants that are shut down or otherwise unavailable to produce power in a market in which all megawatts generated could be sold represent a different situation from plants in a market that is soft and in which operating plants experience low load factors. Incentives should address these factors, and there may be different sets of incentives based on plant operating conditions. As plant operating requirements change, then the incentives that the contractor is measured by also change.

## **Types**

In general, incentives fall into three broad categories:

- Cost incentives
- Technical performance incentives
- Schedule incentives

**Cost Incentives** – Most incentive contracts (GMP, target price, and target man-hour) include incentives for controlling cost. Fixed price contracts are suitable for using a cost incentive but must be more specific in the requirements, while time and material contracts may be suitable under other circumstances. If a fixed price contract is performed well and with a positive impact on the schedule, this may free up resources for other work or provide an opportunity to get the unit back on line sooner than scheduled. The contract could include a bonus clause for this situation.

**Technical Performance Incentives** – Technical performance incentives are set in connection with specific equipment characteristics or other specific elements of contract performance. In power plants, electrical output, heat rate, and environmental compliance are frequently used as technical performance incentives. However, there may be other performance incentives based on equipment efficiencies, reduction in auxiliary power, and reliability that can also be used.

**Schedule Incentives** – Schedule incentives are significant when improvement of an allotted outage schedule is a significant plant objective. Schedule incentives should specify the application of the incentive structure in the event of delays beyond the control and without the fault or negligence of the contractor or subcontractor.

If multiple incentives are used, they should be structured in a manner that recognizes trade-off decisions among the incentive areas. For example, to avoid a schedule penalty, a contractor may elect to hire more people, work longer hours, and perform shift work. The avoidance of a schedule penalty will increase the contractor's costs and, therefore, they may lose out on a cost incentive.

## **Establishing Incentive Amounts**

Arbitrary incentive and/or penalty amounts must not be utilized. There needs to be some realistic and justifiable basis for any reward or penalty. This brings into play a fundamental rule in economic decision making regarding trade-offs—risks and rewards should be in balance. The smaller the risk, the lower the reward, and conversely, the higher the risk, the higher the reward.

To be attractive for both owner and contractor, incentives need to be set so that they make financial sense. The owner needs to ask questions such as the following:

- What is it worth to me to have this plant on line a day early, and what will it cost me if the plant is back on line a day late?
- What is it worth if we improve the heat rate by so many Btu/kWh?

- What is the value to the plant of reducing air emissions?
- If the maximum output of the plant could be increased, how much would that be worth?
- If certain pieces of equipment were more reliable, how would that impact plant economics?
- What is an improvement in availability worth?

For example, consider a plant that has partnered with a contractor and has planned an outage to overhaul a major piece of equipment. They have been studying the technical issues with the original manufacturer and have devised a detailed work scope. They estimate that the work will take 30 work days and have targeted \$2,000,000 as the contractor's cost. The contractor has agreed to an 8% profit, which could be incentive-based. The owner estimates that each day the plant is back on line is worth \$100,000 to the bottom line.

The contractor would be very happy to double their profit from \$160,000 to \$320,000 and prefers not to risk more than the original fee on this project. The contractor further believes that the best case scenario is to possibly improve the schedule by five days and, in the worst case, would experience a delay of six days. The contractor also believes that the target price includes about \$100,000 in contingency, 50% of which will have to be used up by completing the work ahead of schedule. If the contractor is late, the entire contingency will have been used up.

Given this information, what would be a fair cost and schedule performance incentive for the owner and contractor to agree on? We need to examine the economics on the basis of three scenarios: target case, best case, and worst case—from both the contractor's and owner's position. They further agree on a 50/50 split on any cost savings below the target price, not to exceed the contingency amount.

A work-up of this is provided in Table 7-1.

**Table 7-1**  
**Incentive Work-Up Example**

<b>Target Case</b>	<b>Owner</b>	<b>Contractor</b>
Final price achieved	-\$1,900,000.00	\$1,900,000.00
Contingency not used	100,000.00	-100,000.00
Contractor profit	-160,000.00	160,000.00
Cost incentive	-50,000.00	50,000.00
Schedule incentive	0.00	0.00
Power sales profit	0.00	0.00
Total	-\$2,010,000.00	\$2,010,000.00
<b>Best Case (five days schedule improvement)</b>		
Final price achieved	-\$1,950,000.00	\$1,950,000.00
Contingency not used	50,000.00	-50,000.00
Contractor profit	-160,000.00	160,000.00
Cost incentive	-25,000.00	25,000.00
Schedule incentive	-160,000.00	160,000.00
Power sales profit	500,000.00	0.00
Total	-\$1,745,000.00	\$2,245,000.00
<b>Worst Case (six days late)</b>		
Final price achieved	-\$2,000,000.00	\$2,000,000.00
Contractor profit	-160,000.00	160,000.00
Cost incentive	0.00	0.00
Schedule incentive	160,000.00	-160,000.00
Power sales profit	-600,000.00	0.00
Total	-\$2,600,000.00	\$2,000,000.00

When the numbers are examined, it is clear that a greater burden of risk is with the owner. However, the owner also has a greater share of the rewards if the best case is achieved. While the contractor's position has improved by \$135,000, the owner's position has improved by \$365,000. If the worst case scenario is achieved, then the contractor has basically broken even on labor (some economists would argue that the contractor lost \$160,000), and the owner is some \$490,000 worse off, mainly due to loss in power sales profit.

What is worth noting about the above example is that, assuming that no incentives were offered to the contractor and the outage was six days late, the cost to the owner would be higher than with the incentives. By introducing the incentives to the contract, there became a much better



possibility that the contractor would give a greater effort to achieve a significant increase in profits with even larger rewards going to the owner. Therefore, one must conclude that this was a good deal for both parties.

Could the contractor have taken a bigger share of the risk/reward? Possibly. Most plant owners have greater financial resources than a contractor and, therefore, have less at risk in terms of total net worth. Most contractors will want to set some reasonable limit on losses.

There are many issues that the owner and contractor need to address for a performance-based contract. If they are agreed to and documented, a performance-based contract will be a win-win contract. As each side completes a contract, the next one will be better for both, and the plant will have the benefits of continued improvements in all areas.



# 8

## CONTRACT OVERSIGHT

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### **General**

Responsibility for making sure that the contract is followed and completed as required has to be taken in house. Oversight of the contractor's work and the documentation should be on site so that the contractor and the owner can communicate the progress and items needing to be changed as the requirements change. Oversight can be assigned to different individuals depending on their role in the owner's company and their responsibilities in the area or department that the contract covers.

### **Project Manager On-Site**

Single-use contracts usually have a project manager assigned for the duration of the contract. The project manager oversees the project from planning to completion. Daily reports, meetings, and documentation are used to follow the progress of the project. The contract for the project is a part of this oversight.

Long-term contracts may be assigned to a supervisor at the plant. A good example of this would be a housekeeping contract. The contractor could be assigned to the facilities supervisor and report to this person on a daily basis for assignments and time keeping. This supervisor would have the oversight responsibility to make sure that the contractor cleaned the areas that are on the schedule for that day and, with inspections and meetings, confirm that the work was completed as the contract requires.

### **Corporate Project Management**

Some companies may have contracts in place that are not plant-specific. These contracts are used company-wide at several facilities, and the individual plants may not have the resources to assign a person to oversee the contractor when contract work is being performed on site. In this case, a corporate project manager would have the oversight responsibility on a company-wide basis. It would be that individual's responsibility to make sure that the contract requirements were met at each facility as the work was completed and document the progress for each site. These contracts are paid out of corporate funds and are not under the direct control of the plants.

## **Third-Party Contracted Management**

As companies continue to do more with less, outsourcing of work is becoming more frequent in power plants. Contract management is an area in which outsourcing is being used. There are many placement services that specialize in specific skills for contract work that can recommend individuals for short-term or long-term contracts to oversee a specific performance-based contract. This individual would report directly to plant management or to corporate management, depending on the areas or facilities covered by the contract. The contracted project manager would have the same responsibility and authority as an in-house employee would, but the contractor's employment status would be based on the length and completion of a specific contract. Note that hiring a project manager also presents the opportunity for a performance-based contract to be put into place.

# 9

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