

Evolving the EPC model

The case for expanding OEM participation in power plant design and construction



Summary

The EPC model for power plant design and construction is very valuable in terms of overall project guarantees and providing a single point of responsibility for increasingly short staffed owners. However, it is possible to significantly improve the model, for both the EPC and the owner, while still preserving its inherent benefits. The point of this paper is not to insinuate that the model should be replaced at the macro level, but to inform of ways to work within the existing frame work to achieve significant improvements.

In terms of overall cost of construction, the instrumentation, control and electrical system (ICE) in a power plant represents a comparatively small fraction of the total capital. However, no plant subsystem will be the focus of more attention and care over the life of the facility. A well integrated ICE subsystem is therefore critical to everything from smooth initial commissioning to more efficient long-term operation of the plant.

The integration of this vital subsystem nevertheless is routinely handled by third parties who are simultaneously training staff on the nuances of each component, while also executing the project. Such is the nature of the traditional EPC approach to engineering, procuring and commissioning the ICE subsystem.

This paper considers an alternative to this model. In particular, we examine the advantages of fully utilizing the expertise of an OEM who designs, manufactures, and markets the electrical and control products that are integrated into a functioning whole.

Such an approach is not new, and indeed much of this paper draws on a model first described in a 1998 report by the Construction Industry Institute. Still, plant owners may find significant value in rethinking the role played by suppliers of complex, mission-critical equipment.

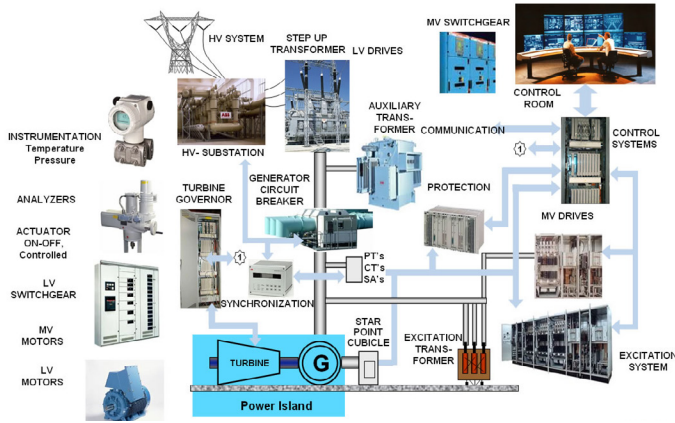


Figure 1: ABB delivers up to 25% of instrumentation, control and electrical equipment at a typical power plant

Scope of ICE

The ICE subsystem can be thought of as consisting of two fundamental components, products and services. The diagram in Figure 1 illustrates the range of ICE products found in a typical power plant.

Modern power plant ICE integration

The interface between instrumentation, control, and electrical systems today is infinitely more complex than in the past. Each connection between a distributed control system (DCS) and an instrument or intelligent electrical device is a bona fide digital communication link with a myriad of data exchange possibilities. The connectivity possibilities are endless and the importance of making the right choices in the earliest stages of the project cannot be overstated.

Engineers need to understand the full capabilities of each component being used prior to the commencement of design and execution. This is a difficult proposition for an engineer working with components from multiple manufacturers across multiple projects as is often the case with EPC engineers. These individuals are faced with a range of difficult questions that must be answered, including:

- What information can I get from the range of intelligent electrical devices being considered?
- What information can I get from the range of pressure, temperature, flow transmitters and analytical instruments being considered?
- How can I use that data to improve plant decision making?
- What protocols are supported by the various manufactures of devices being considered?
- Which protocol offers advantages for each of the devices being considered?
- What do I not know about the limitations of any of the devices pre-selected by the supply chain?

Often the answers to these questions come too late in the project to be of much use. The final solution ends up being a compromise born out of the necessity to stay on a path that was chosen without full understanding of the capabilities of each of the “lowest evaluated cost” products.

The EPC business model

EPC firms have sophisticated supply chains that buy products at the lowest possible market price. Once the contract is signed, the EPC has a very strong incentive to exercise that supply chain to the benefit of contract profitability. This approach helps to ensure the lowest possible installed cost, but it can actually work against the overall value of the project because the emphasis is on first cost rather than total cost of ownership. The EPC is focused on the short term while the owner must consider the plant’s performance beyond the guarantee period.

Some of the questions faced by the plant owner that are not necessarily front-of-mind for the EPC include the following:

- How do I ensure that the operation of the new facility is effectively folded into that of an existing fleet?
- How do I ensure long-term support of all plant equipment - not just main equipment - is manageable?
- Is the plant data acquisition system configured in a way that will allow me to quickly determine the source of equipment malfunctions, minimizing downtime and lost revenue?
- Is the plant data acquisition system configured to support a predictive maintenance philosophy that spots trouble before failures occur?



Obviously, there are many other similar questions on the mind of the end user that fall into this category, but the in-depth knowledge needed to answer them might not be available within either the EPC organization or that of the plant owner. Without question, no firm is better positioned to integrate a set of products than the firm that designs and manufactures those products. Why, then, is so much of the OEM's expertise often left out of the equation?

The case for OEM engagement

The traditional approach to building power plants makes no distinction between strategic equipment—highly engineered, mission-critical components—and more common aspects of the plant's infrastructure. Obviously, there is a difference between a power transformer and a low-voltage relay, not only in terms of cost but also lead time and impact to the facility in the event of a failure.

It makes sense then to elevate the transformer so that the considerable resources used to procure it are spent wisely, with a view to how the unit fits into the long-term performance of the plant. However, the plant owner and even the EPC may not be in the best position to specify critical equipment and systems. Settling on a strategic equipment supplier before detailed engineering begins allows the plant owner to leverage that supplier's expertise throughout the project.

To understand how this works, consider switchgear as an example. Each manufacturer of switchgear will have slightly different requirements in terms of the footprint needed for the equipment, but it is impossible to design an enclosure for those units until the dimensions are known. Bringing in the manufacturer before the engineering phase removes this uncertainty and speeds up the engineering process.

On the surface, it might seem counter-intuitive to commit to a single equipment supplier so early on, but in practice it yields benefits in both time and cost. An earlier start to detailed design (realized thanks to the OEM's expertise) means faster project execution time, but it also means fewer scope gaps discovered during the commissioning phase.

Suppliers, then, ought to be considered on the basis of the overall value they bring to the project, not simply on price. The questions around data requirements and communication protocols cited above and how aspects like these impact long-term plant performance are questions the ICE supplier can answer better than anyone else. That capability is valuable, but it often goes untapped.

The cost of that under-utilization was quantified in CII's 1998 study, which coined the acronym "PEpC" to make a distinction in the EPC model between procurement of strategic products ("big P") essential to the plant's performance and the other ("little p") items to be procured. The study reported that "in both theoretical and field implementations, the results indicated that PEpC could produce savings in excess of 10 percent to 15% of the time and 4-8% of the cost of the traditional EPC process."



The advantages of the alternative in relation to the traditional approach arise mainly through the additional value the ICE equipment manufacturer can bring to the table and the time and cost savings that result. However, by engaging the OEM early, it also becomes possible to more fully commission the ICE systems in a factory environment rather than on-site. This, in turn, has several implications.

Schedule

Commissioning in the factory relieves congestion on the critical path of the project at a time when responsibility gaps are likely to come to light with little time to recover.

Reliability

Correctly integrated modern systems contain intelligence for quick diagnosis and recovery from trips as well as analytics to alert operators of impending trouble. Engaging the ICE supplier early on ensures these benefits will be realized.

Efficiency

The OEM's experts can design a system that minimizes parasitic load, for example by employing variable frequency drives and low loss transformers. Benefits accrue to the long-term operating cost of the plant.

Safety

Perhaps most importantly, shifting work off the construction site improves the safety profile of the project. Hundreds of on-site man-hours can be eliminated. This is important from a risk management perspective because recordable injuries that occur in the factory are not charged against the end use customer by OSHA. Conversely, all injuries that occur on the construction site are charged to the owner regardless of whether the injury is suffered by a direct employee or an employee of a subcontractor.

Conclusion

As is hopefully clear by now, there is a compelling business case for power plant owners to bring ICE suppliers into the fold under a more inclusive and forward-looking project execution model. This approach should not be viewed as a zero-sum game that simply “takes away” project scope from the EPC and reassigns it to the OEM. Quite the opposite—the EPC will be in a better position to deliver greater overall value to the end user when the OEM is allowed to make the greatest contribution. Ultimately, though, the benefits of the approach outlined here accrue to the long-term performance of the plant and clearly that is what matters most.



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