



## White Paper 2019-08

### What should a Project Estimate Comprise of? An Extended Definition of Estimate Class

*The concept of estimate is often limited to cost estimate. However, the actual estimate of the project also consists of many other elements, including schedule and risk analysis – everything which can be used to establish a project performance measurement and control baseline. In this paper, we develop this extended definition of estimate and the consequences of that more comprehensive view.*

#### What does project estimate comprise of?

Generally, the term ‘estimate’ is used to mean ‘cost estimate’. It is important to understand that a “project estimate” cannot be just a cost estimate, as it needs to include the underlying schedule and risk estimates; and it also needs to encompass both Capital expenditures (Capex) and Operating expenditures (Opex) to provide sufficient data for the project business case.

Capex full estimates comprise as a minimum of a cost estimate, a schedule estimate and a risk analysis to support contingency evaluation. Those components are deeply inter-related, need to be of a consistent quality and accuracy, and all are needed to feed the project’s business case. The estimates need to be supported by adequate backup. While a lot of literature exists on the concept of cost estimate, less exist on the other components, whereas each cannot be considered in isolation.

Opex full estimates comprise as a minimum a cost estimate, a maintenance/shutdown schedule estimate and a risk estimate. It also needs to include a production ramp-up estimate during start-up to have the full data necessary to properly assess the profitability of the facility.

In addition, it is now necessary to include an estimate for the decommissioning, removal and disposal at the end of the planned operating life of the facility.

#### An extended definition of estimate class to cover overall project maturity

##### Limitations of AACEI estimating class

Estimating class is a well-established concept for cost estimates and it has been extensively developed by AACEI in its Recommended Practices (e.g. 17R97 and 18R97 for process industries). It is a useful concept but is limited to cost estimates and focus mainly on the underlying design maturity of the project.

##### Broadening estimate class to schedule and risk

To ensure a given quality of an estimate, the maturity of the estimate model must be consistent between the cost estimate, schedule estimate and risk estimate. This shows in terms of level of detail, of accuracy and actual estimating methods and backups. It should actually be impossible to

judge a cost estimate in isolation from the associated schedule and risk models, which in turn depend heavily on the execution strategy and the context of the project.

##### Broadening the required underlying maturity of the project

To support an estimating class, the maturity of all underlying project components has to be checked. A good reference in that respect is the Independent Project Analysis (IPA)’s Front-End Loading approach and the key components that comprise the maturity rating of a project under development. This includes of course the actual design maturity, but also the relevant maturity of the project execution plan and a mature understanding of all site-related conditions, including actual availability and productivity of manpower, permitting aspects, soil and general environment conditions, tax and customs aspects etc.

##### Checking estimate documentation

The quality and thoroughness of the underlying documentation and backup should be consistent with the announced estimate class.

AACEI recommended practice 34R05 gives a good starting point of the backups that are expected. The higher the estimate quality, the higher the backup requirements are. Those documents should provide backups to cover cost, schedule and risk estimates and, in general, the maturity level of the estimates.

#### Broadening the concept of estimate class

The AACEI definition of estimate classes is very useful and recognised. It can be broadened to an overall estimate class. Extensions to the AACEI concept should cover:

- AACEI relates estimate class mainly to a certain level of project design maturity. The concept should be expanded to encompass all aspects of project maturity as integrated for example by IPA in its Front-End Loading approach, relating to key definition milestones (class 5 for screening, class 4 for preliminary feasibility, class 3 for Final Investment Decision, class 2 for execution control). Therefore, it should also include analysis of the maturity of site-specific parameters including permitting, and of the project execution planning, project team build-up, etc., in much more detail than is currently given in AACEI standards,

**A project estimate is a wider concept than strictly a cost estimate and should include as a minimum schedule and risk estimates at a consistent level of detail and accuracy, as well as both a Capex and an Opex estimate**

- The concept needs to be broadened to scheduling and risk, with similar reference to the various available estimating approaches (parametric, detailed etc) underlying those models, and with a requirement for consistency between all those various estimates.

### **Example of extension of the AACEI class concept**

We will here take as a basis the estimate class definitions given in the document 18R-97 specific to process industry projects, for class 3 estimates (which is the level required for Final Investment Decision).

According to AACEI this corresponds to a maturity level described as “typically, engineering is from 10% to 40% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, preliminary piping and instrument diagrams, plot plan, developed layout drawings, and essentially complete engineered process and utility equipment lists. Remedial action plan resulting from HAZOPs is identified”. “Class 3 estimates generally involve more deterministic estimating methods than conceptual methods. They usually involve predominant use of unit cost line items, although these may be at an assembly level of detail rather than individual components. Factoring methods may be used to estimate less-significant areas of the project.”

This definition should be completed with the maturity level definition of the full project. This would typically include following additional requirements:

- Site-specific conditions
  - Local resource availability and productivity factors
  - Geotechnical soil investigations performed
  - Permitting dossier filed at least or even main permits obtained
  - Stakeholder & local community management plan
  - HSE and emergency response plan
- Design maturity
  - Constructability, operability, maintainability reviews performed

- HSE reviews (HAZOP etc)
- TRL6 maturity for innovative segments
- Project execution planning
  - Project team mobilised integrating all disciplines, and detailed team organisation for execution
  - Project control implemented and ready for execution (people, process, systems)
  - Project implementation plan including contracting and allotment strategy
  - Ready to contract long lead equipment and early works
  - Logistics plan for construction
  - Preliminary implementation plan for construction, commissioning and start-up

There should also be some requirements for the level of detail of the integrated project execution schedule, the basis of estimate of the durations (e.g. the need to have performed manning curve checks and resource-levelling as appropriate), and the level of quality of the quantitative risk assessment that supports the value of contingency or management reserve.

### **Conclusion**

A project estimate is a wider concept than strictly a cost estimate and should include as a minimum schedule and risk estimates at a consistent level of detail and accuracy. This approach leads to broadening the definition of estimate class to account both for this extended definition of project estimate, and to account in more detail for the requirements related to other aspects of project definition than strictly technical maturity of the facility design.

This broadened view of project estimating can be usefully deployed to ensure a better assessment of the quality of estimates at various stages of project development. It is also consistent with both the AACEI estimate class concept and the proven Front-End Loading approach by IPA.

**Project estimate class definition cannot be limited to the technical maturity of the facility design, but extended to the other requirements of the project execution plan**



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