

# ESTIMATING TODAY'S MEGA PROJECTS

# Seattle



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## BIOGRAPHY



- Estimating Director for Fluor Corporation in Sugar Land, Texas
- 19 years of Estimating experience
- Positions held with various organizations including Engineering, Owner, and Software companies
- Expert in the use of the Aspen Tech Estimating Software
- Presented at numerous conferences including AACEI Conferences

A panoramic view of the Seattle skyline, featuring several prominent skyscrapers under a hazy sky. The text 'MEGA PROJECT' is overlaid on the left side of this image.

## MEGA PROJECT

- MEGA is very big, when talking about a Petro-chemical construction project a billion dollar project is thought of as a MEGA project
- Today we're estimating projects that cost 5, 10, even 20 billion dollars
  - Ten years ago a large project was \$500 million
  - Currently Fluor in Houston is working on 10 projects that range from 2 to 25 billion dollars
- To understand the concept of a billion – a one with 9 zeros, over 30 years old to have lived a billion seconds

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## ESTIMATING MEGA PROJECTS

- Today's projects are requiring more cost information earlier in the life cycle of the project than in the past
- These mega projects have so much scope, that it takes a lot more time to cost the scope than a traditional sized project
  - Piping that is over 200 miles long if extended end to end
  - Wiring/cable that is over 500 miles long
  - 1,500 to 2,500 P&ID's with multiple revisions
  - Over 1,000 mechanical equipment items, some as much as 4,000-5,000



## TYPES OF MEGA PROJECT ESTIMATES

- Conceptual Estimate
- Detailed Estimate
- Study Estimates
- Change Estimates

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## CONCEPTUAL PROJECT ESTIMATES

- Conceptual Estimate – first view of costs
  - Based on preliminary information that is available
  - Typically based on New Process Unit sizes and mechanical equipment lists
  - Often undefined utility requirements – so assumptions are made
  - Other offsite scope such as tankage, interconnecting piperacks, power supply, and others are rarely defined. The best information that is available is used to make assumptions of the scope and estimate.

## DETAILED PROJECT ESTIMATES

A background image showing the Seattle skyline with several skyscrapers under a hazy sky.

- Detailed Estimate – set project budget
  - Based on Front End Engineering Design (FEED)
  - Detailed Mechanical Equipment List and data sheets
  - Piping and Instrument scope is defined on the project Piping and Instrument Diagrams
  - Project Plot Plan to define lengths, buildings, site work, etc.
  - Material pricing from Procurements and Contracts
  - Construction definition of labor costs

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## STUDY ESTIMATES

- Study Estimates – give direction
  - As the project evolves, there will be many questions that will be decided by cost impacts
    - Process studies
    - Discipline engineering studies
  - Construction execution studies, modules vs stick-built
  - Typically comparative conceptual estimates
  - Not all scope is evaluated, just the scope that changes
  - By utilizing the same pricing basis, the comparison is valid



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## CHANGE ESTIMATES

- Change Estimates – measure cost impact of changes in scope
  - Changes in scope that occur after the conceptual estimate and prior to the detailed estimate
    - The sum of these changes and the conceptual estimate should result in a cost similar to the detailed estimate
  - Changes in scope after the detailed estimate scope is defined but not complete
    - If early enough, include the scope in the detailed estimate
    - If too late to include, generate a Rough Order of Magnitude (ROM) and include it as a “late cut and add” cost to the detailed estimate
  - Changes in scope after the detailed estimate is complete
    - These are change estimates and should be estimated so that it can be added to the detailed estimate for tracking purposes



## STAFFING FOR MEGA PROJECTS

- Estimating Staffing
- Other Staffing support



## ESTIMATING STAFFING FOR MEGA PROJECTS

- Estimating Staffing
  - On Project
    - One Estimating Manager
    - One Lead Estimator for each major breakout of project scope, ie. Inside Battery Limits (ISBL) and Outside Battery Limits (OSBL)
    - One to three support estimators under each of the lead estimators. Possibly by discipline; Mechanical, Civil/Structural, Instruments/Electrical.
    - One Lead Estimator to manage the change estimates
    - One support estimator to help with the change estimates
  - Off Project
    - Material take-off
    - Pricing exercises
    - Ratio analysis



## ESTIMATING SUPPORT FROM DISCIPLINE STAFFING

- Disciplining Staffing
  - Engineering disciplines
    - Scope definition - drawings
    - Material take-offs
  - Procurement/Contracts
    - Pricing
    - Escalation advise
  - Construction
    - Labor hours
    - Labor rates
    - Heavy lifts
    - Construction indirect costs
  - Scheduling
    - Home office support costs
    - Buying schedule – escalation costs
    - Construction indirect costs

## CHALLENGES OF ESTIMATING MEGA PROJECTS

- Size of project
  - With such large scopes these projects can influence the market
  - Difficult to get material pricing for such large number of items
    - Vendors resist provide pricing for 800 pumps at no cost when they have so much work providing bids
    - Going back to the same vendors for multiple versions of estimates
    - These vendors may or may not get a purchase order
  - Logistics – these project could have 30,000 peak manpower
    - If bussing is required  $30,000/50 = 600$  buses (over 5 miles of buses)
      - How much is a school bus? How many are available? If the supply is exhausted, what then?
      - How long does it take to get 600 buses loaded and unloaded?
    - Housing
      - Provide camps?
      - Community housing?
    - Temporary power
    - Potable water
  - Exceeds capabilities of existing estimating technology
    - Must develop new tools for summaries and analysis
    - Files are too big
    - Demands more computer memory and speed

A background image showing a city skyline with several tall buildings under a hazy sky, likely Seattle.

## CHALLENGES OF ESTIMATING MEGA PROJECTS

- These projects can influence market pricing
  - Escalation of 3% for 15 years is easy, but 100% for 2 years is difficult to anticipate
  - Local materials may be inadequate which would require additional freight costs
  - The projects often exhaust the labor pool requiring importation of labor, paying per diems, etc.
  - Typical benchmarks may not apply
- Changes
  - Like driving a big bus, you can't change directions quickly. The estimator must anticipate there will be changes and how to handle them
  - Changes made during the review cycle become daunting due to the volume of paperwork and the tight schedule for their completion
  - Keeping up with the changes and how they will impact scope and cost
  - Small changes can take a lot of time due to the number of items to change such as changing pump seals on 800 pumps verse 20

## CHALLENGES OF ESTIMATING MEGA PROJECTS

- Multiple Office / Locations for FEED engineering
  - Example: On one projet FEED was being developed in the following Fluor & licensor offices:
    - Fluor Houston, AV, & New Delhi
    - Seven different licensors to develop 20 different units
    - Project information (equipment lists, P&ID's, etc.) coming from 10 different places in different formats with different symbology
- Documentation
  - Volumes and volumes of estimate scope and drawings
  - Each estimate cycle has it's own documentation
  - Estimate review books take more time to prepare
    - Say 5 reviews per estimate and 20 review books for each review
    - Will take 2-3 weeks just making copies and developing books
- Dollar value of accuracy ranges
  - +/-10% on \$20 billion is +\$2 billion/-\$2 billion, a lot of money

A background image showing a city skyline with several tall buildings under a hazy sky. The text 'ADVANTAGES OF ESTIMATING MEGA PROJECTS' is overlaid in white on this image.

## ADVANTAGES OF ESTIMATING MEGA PROJECTS

- Averaging effect
  - Because the projects are so large, there is an “averaging” that happens
  - One item may be a bit low, but another item will be a bit high
  - The key is to account for the scope
- Growth opportunities
  - New estimators have opportunities that traditionally would have taken years to get
  - Support estimators get opportunities to actually lead unit estimates
    - These unit estimates traditionally were total project estimates



## SUMMARY OF ESTIMATING MEGA PROJECTS

- Very large projects – be clear on what it's going to take to develop the estimate
- Numerous types of estimates are required and estimator must anticipate these before they happen
- Adequate staff is required with specific defined responsibilities – make sure the staff is in place and ready to handle the challenges
- Unique challenges due to size and time restraints – have a plan in place to handle the challenges
- Offers unique opportunities for new and support estimators

## QUESTIONS

Marlene's Comments – the last word

- 1- Good estimate plan covering estimate methodology and deliverables
- 2- Clear responsibility matrix to show role + responsibility of all contributors to the estimate.
- 3- Scope understanding and follow-up of engineering changes.
- 4- Teamwork between eng + procurement +engineers +planners.
- 5- Importance of market study, logistics for material or labour supply.
- 6- Importance of a good WBS and commodity codes in order to structure the estimate and not forget anything.



Regards  
Marlene