



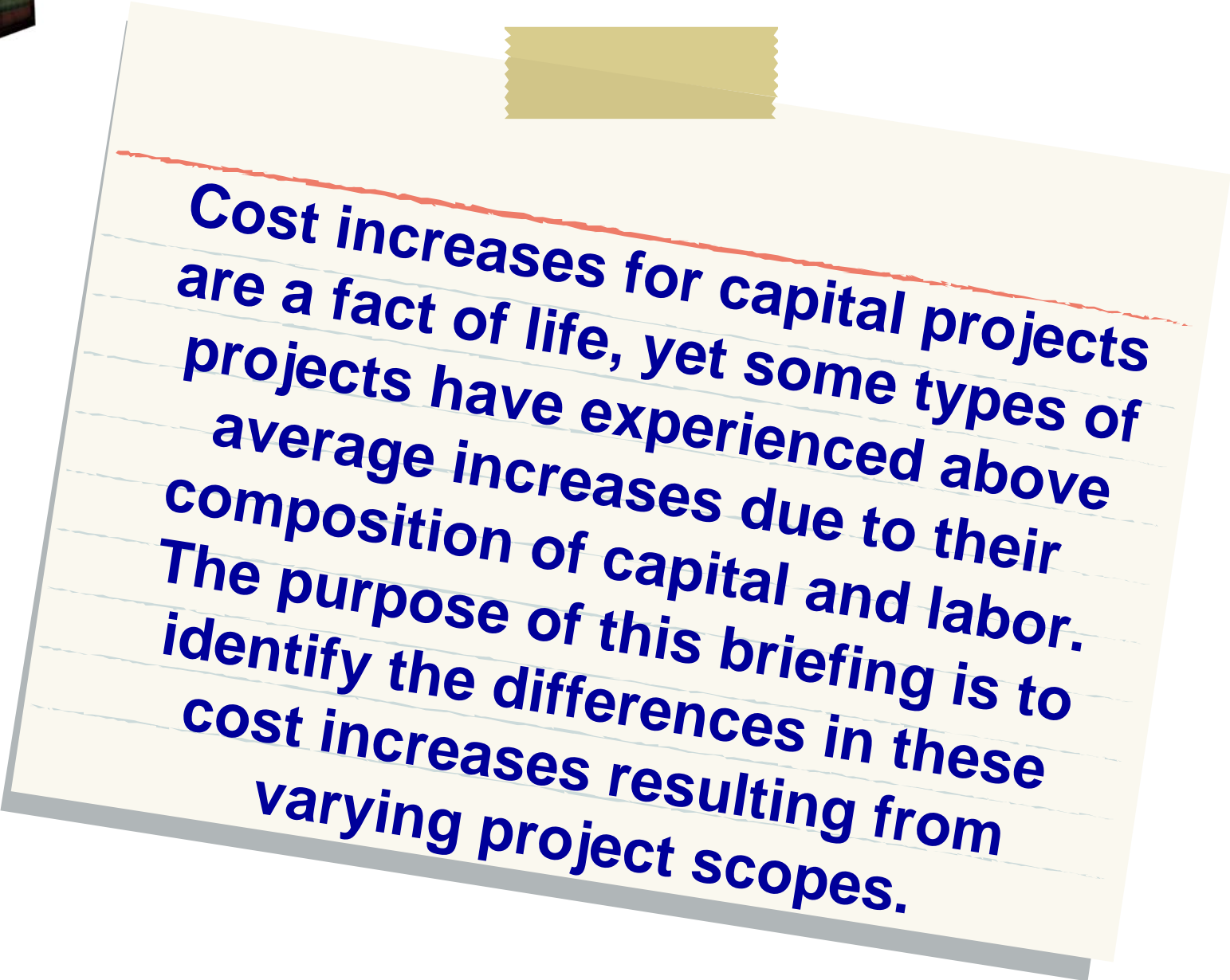
Industry Cost Trends & Estimating in Today's EPC Market

Presented at the AACEI Houston Chapter
November 11, 2008

Robert Brown & Corey West



Introduction

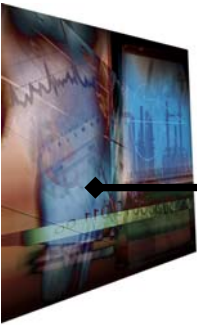


Cost increases for capital projects are a fact of life, yet some types of projects have experienced above average increases due to their composition of capital and labor. The purpose of this briefing is to identify the differences in these cost increases resulting from varying project scopes.



Plan of Action

- ***Introduction***
 - ***What is escalation?***
 - ***Methodology***
- **Scope Specific Escalation**
- **Conclusions**



What is Escalation?

- **The change in prices due to normal wage and price inflation over a period of time. This is similar to inflation or deflation, except that escalation is specific to an item or class of items.**
- **Drivers of market conditions include:**
 - **General industry conditions**
 - **Scope of project**
 - **Productivity**
 - **Technology**
 - **Resource supply & demand**
 - **Profit margins**
 - **Location of project**
 - **Procurement strategy**
 - **Project risk**



What's Required to Execute a Project?

Capital

- **Bulks**
 - Concrete
 - Steel
 - Piping
- **Equipment**
 - Mechanical
 - Fabricated
 - Electrical/Instrumentation

Labor

- **Office**
 - Project Management
 - Civil Structural & Architectural Engineering (CSA)
 - Piping Engineering
 - Process Engineering
- **Field**
 - Construction Management
 - Laborers
 - Concrete Masons
 - Millwrights
 - Pipefitters



Methodology

- **Find the resource composition of projects by scope**
 - **Capital**
 - **Labor**
- **Calculate individual cost increases**
 - **Capital**
 - **Labor**
- **Sum the multiplication of project composition and cost increases**

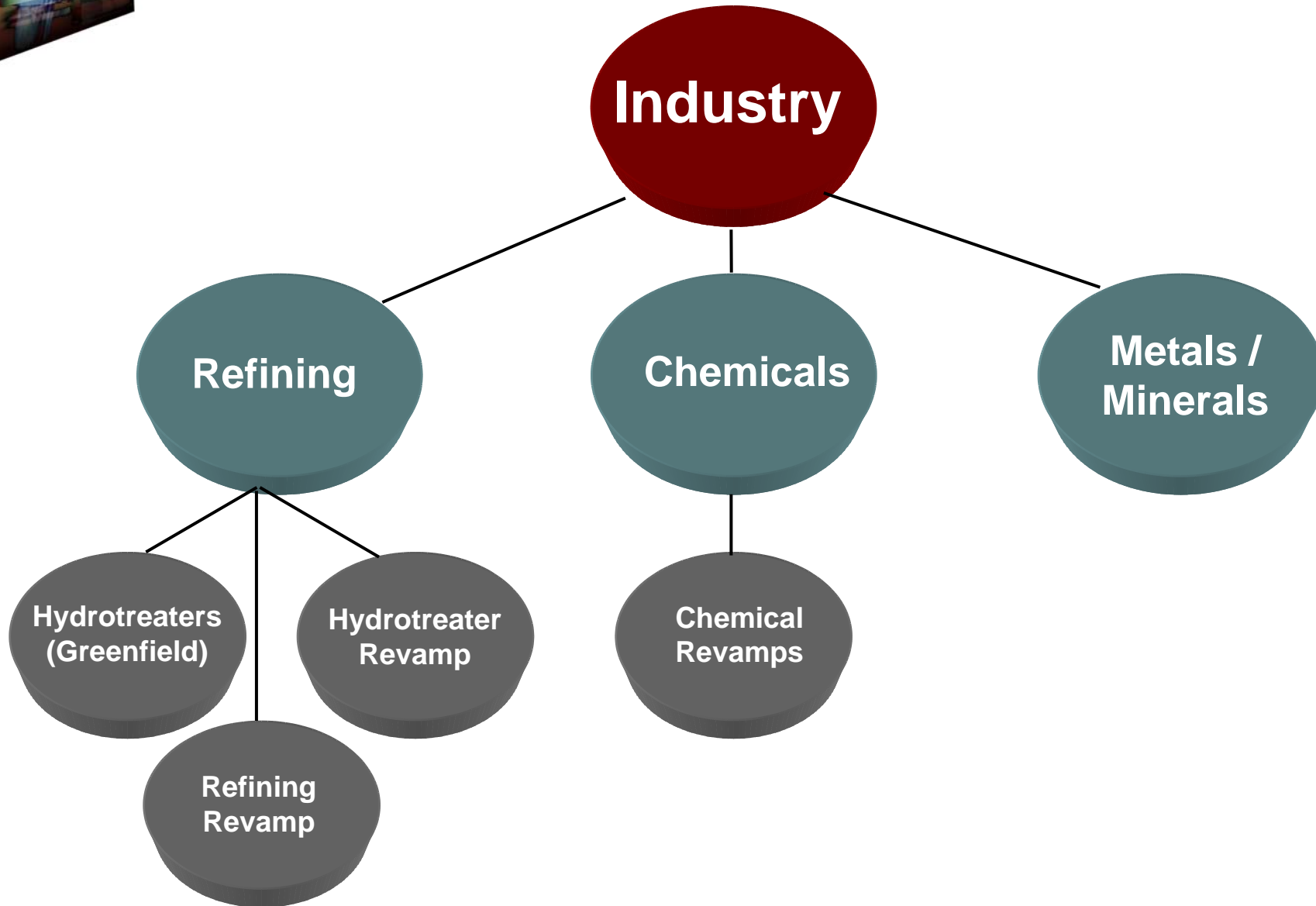


Plan of Action

- Introduction
- ***Scope Specific Escalation***
 - ***Capital and labor composition by scope***
 - ***Escalation rates***
- Conclusions



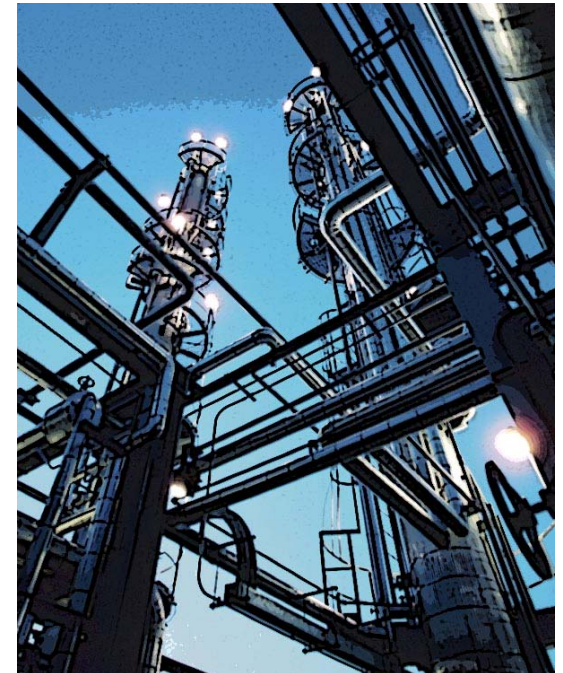
Industry Scopes of Work



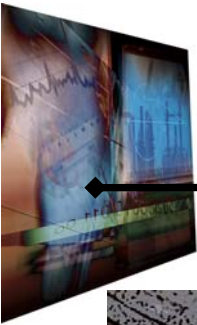


Industry Scopes of Work Defined

- **Industry** – Industry is defined as all project scopes encompassed by the process industries
- **Refining** – All process projects executed as part of the oil refining process
 - **Refining Revamp:** Revamp/Debottleneck project to expand capacity and/or functionality. These projects tend to upgrade equipment for additional capacity and may focus more on mechanical equipment upgrade
 - **Hydrotreater Revamp:** Revamp of hydroprocessing unit. These projects differ from other revamps as their scope tends to include large fabricated equipment
 - **Hydrotreater Greenfield:** A standard grassroots or colocated driven by large fabricated equipment and a mix of bulk material types

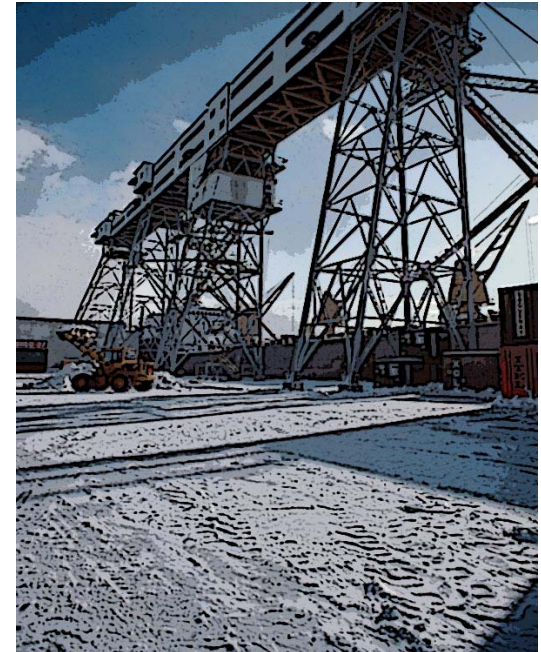


Industry Scopes of Work Defined *(continued)*

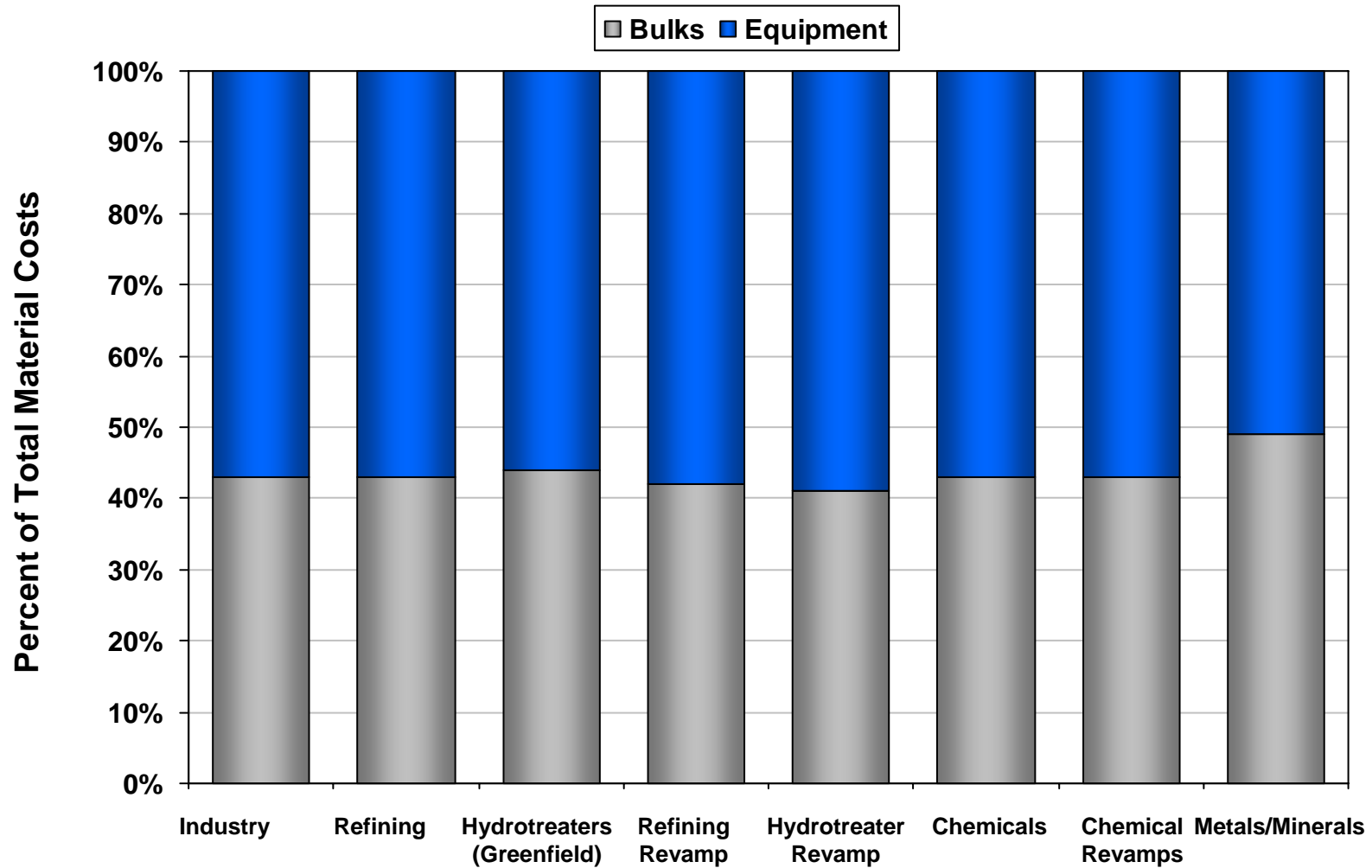


- **Chemicals -- All process projects executed within a commodity or specialty chemicals facility or process. Bulk of projects are gases or liquids processes**
 - **Chemical Revamps:** This scope tends to be for debottlenecking existing units with emphasis of upgrading mechanical equipment
 - **Chemical Grassroots:** A standard grassroots or colocated unit with a standard mix of equipment and bulk material types. On average, chemical projects tend to have a bit more mechanical equipment than fabricated

- **Minerals – A standard grassroots or colocated unit for minerals processing. These processes include crushing, grinding, milling/pulverization, gravity separation, and electrostatic separation. These projects tend to be solids-handling processes**

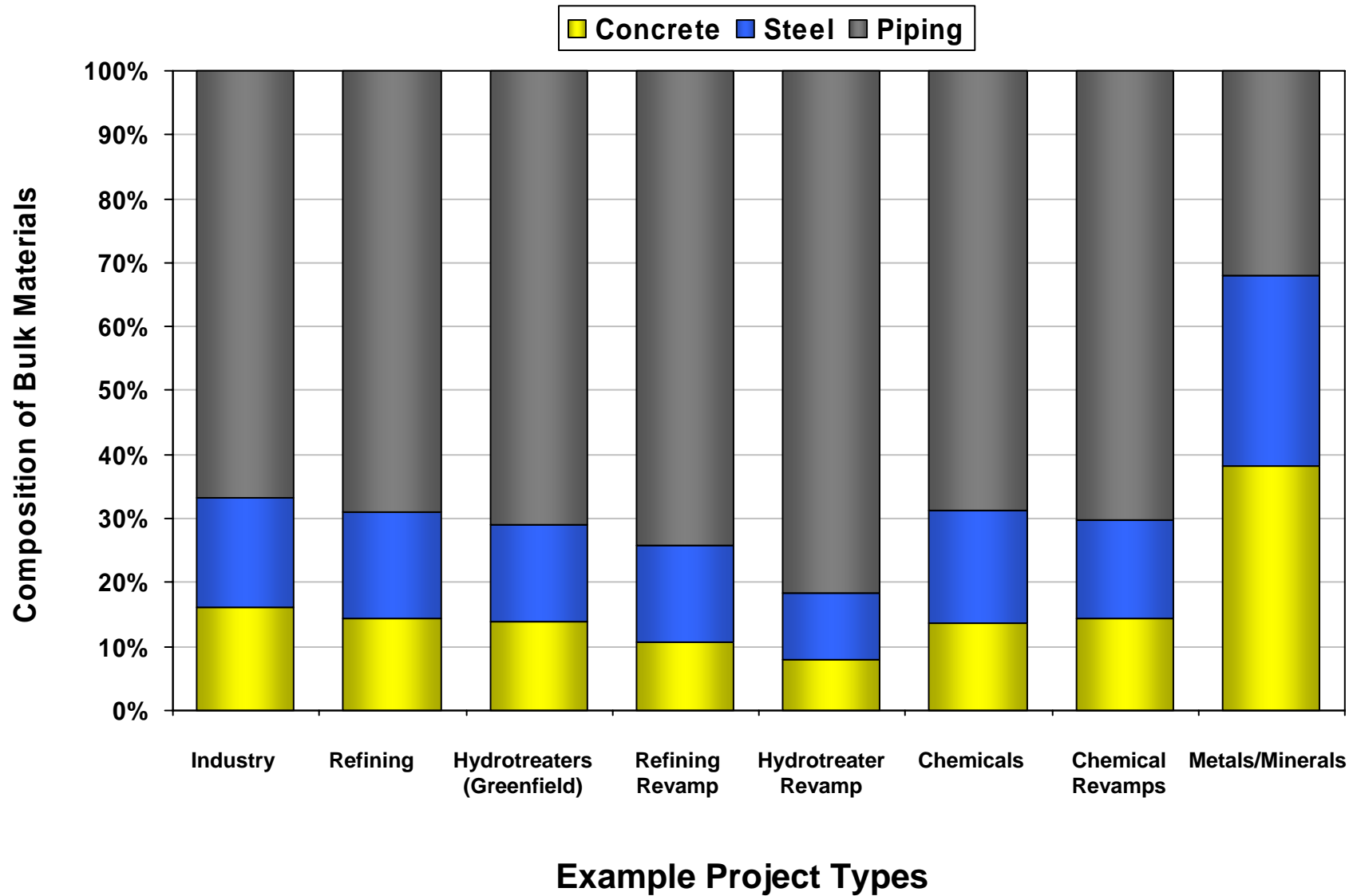


Total Material Percentages by Scope

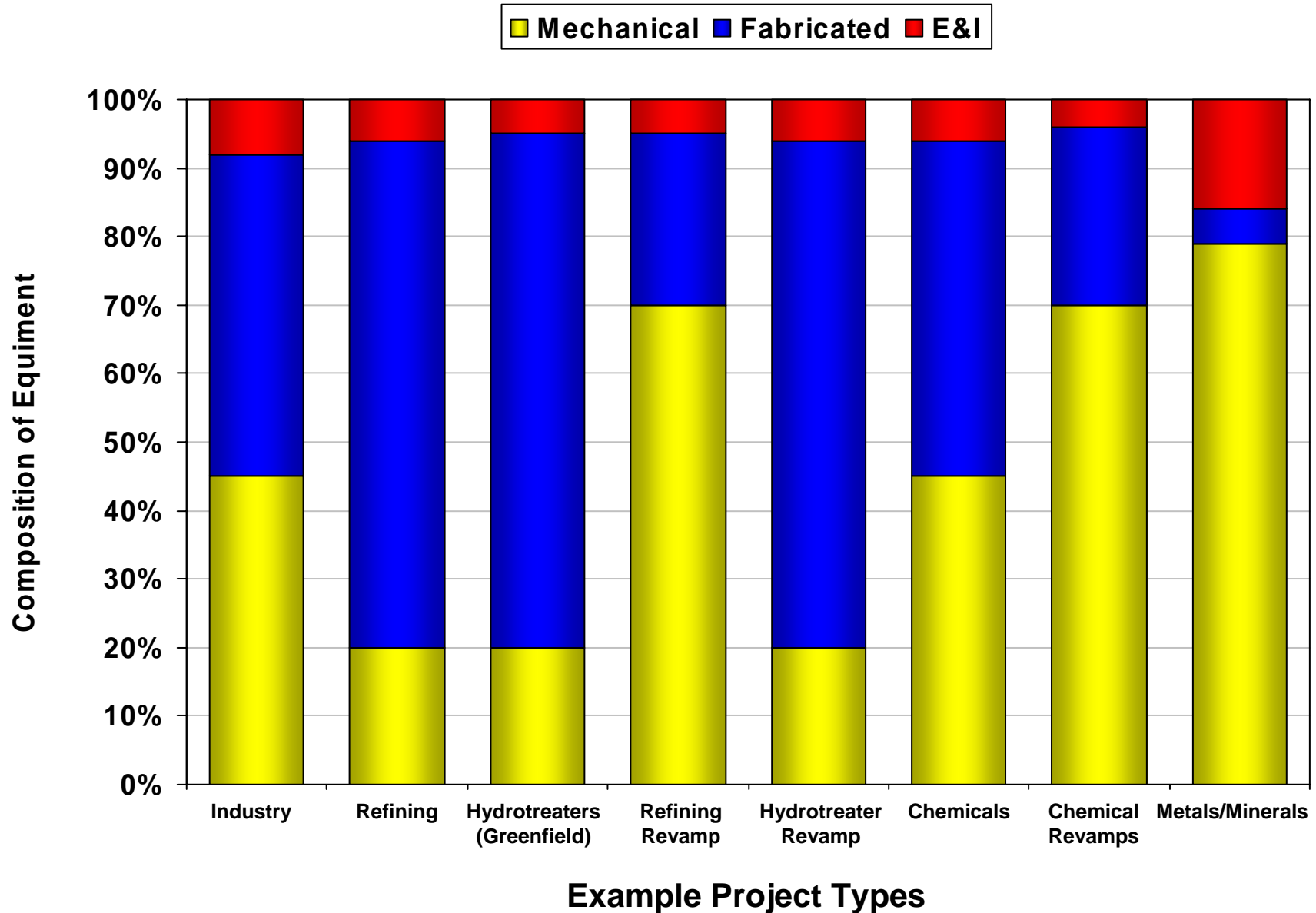


Example Project Types

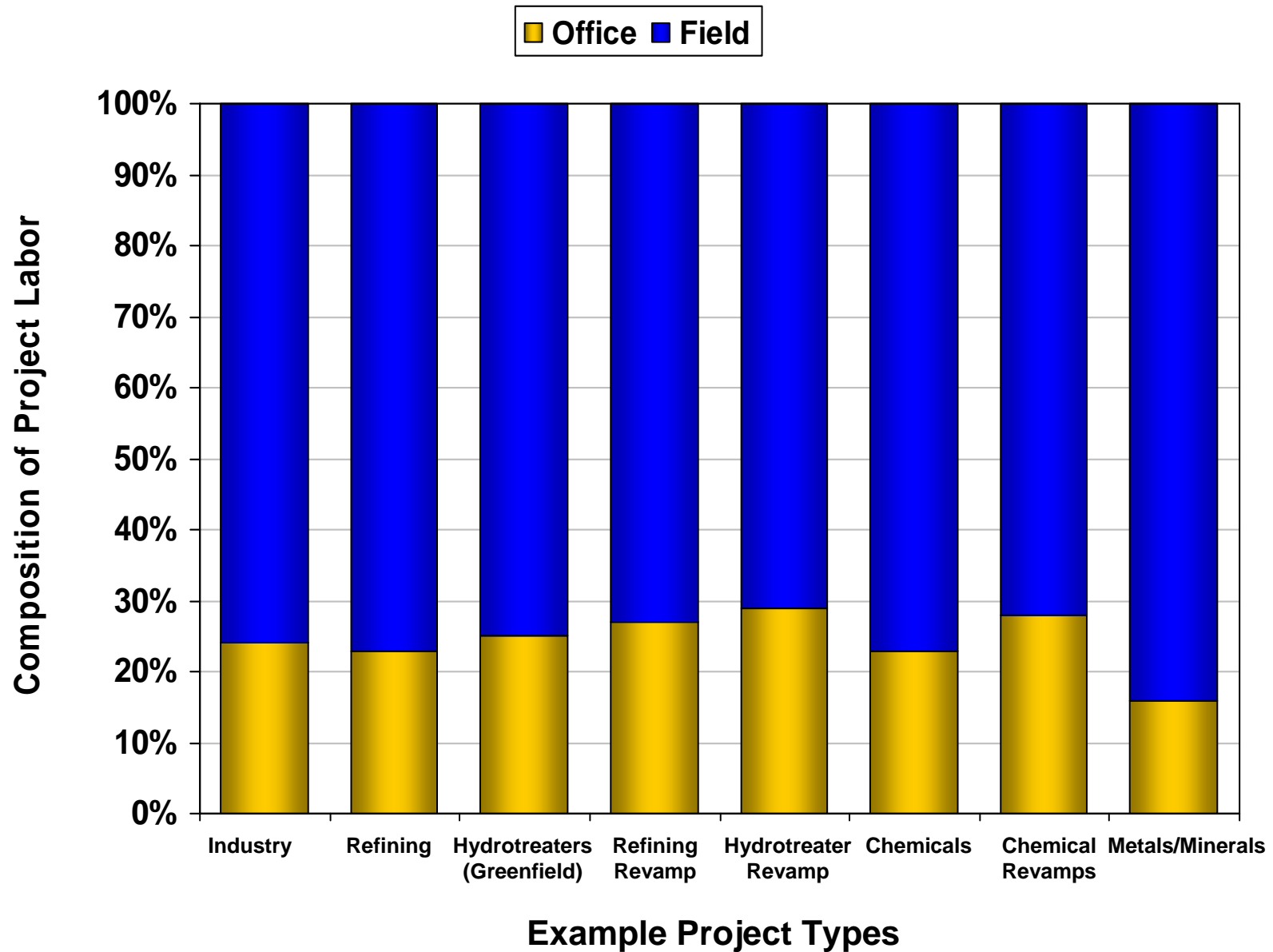
Bulk Material Percentages by Scope



Equipment Percentages by Scope

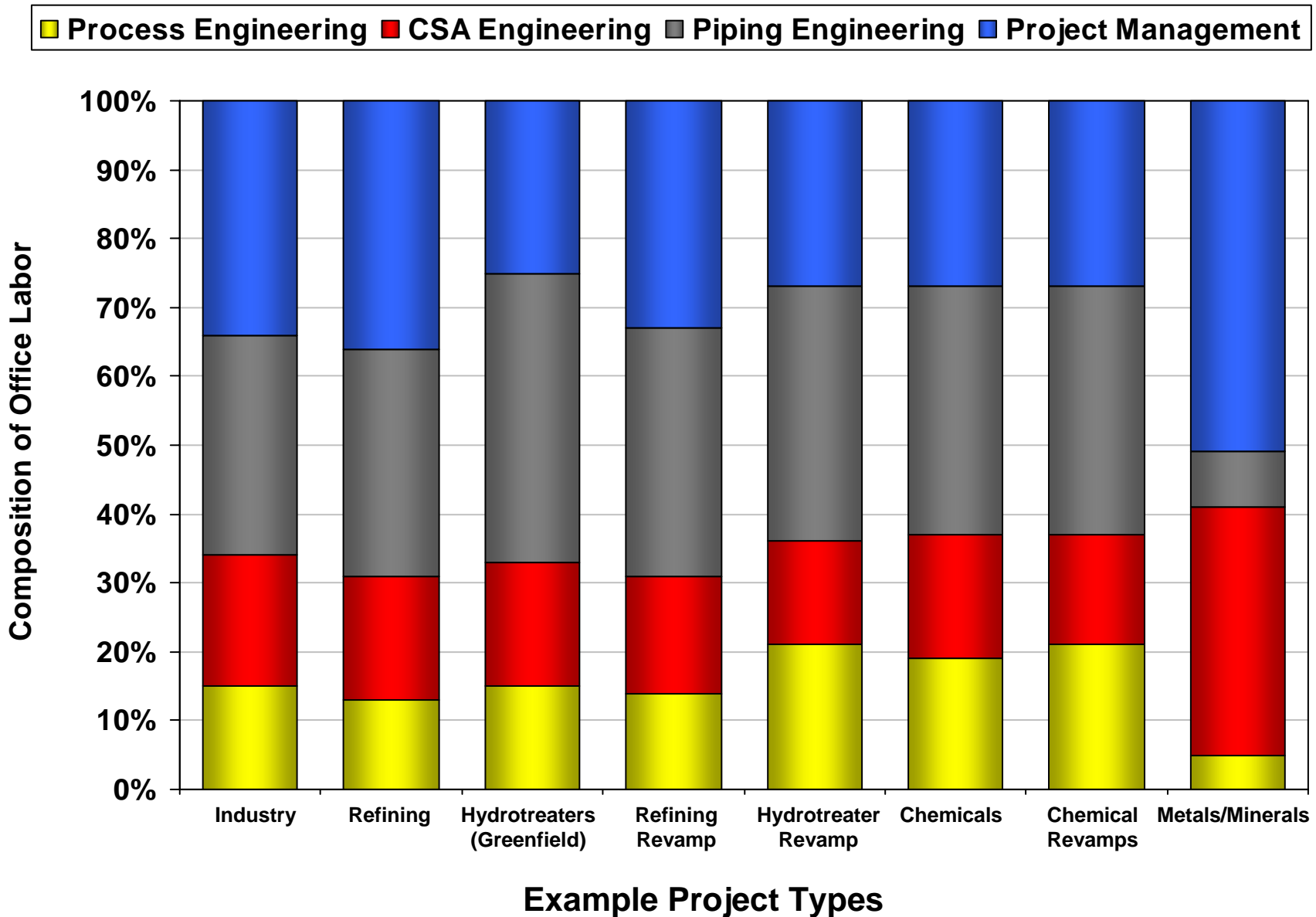


Total Labor Percentages by Scope *



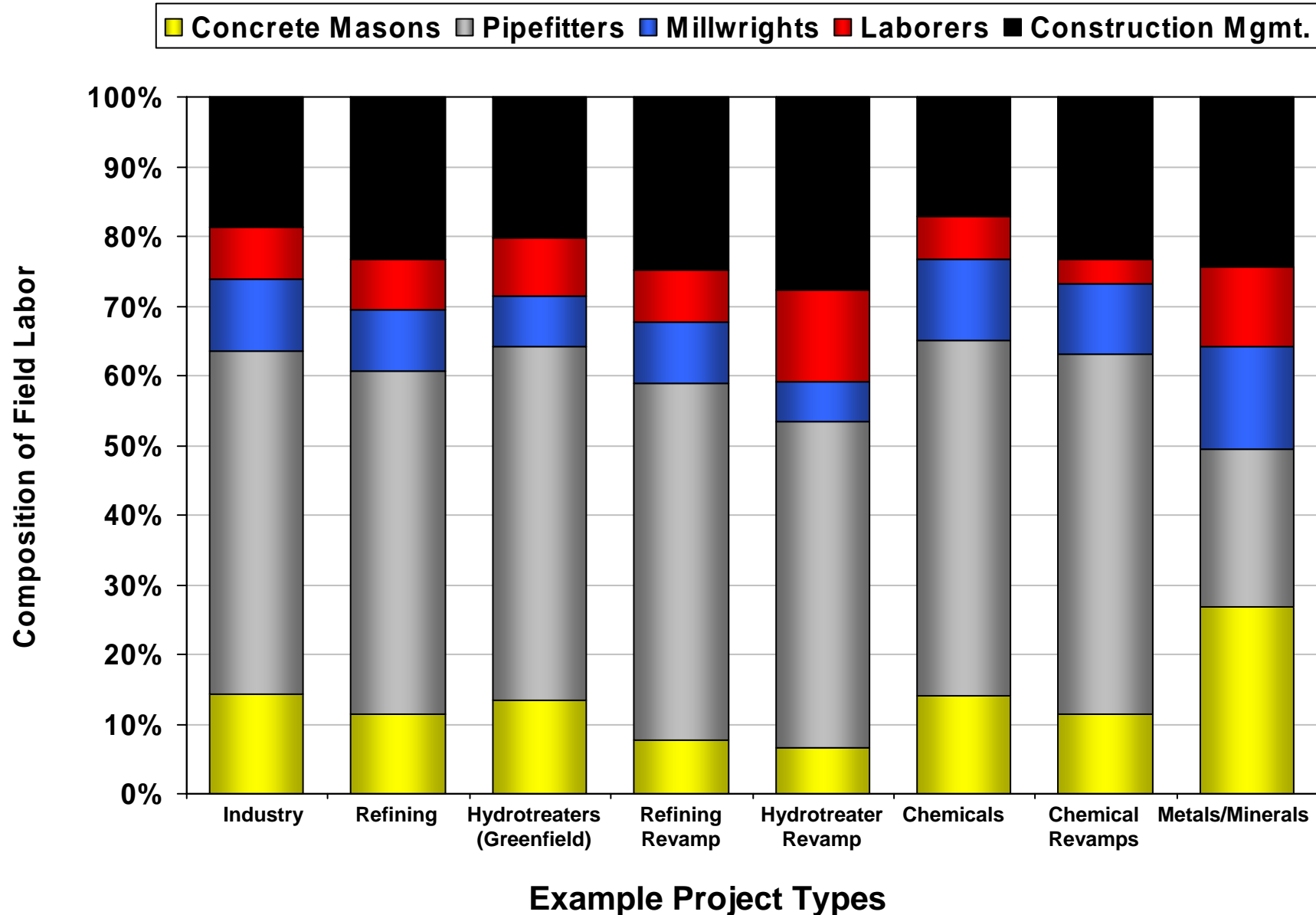
*Hours used to produce percentages

Office Labor Percentages by Scope*



*Hours used to produce percentages

Field Labor Percentages by Scope*



*Hours used to produce percentages



Plan of Action

- Introduction
- ***Scope Specific Escalation***
 - ***Capital and labor composition by scope***
 - ***Escalation rates***
- Conclusions

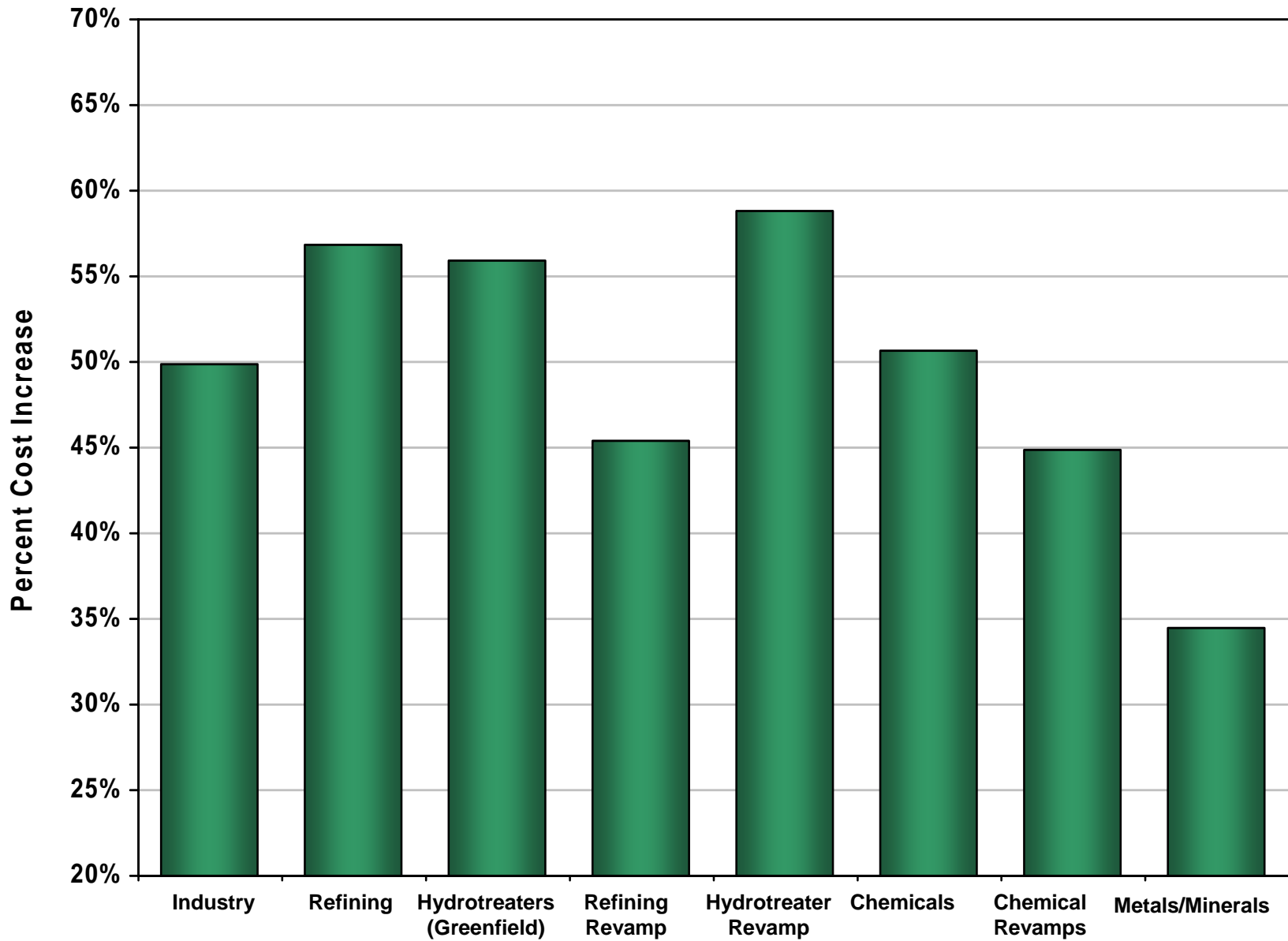
Field Cost Increases

| Resource | Cost Increase (1/03 to 8/08) |
|------------------------------------|---|
| Concrete Masons | 32% |
| Pipefitters | 40% |
| Millwrights | 42% |
| Laborers | 31% |
| Construction Management | 41% |

Material Cost Increases

| Resource | Cost Increase (1/03 to 8/08) |
|-----------------|---|
| Concrete | 35% |
| Steel | 86% |
| Pipe | 62% |

Scope Specific Escalation





Plan of Action

- Introduction
- Scope Specific Escalation
- ***Conclusions***
 - ***Required Escalation***
 - ***Group Discussion***



Changing Times

- **Prior to 2004, the average amount of escalation estimators accounted for was roughly 3%**
 - **In other words, a project that cost \$200 MM in 2003, would cost slightly more than \$232 MM in 2008**
- **Due to the changing capital market, the necessary amount of escalation for typical projects has increased to 8.5 % per year since 2003**
 - **This has caused that same \$200 MM project to cost \$300 MM in 2008, which is 30% more than the project cost using the standard 3% per year**



Conclusion

- **Keep in mind, the escalation figures shown did not control for the myriad of external factors that lead to cost increases such as resource shortages, contracting strategy and project location**
- **As seen, the Metals/Minerals group experienced a lower rate of increase since 2003 mainly due to the high degree of mechanical pieces of equipment and CSA engineering, both components that trailed industry terms of cost increases**
- **On the other hand, the above average use of piping bulks along with the fabricated pieces of equipment caused the recent hydrotreater revamps to be subjected to the highest cost increases over the past few years**

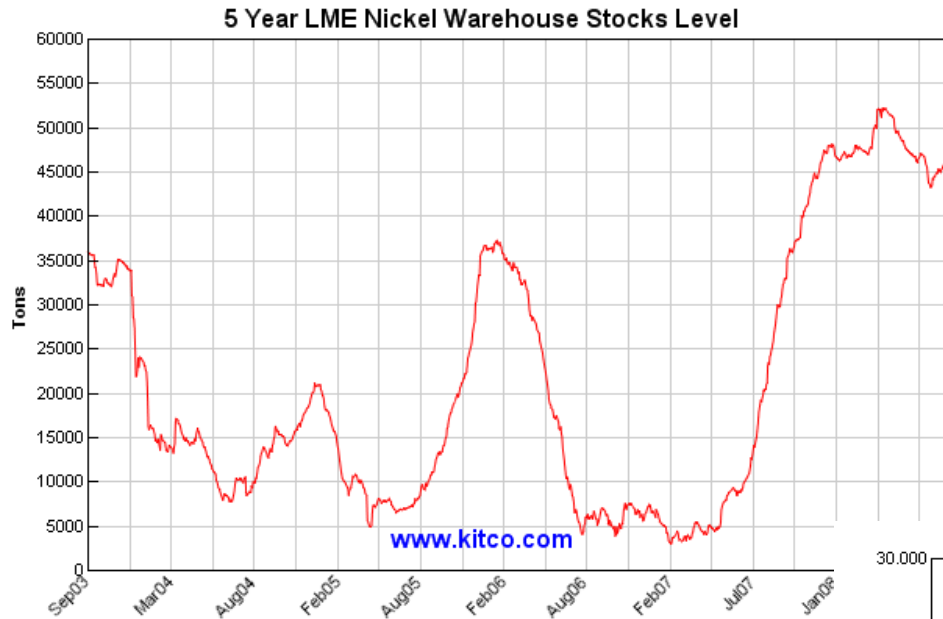


Discussion Points

- **The industry scope examples range from high level (chemical revamp) to more specific (refinery hydrotreater revamp)**
 - **It is not difficult to find exceptions to the assumptions which define the industry scopes**
 - > **A chemical revamp could install more fabricated than mechanical equipment**
 - > **Some minerals projects incorporate significant gases/liquids handling (i.e. more pipes than conveyors)**
 - **All the examples assume standard materials of construction and equipment sizing**
 - > **We will provide some data which indicates that this issue likely introduces additional dimensions into defining escalation**
 - **Results assume World Open Market (WOM) and do not include location specific cost adjustments**
- **However, the point is to provide a framework for understanding the sensitivity of escalation to a project scope**

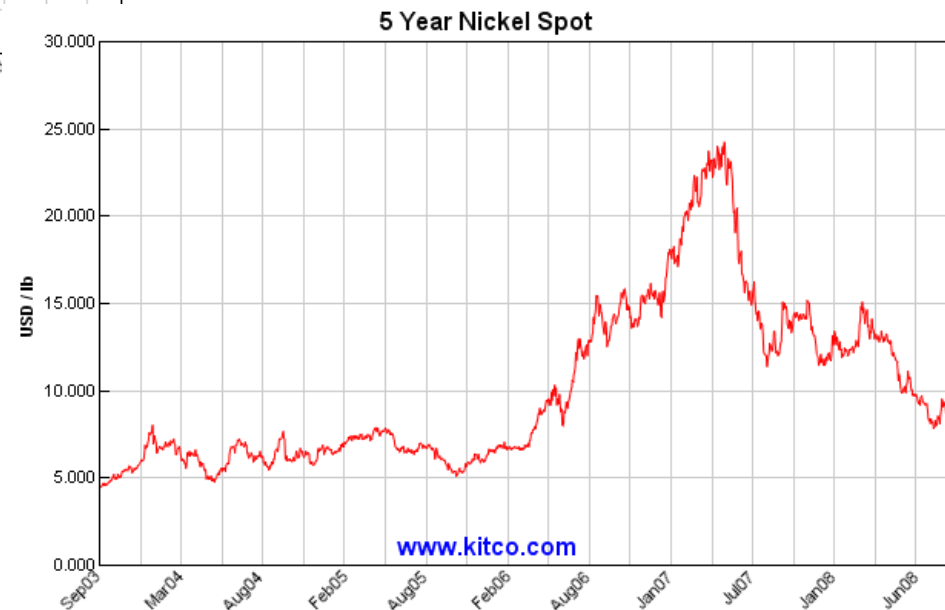
Additional Dimensions

(Accounting for High Alloy Materials of Construction)

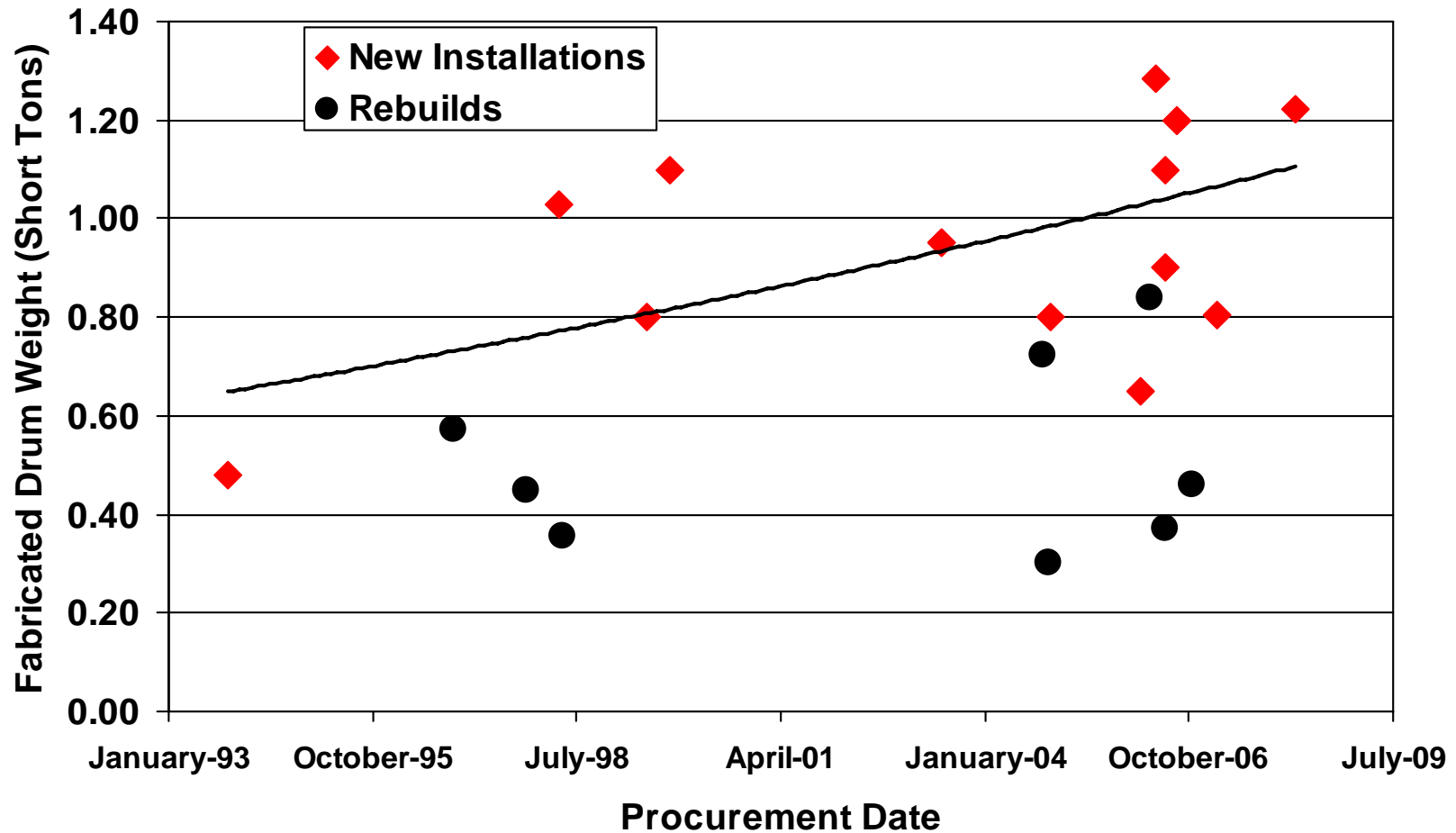


- High Alloy Base Metal Prices have experienced volatility
- Must also consider the additional costs to design and install specialized equipment and material

Charts from Kitco
Metals International
(www.kitcometals.com)

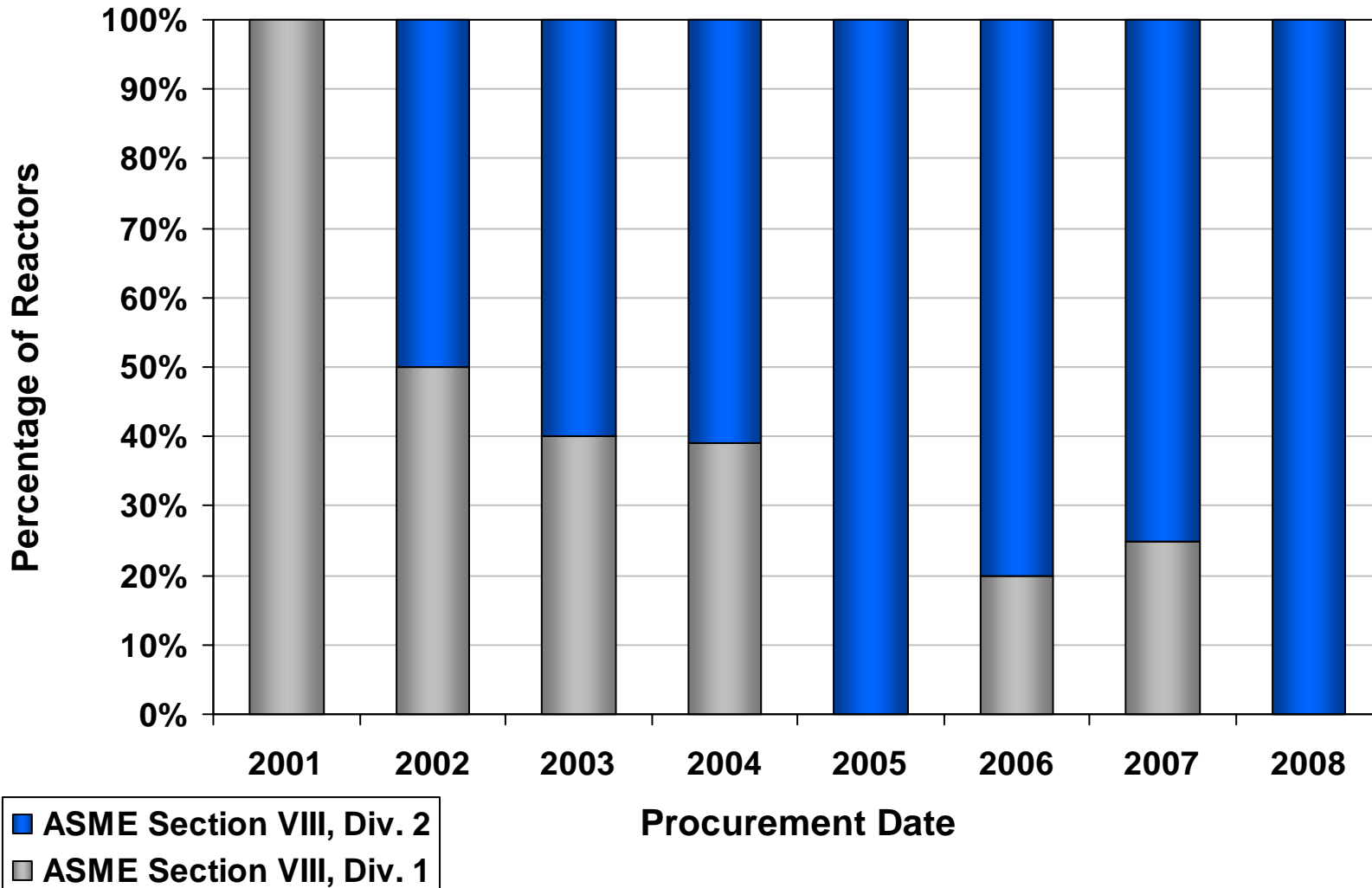


The Definition of World Scale Has Changed



(Weight of Fabricated Drums for Delayed Cokers have increased 2X from 1990s)

Industry is Shifting to More Severe Operating Conditions





Why Does an Investment Engineer Care About the ASME Engineering Code?

- A sample of 68 reactors procured by industry highlights a trend to higher pressures and changes to reactor design codes (e.g. more Div. 2 than Div. 1)
 - Div. 2 reactors are generally used at higher pressures
 - Div. 2 reactors are generally vanadium based alloy (SA-336-F22-V, SA-541-F22 V)
- Observations on Vanadium Markets: from “Vanadium and Supply Trends” presented at the Metal Bulletin’s 9th Asian Ferro-Alloys Conference (March 2007)
 - “Demand for Vanadium has recently been at a higher rate than for steel”
 - “Growing demand and constraints on supply will lead to shortages” with “few alternative new sources for supply”