Project Controls Expo – 13th Oct 2015
Emirates Stadium, London

Total Cost Management
The synergy between Cost Estimating and Project Controls

About the Speaker

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Professional career:

- 1990-1998 Dow Chemical - Project Controls department
- 1998-2000 Stork Comprimo
- 2000-2001 Jacobs Engineering
- 2001- present Cost Engineering Consultancy B.V.

CCP, CEP by the AACE International standards.

Comprehensive experience in cost engineering and cost estimating solutions in wide variety of industries.

References

- Bulk storage
- Construction industry
- EPC(M)
- Food and Nutrition
- Government
- Offshore
- Oil & Gas industry
- Heavy industry
- Pharmaceutical industry
- Petro-/chemical industry
- Power industry
- Mining & Minerals

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Project experience

- One of the most important tools for an estimator is experience
- Desire to improve capital cost estimating systems, tools, methodologies and practices.
- Data collection of project cost, schedule and scope information required in a structured format
- Missing feedback loop during the execution phase in order to validate and/or improve their estimating data.

Broken feedback loop

Many reasons can be identified:

- Disconnects exist between project management, estimating, planning and cost control, due to a lack of understanding of each other's need which could disrupt a proper feedback cycle
- The cost control baseline could lack the level of detail required to evaluate for instance compensation events during execution
- It could be induced by opting for lump-sum turnkey EPC contracts for the majority of the projects, as engineering contractors are reluctant to share information regarding hours, costs and key quantities

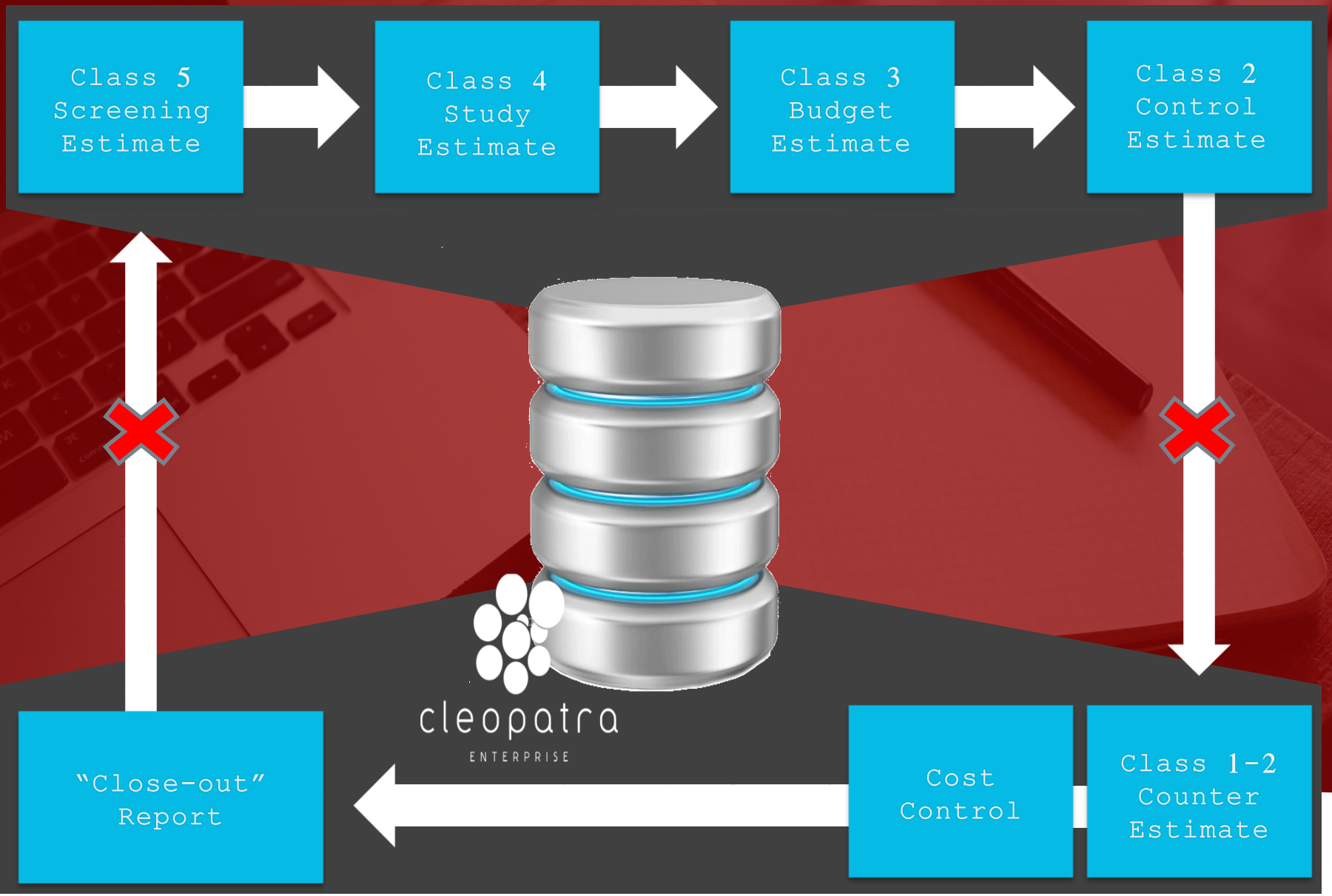
Companies have a need for a project historical retrieval and analysis system

Synergy between Cost Estimating and Project Controls

It is time to establish synergy between Cost Estimating and Project Controls by working with pre-set visual performance indicators during project execution.

- Should start by setting up a proper baseline conforming to all requirements of the stakeholders.
- Monitor project cost and schedule performance during Project Cost Control
- Give improved forecasting information.
- Meaningful ratios and statistics for your projects to aid estimate reviews, providing estimating database feedback and calibration information.

Initiation through close-out phase



Estimating the cost baseline

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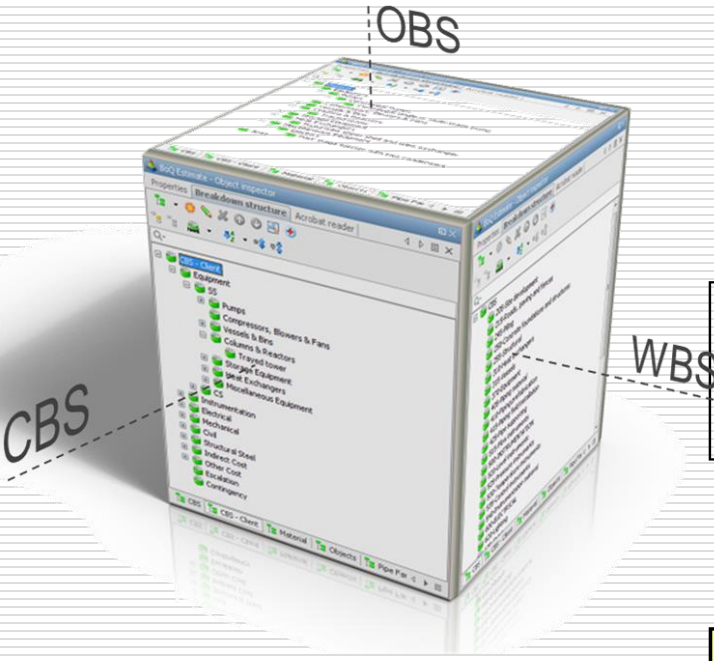
Estimating the cost baseline
Estimate classification

AACE Cost Estimate Classification System

Primary Characteristics			Secondary Characteristics		
Estimate Level	Level of Project definition	End Usage	Methodology	Expected Accuracy Range	Preparation Effort
5	0% to 2%	Concept Screening	Capacity factored Parametric Models, Judgment or analogy	L: -20% to -50% H: +30% to +100%	1
4	1% to 15%	Study or Feasibility	Equipment factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
3	10% to 40%	Budget, Authorization or Control	Semi-detailed unit cost with assembly level line items	L: -10% to -20% H: +10% to +30%	3 to 10
2	30% to 70%	Control or Bid / Tender	Detailed Unit Cost with Forced Detailed take-off	L: -5% to -15% H: +5% to +20%	4 to 20
1	50% to 100%	Check Estimate or Bid / Tender	Detailed Unit Cost with Detailed take-off	L: -3% to -10% H: +3% to +15%	5 to 100

Estimating the cost baseline Breakdown Structures



Work Breakdown Structure

WBS

Responsibility Assignment Matrix

RAM

Work Packages

OBS

Cost Elements

CBS

Organizational Breakdown Structure

Cost Breakdown Structure

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Estimating the cost baseline
Breakdown Structures

Grand total

Grand total | Direct totals | Rate totals | Crew totals | Breakdown totals | Breakdown cube | Currency totals

Row structure: CBS — Row key depth: 4

Column structure: Area — Column key depth: 2

Breakdown structure "CBS"	Breakdown structure "Area"								
	3100 - Raw materials	3300 - Evaporation	3400 - Storage	3800 - Utilities	3900 - Roads, ...	4000 - Indirec...	5000 - Escalation	6000 - Contingency	
	Total cost	Total cost	Total cost	Total cost	Total cost	Total cost	Total cost	Total cost	Total cost
CBS - CBS Cost Engineering	900.819,44	444.731,51	298.126,07	760.412,54	718.414,70	778.031,23	128.675,24	402.921,07	4.432.131,81
SBE - Subtotal Base Estimate	900.819,44	444.731,51	298.126,07	760.412,54	718.414,70	778.031,23	0,00	0,00	3.900.535,50
SMC - Subtotal Materials and Construction	900.819,44	444.731,51	298.126,07	760.412,54	718.414,70	95.043,90	0,00	0,00	3.217.548,18
DFM - Direct Furnished Materials	569.588,36	261.464,51	170.909,67	448.704,94	0,00	0,00	0,00	0,00	1.450.667,48
1000 - Mechanical Equipment	234.460,00	84.300,00	52.800,00	140.600,00	0,00	0,00	0,00	0,00	512.160,00
3000 - Piping Materials	98.524,37	59.114,62	39.409,75	98.524,37	0,00	0,00	0,00	0,00	295.573,10
4000 - Instrumentation Materials	179.821,73	107.476,34	71.650,89	179.358,73	0,00	0,00	0,00	0,00	538.307,69
5000 - Electrical Materials	56.782,26	10.573,55	7.049,03	30.221,84	0,00	0,00	0,00	0,00	104.626,68
DFC - Direct Field Contracts	331.231,08	183.267,00	127.216,40	311.707,60	718.414,70	95.043,90	0,00	0,00	1.766.880,70
7100 - Site Development	0,00	0,00	0,00	0,00	24.570,00	0,00	0,00	0,00	24.570,00
7300 - Civil	0,00	0,00	0,00	0,00	543.229,70	0,00	0,00	0,00	543.229,70
7500 - Structural Steel	0,00	0,00	0,00	0,00	150.615,00	0,00	0,00	0,00	150.615,00
7600 - General Mechanical	268.753,23	153.645,24	107.468,56	260.073,45	0,00	95.043,90	0,00	0,00	884.984,38
7700 - Instrumentation & Electrical	62.477,86	29.621,77	19.747,84	51.634,15	0,00	0,00	0,00	0,00	163.481,62
IFC - Subtotal Indirect Field Costs	0,00	0,00	0,00	0,00	0,00	682.987,32	0,00	0,00	682.987,32
8000 - Indirect Costs	0,00	0,00	0,00	0,00	0,00	682.987,32	0,00	0,00	682.987,32
8100 - Definition Costs	0,00	0,00	0,00	0,00	0,00	144.789,67	0,00	0,00	144.789,67
8200 - Project Management	0,00	0,00	0,00	0,00	0,00	116.160,00	0,00	0,00	116.160,00
8300 - Engineering	0,00	0,00	0,00	0,00	0,00	321.754,82	0,00	0,00	321.754,82
8400 - Construction Management & Commissioning	0,00	0,00	0,00	0,00	0,00	93.847,74	0,00	0,00	93.847,74
8500 - Start-Up	0,00	0,00	0,00	0,00	0,00	6.435,10	0,00	0,00	6.435,10
9800 - Escalation	0,00	0,00	0,00	0,00	0,00	0,00	128.675,24	0,00	128.675,24
9900 - Contingency	0,00	0,00	0,00	0,00	0,00	0,00	0,00	402.921,07	402.921,07
Grand total	900.819,44	444.731,51	298.126,07	760.412,54	718.414,70	778.031,23	128.675,24	402.921,07	4.432.131,81

100%	Total cost	%
Direct costs	3.122.504,27	70,45%
Allowances	95.043,90	2,14%
Sub total	3.217.548,18	72,60%
Indirect costs	682.987,32	15,41%
Sub total	3.900.535,50	88,01%
Escalation	128.675,24	2,90%
Sub total	4.029.210,74	90,91%
Contingencies	402.921,07	9,09%
Sub total	4.432.131,81	100,00%
Markups	0,00	0,00%
Grand total	**4.432.131,81**	**100,00%**

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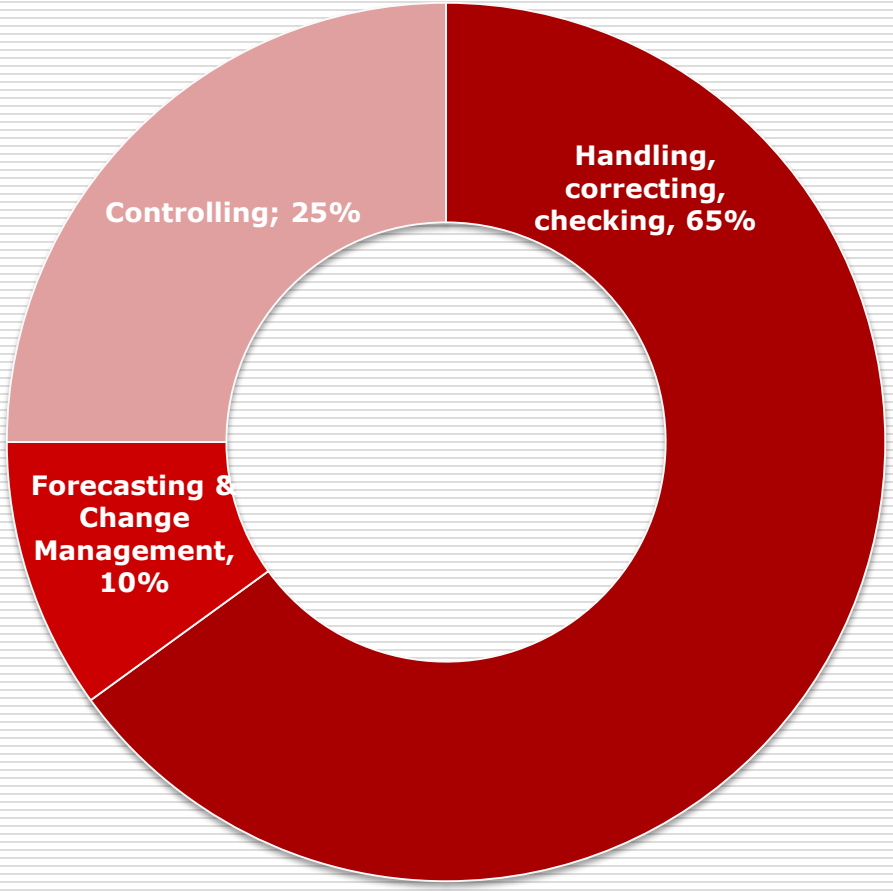
Spending valuable time on things that matter



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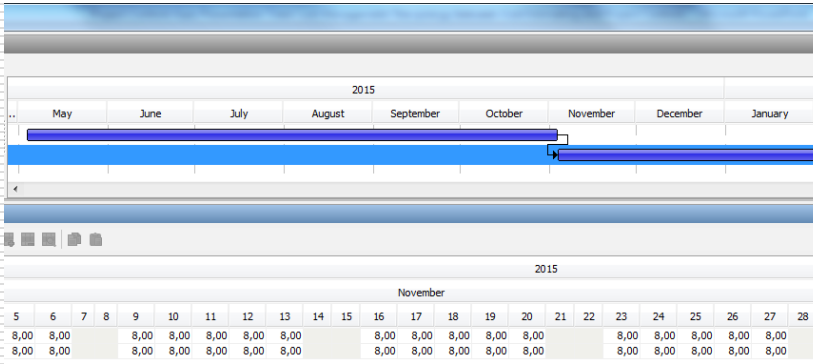
Forecasting – the link with estimating

The link with estimating

- Better integration
- Keep the estimate alive
- Involvement estimator during project controls

EAC

	Description	Estimate link	Total cost	Cost
1	EAC		63.779,84	63.779,84
2	EAC components		55.808,25	55.808,25
3	CS Pipe materials 1/2"	☑	13.452,06	13.452,06
4	CS Pipe materials 2"	☑	13.452,06	13.452,06
5	CS Pipe materials 4"	☑	13.452,06	13.452,06
6	CS Pipe materials 8"	☑	13.452,06	13.452,06
7	Piping materials extra	☑	2.000,00	2.000,00
8	Description			Cost



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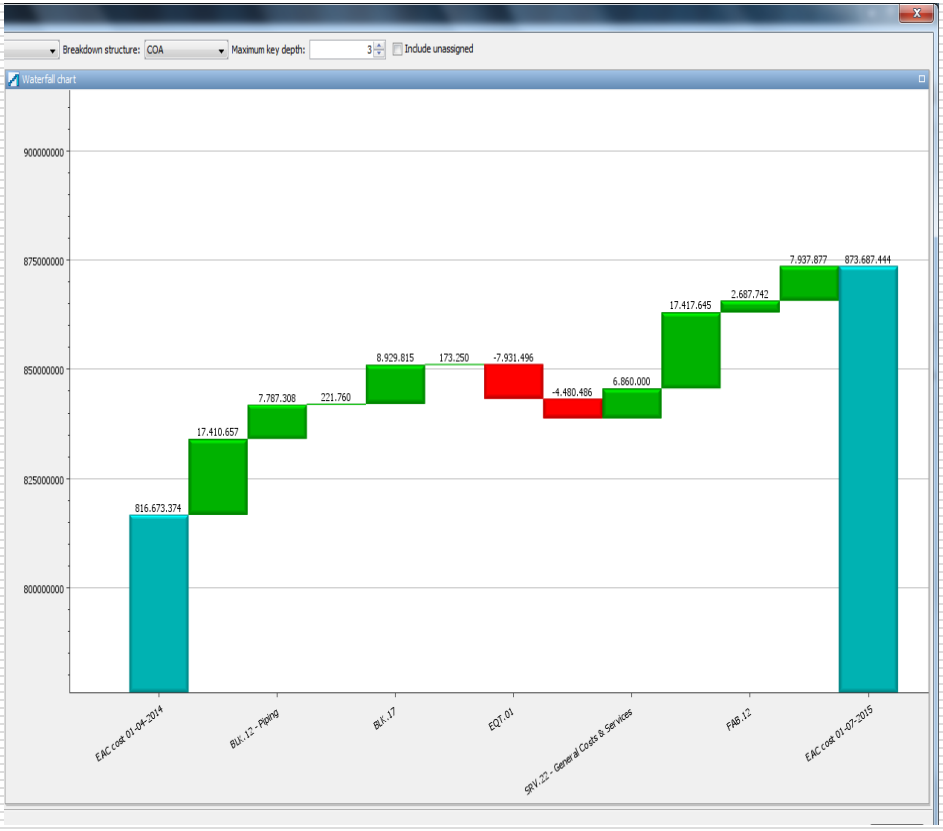
Forecasting – the link with estimating

The link with estimating

- Changes based upon proper estimating
- Visualize project development through time



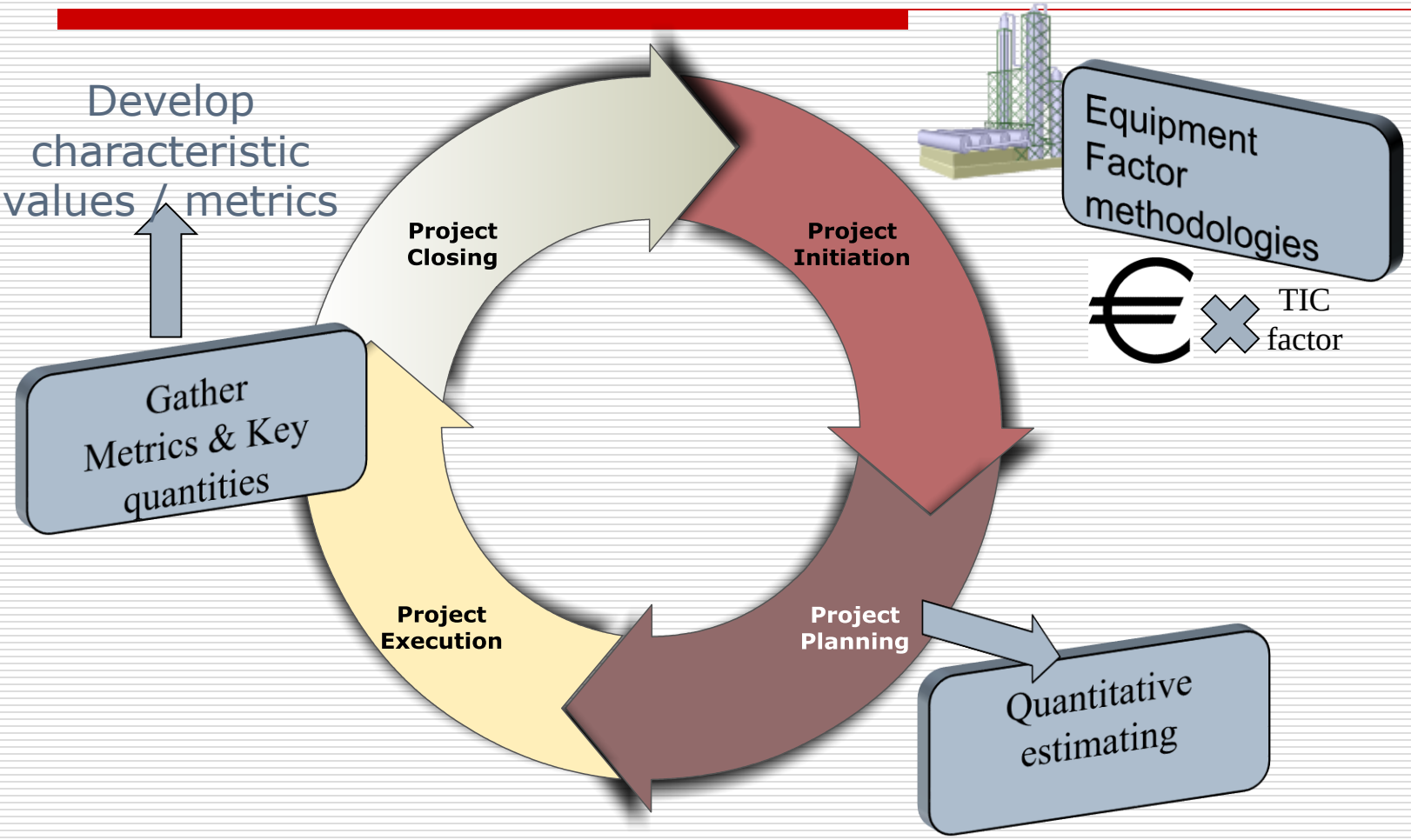
Project close-out

Project close-out

Information of interest:

- Cost Factors – for early phase estimating
  - Hand factors
  - Lang factors
- Characteristic values and metrics – concept studies
- Realized hours – benchmarking estimating norms

Project close-out



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Project close-out

What are important metrics?

- Metrics used for quantitative estimating in order to determine the expected project quantities without having to involve a full design team to determine these quantities.
- For example:
  - Length of pipe per main equipment item : 150 m pipe / eq.
  - Number of fittings per length of pipe : 0,6 fitting / m pipe

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Project close-out

- The purpose of this focus on cost metrics is to extend to cost engineering practices. By using these metrics and research findings, companies can improve their project and business results.
- These characteristic values will:
  - Support conceptual estimate
  - Support estimate reviews
  - Assess company performance against industry norms.
  - Support calibration and improvement of company tools and databases.
  - Improve asset cost evaluation and concept development

Project close-out

"It was a good project. It will be missed"

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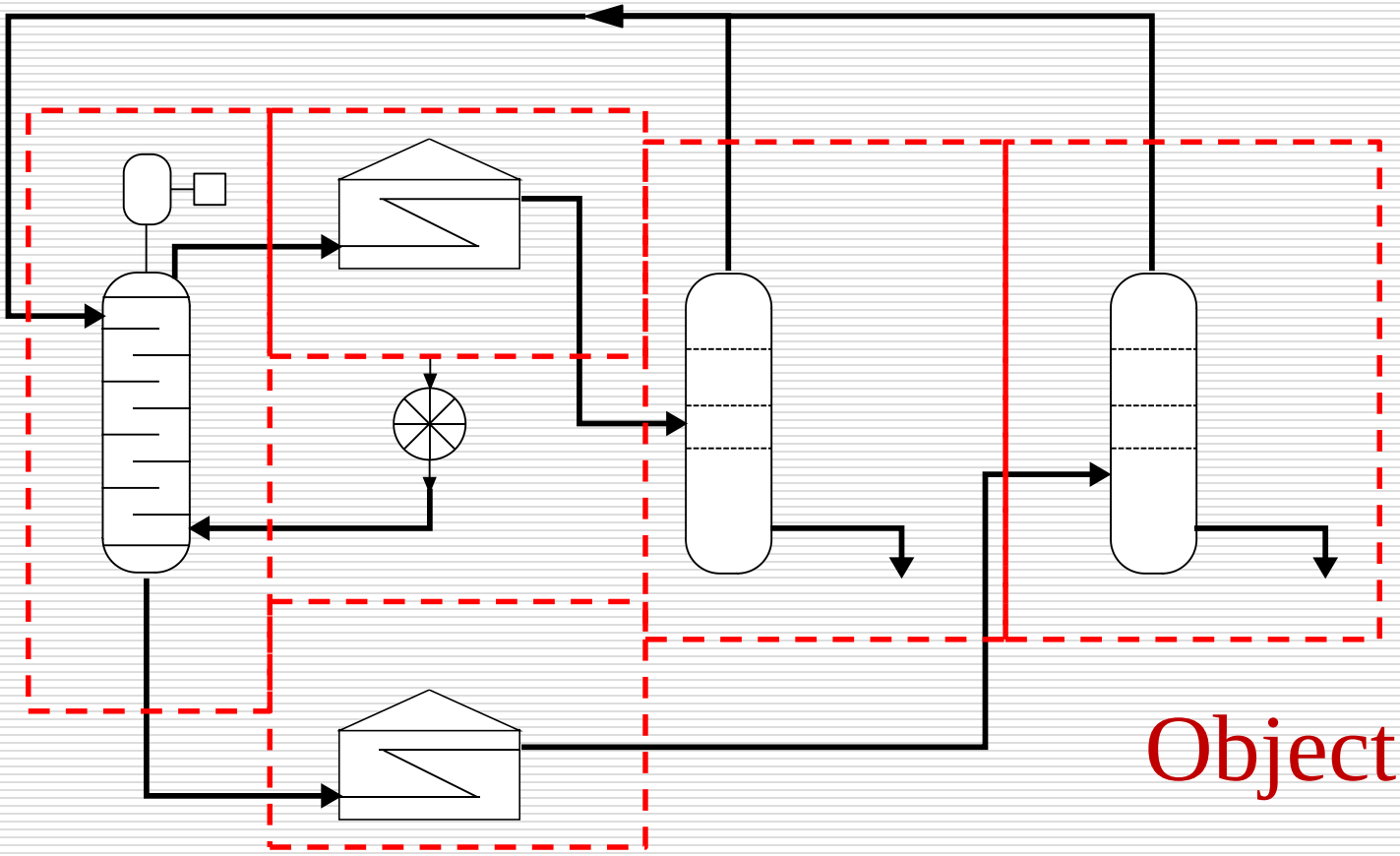
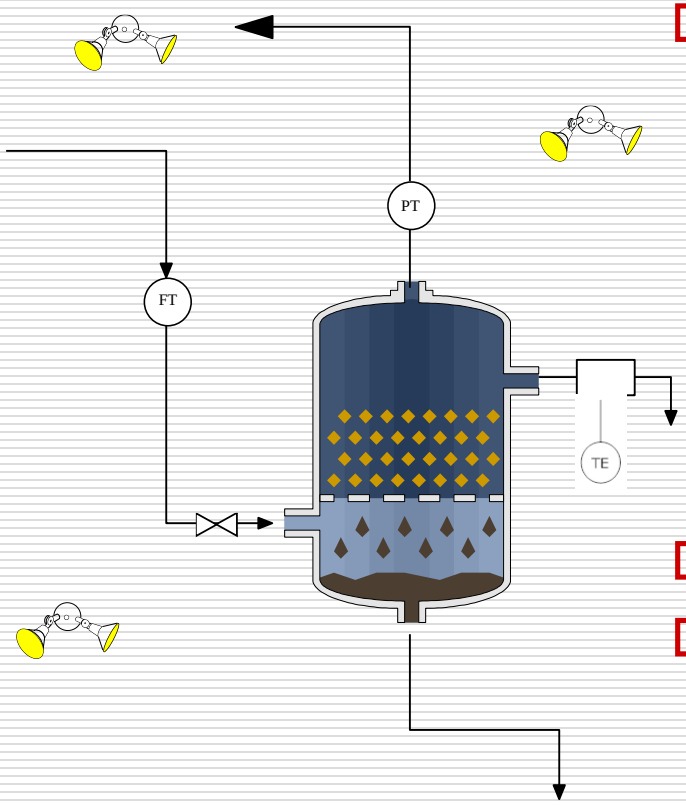
Project Structure



Project Structure - objects



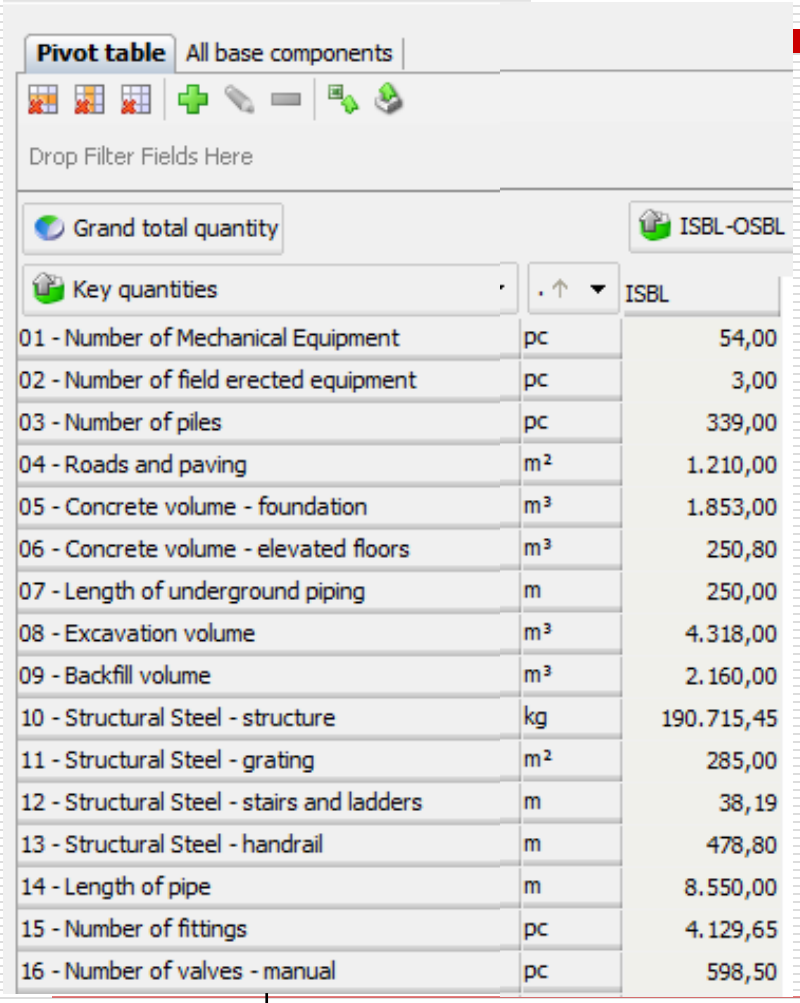
- Metrics
  - @ 4.5” pipe
  - @ 150 m pipe per equipment
  - @ 0,9 - 1,2 Control valve per equipment
  - @ 5.5 Field instruments per equipment
  - @ 3 lighting fixtures per equipment
- Cost database aligned with metrics
- Core metrics in estimating are often key quantities

Key quantities

Essential basis for metric development:

- What is included in the metric – ISBL versus OSBL
- Analyzing key quantities of projects
- Develop useful characteristic values
  - No relation: Length of Electrical cable per meter pipe
- Distinguish between different types of projects
- Develop and maintain cost database inline with composites supporting the characteristic values

Key quantities



Pivot table | All base components

Drop Filter Fields Here

Grand total quantity		ISBL-OSBL
Key quantities		ISBL
01 - Number of Mechanical Equipment	pc	54,00
02 - Number of field erected equipment	pc	3,00
03 - Number of piles	pc	339,00
04 - Roads and paving	m²	1.210,00
05 - Concrete volume - foundation	m³	1.853,00
06 - Concrete volume - elevated floors	m³	250,80
07 - Length of underground piping	m	250,00
08 - Excavation volume	m³	4.318,00
09 - Backfill volume	m³	2.160,00
10 - Structural Steel - structure	kg	190.715,45
11 - Structural Steel - grating	m²	285,00
12 - Structural Steel - stairs and ladders	m	38,19
13 - Structural Steel - handrail	m	478,80
14 - Length of pipe	m	8.550,00
15 - Number of fittings	pc	4.129,65
16 - Number of valves - manual	pc	598,50
17 - Number of valves - control valves	pc	68,40
18 - Number of field instruments	pc	256,50
19 - Number of welds	pc	7.309,22
20 - Number of x-rayed welds	pc	730,92
21 - Insulation - Equipment	m²	4.295,00
22 - Insulation - Pipe	m	6.412,50
23 - Painting - Pipe	m	6.840,00
24 - Fire proofing	m²	114,00
26 - Number of JB - Instrumentation	pc	40,61
27 - Number of JB - Electrical	pc	85,50
28 - Cable length multicore - Instrumentatio	m	12.183,75
29 - Cable length singles - Instrumentation	m	6.498,00
31 - Cable length - Electrical LV	m	21.330,00
32 - Trace Heating Cable length	m	6.384,00
33 - Length of trays	m	2.619,40
34 - Length of conduits	m	855,00
35 - Length of tubing	m	3.249,00
36 - Number of lighting fixtures	pc	171,00
37 - Number of I/O's	pc	454,06

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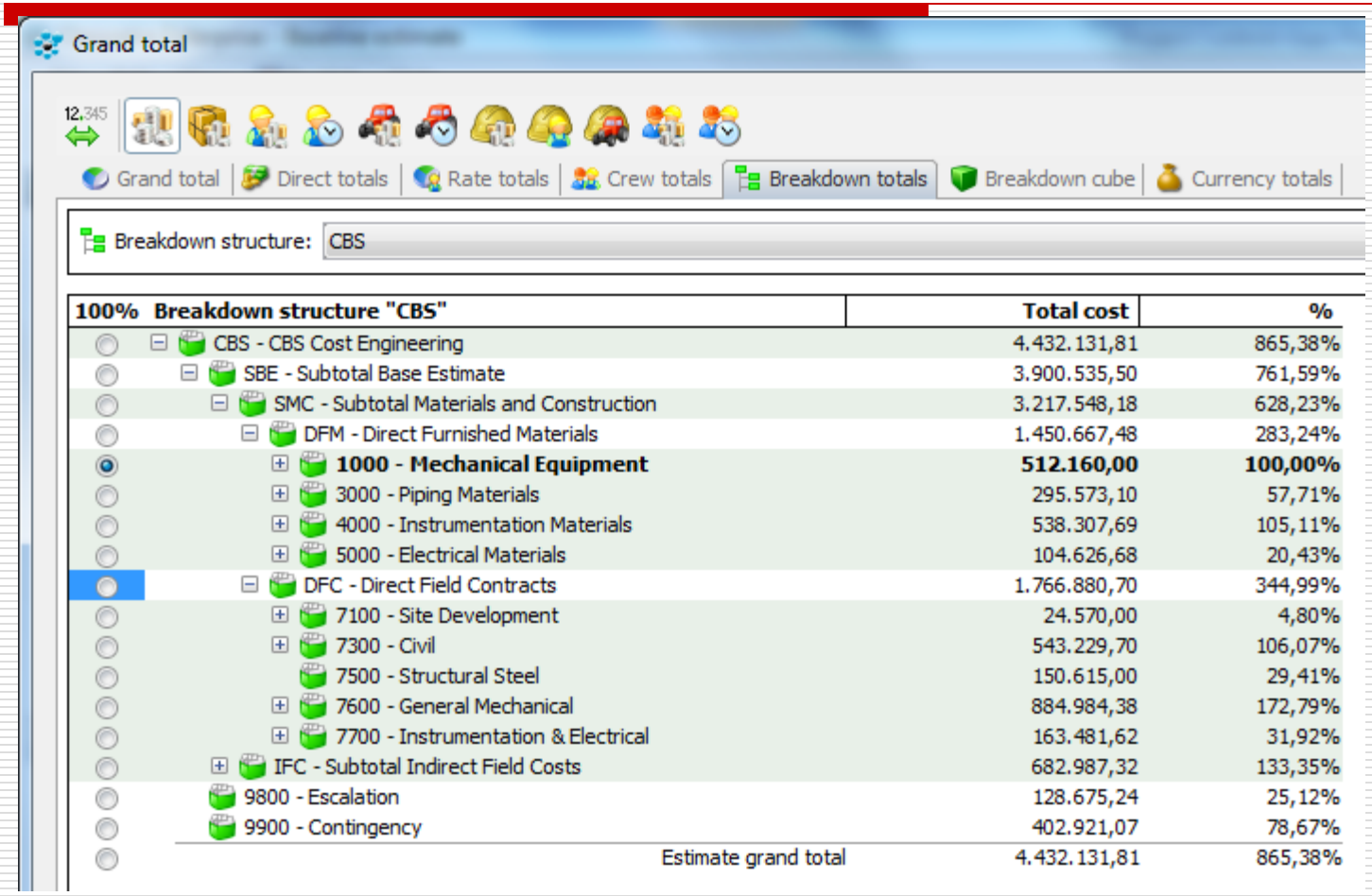
Project metrics



100% Breakdown structure "CBS"	Total cost	%
CBS - CBS Cost Engineering	4.432.131,81	865,38%
SBE - Subtotal Base Estimate	3.900.535,50	761,59%
SMC - Subtotal Materials and Construction	3.217.548,18	628,23%
DFM - Direct Furnished Materials	1.450.667,48	283,24%
1000 - Mechanical Equipment	**512.160,00**	**100,00%**
3000 - Piping Materials	295.573,10	57,71%
4000 - Instrumentation Materials	538.307,69	105,11%
5000 - Electrical Materials	104.626,68	20,43%
DFC - Direct Field Contracts	1.766.880,70	344,99%
7100 - Site Development	24.570,00	4,80%
7300 - Civil	543.229,70	106,07%
7500 - Structural Steel	150.615,00	29,41%
7600 - General Mechanical	884.984,38	172,79%
7700 - Instrumentation & Electrical	163.481,62	31,92%
IFC - Subtotal Indirect Field Costs	682.987,32	133,35%
9800 - Escalation	128.675,24	25,12%
9900 - Contingency	402.921,07	78,67%
Estimate grand total	4.432.131,81	865,38%

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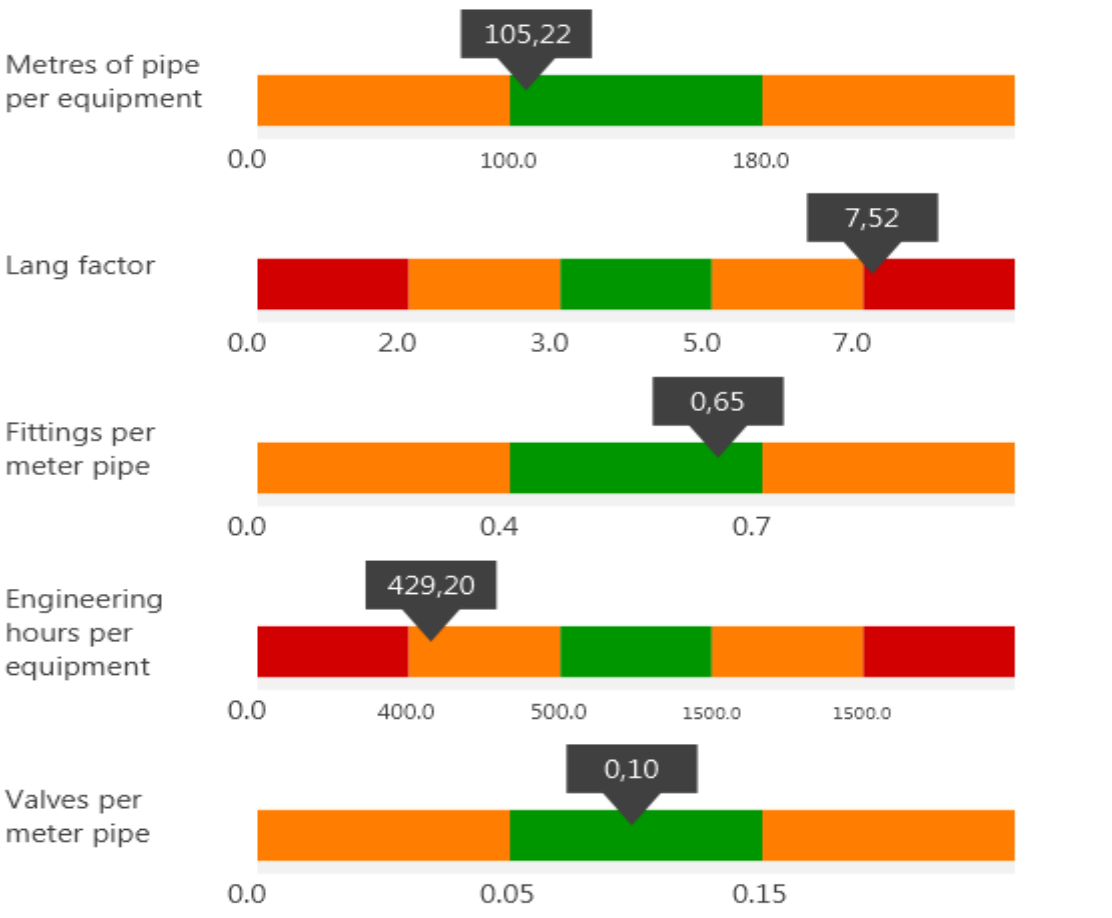
Project metrics



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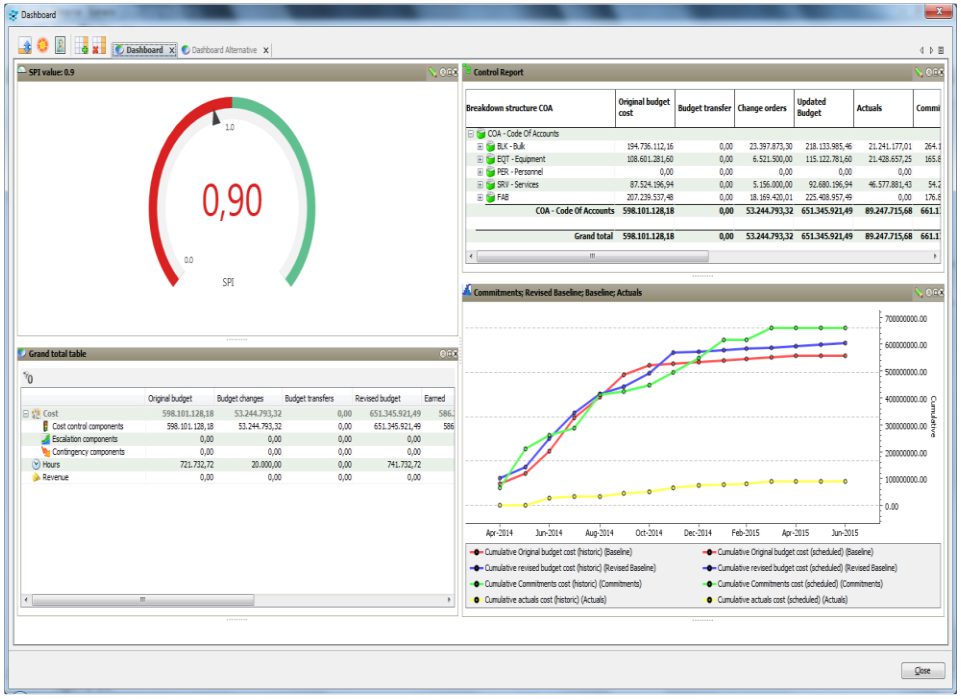
Project metrics

Database system for project historical retrieval and analysis system

- Always actual metrics by using Estimate at Completion Quantities
- Specify companies needs
- Both project metrics and project controls EVM metrics

Project metrics



Improving the Quality of Earned Value information:

- ☐ Credible
- ☐ Timely
- ☐ Significant
- ☐ Analyzed (numbers don't speak analysts do)

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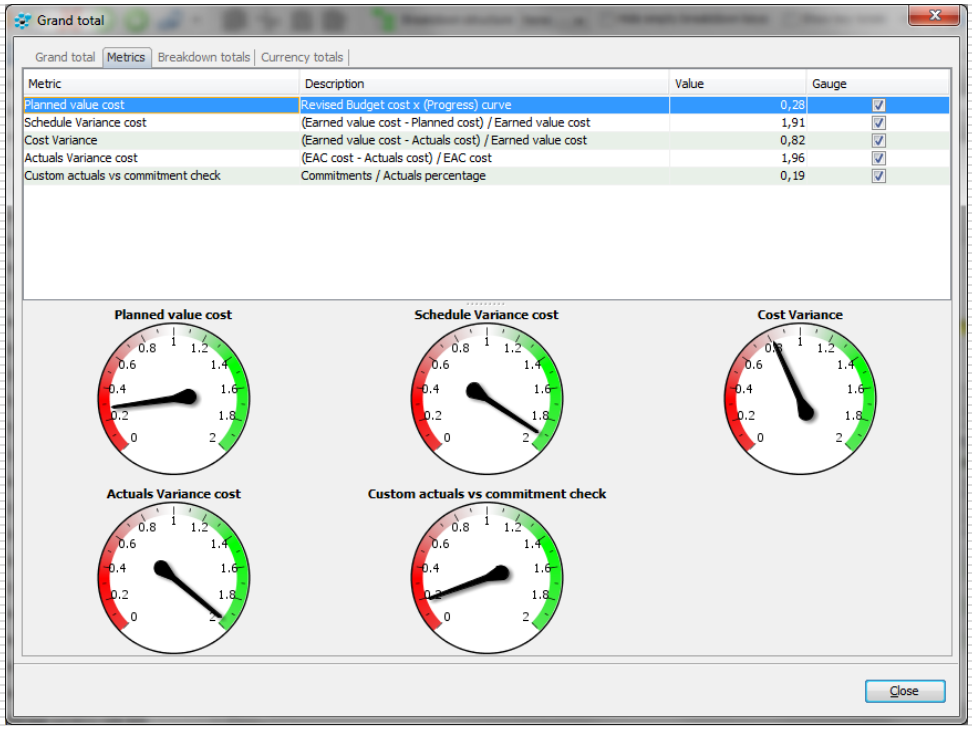
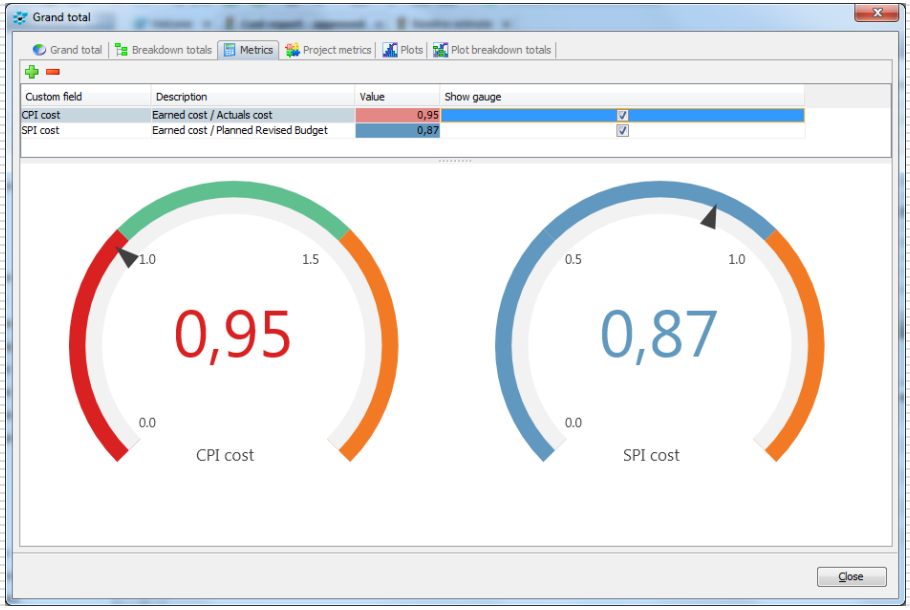
Earned Value Management
Example Reporting





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Total Cost Management

Create synergy between estimating and project controls

- Align estimate requirements with project controls system
- Embed metrics reporting into your organisation
- Involve estimating during forecasting
- Do not wait till project closure – you will be too late!

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