Better PBL contracts – An analytical approach

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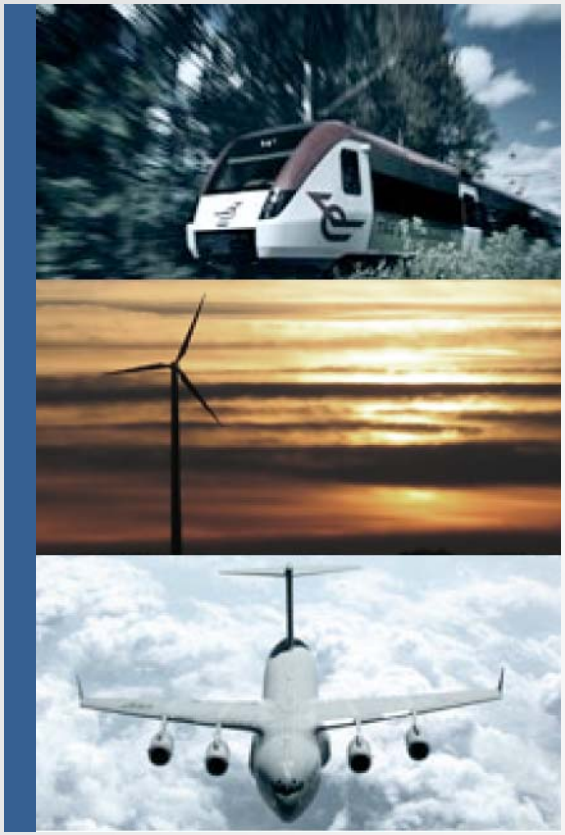

- Combination of expert consultancy and a strong software suite for resource optimization and financial analysis.
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Tools for Strategic Analysis and Decision Support in System Logistics

by Systecon opus suite

SIMLOX

PERFORMANCE

- Operational Availability
- Resource Utilization
- Dynamic Scenario Assessment

OPUS10

SPARES SUPPLY

- Optimized Assortment
- Repair Strategy
- Supply Solutions

CATLOC

COST & REVENUE

- Life Cycle Cost
- Budget & Forecasting
- Cost Driver Identification

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Saab Security & Def. Solutions
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Samsung Thales
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ST Electronics
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Turbomeca

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Performance-based Logistics (PBL)

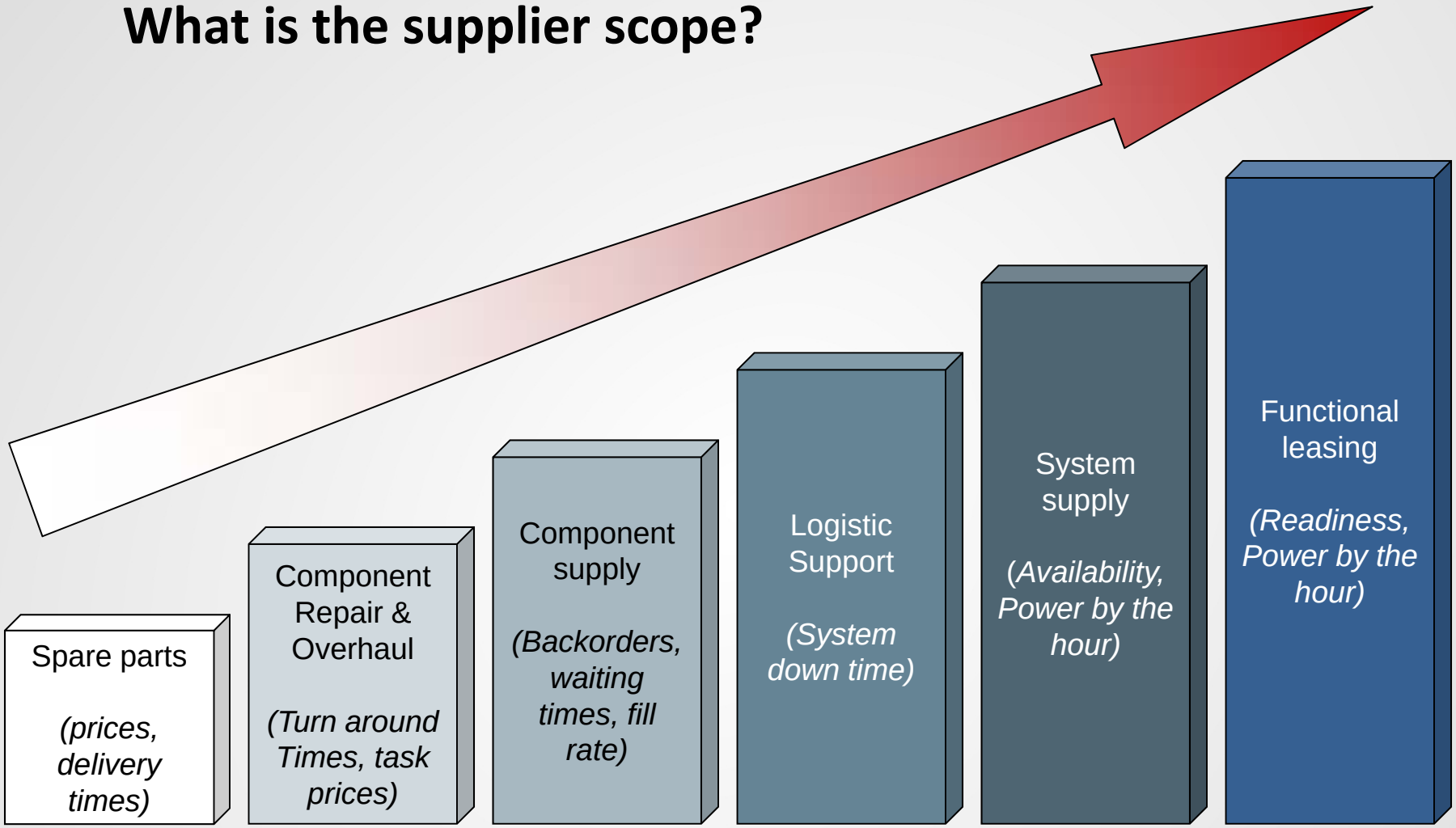
- Seeks to deliver product support as an integrated, affordable performance package designed to optimize system readiness.
- A support structure based on long-term performance agreements with clear lines of authority and responsibility.
- These strategies should optimize total system availability while minimizing cost and logistics footprint. Trade-off decisions involve cost, useful service, and effectiveness.
- The selection of the specific performance metrics should be carefully considered and supported by an operationally-oriented analysis.

Critical success factors

1. A clear definition of the supplier scope
2. Appropriate performance parameters (KPIs)
3. Appropriate KPI target levels
4. A clear and relevant incentive model
5. Performance measurement approach and intervals

Appropriate performance parameters?

What is the supplier scope?



Setting appropriate target levels and designing a clear incentive model

- The *customer*
  - wants to secure that the operational needs will be met without risking to pay too much
- The *supplier*
  - wants to assess the resources needed to fulfill the commitment and the risks and economical consequences
- A complex problem
  - need for efficient analysis models...
  - You want to create a Win-Win situation!

Use models and simulate

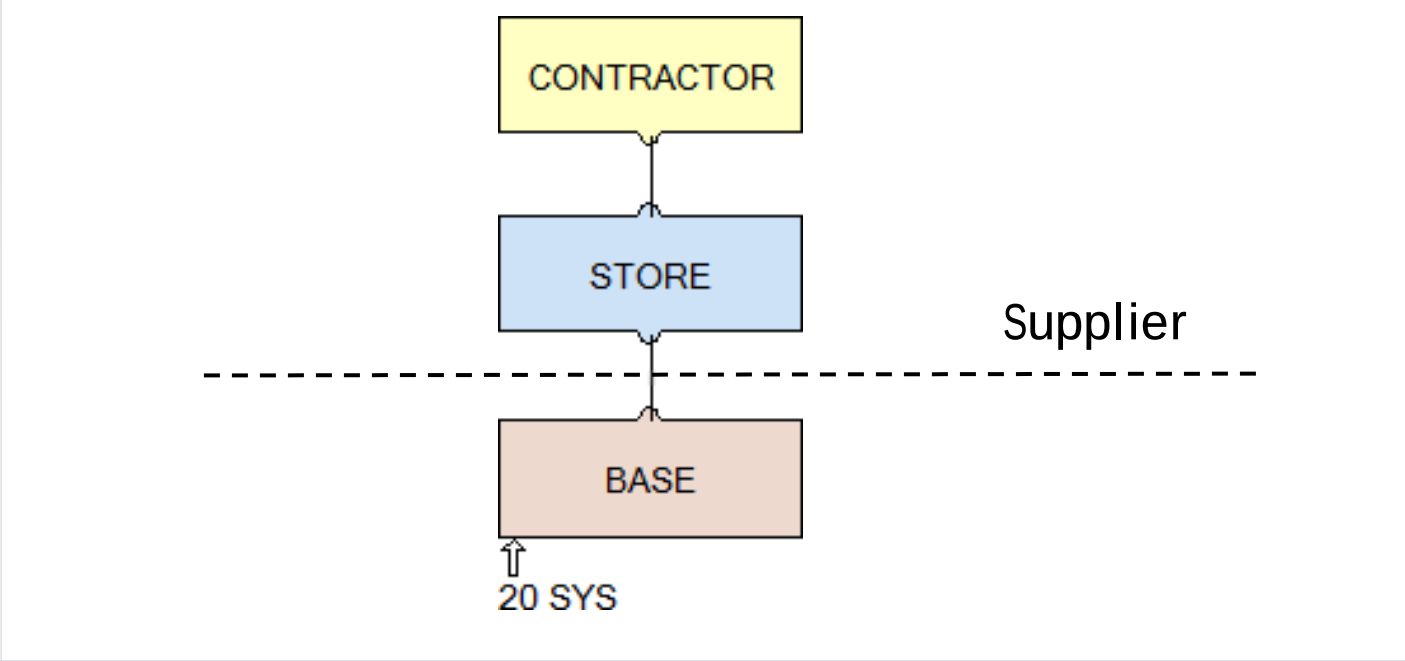
- Simulation tools like SIMLOX
  - Evaluates the operational performance that the customer can achieve given a certain contractual performance level
  - Evaluates the probability of meeting the performance level given a certain logistics solution.
  - Provides important statistics concerning the inherent variations of the logistic parameters, this should be used when formulating the PBL contract terms
- Optimization tools like OPUS10
  - Defines the most cost effective spares parts solution to meet the objectives
  - Calculates the logistics support cost to meet a certain performance level

How to assess an Incentive Model?

- What type of reward or penalty function should be used?
- How does the penalty distribution look like,
  i.e. how large penalty can be expected?
- What is the probability for not getting any penalties?
- What is the risk that we will loose money on this contract?
- other consequences…

Example

Example: Baseline scenario



- PBL contract for supplying 10 years of operation
- 20 technical systems, utilization 15 % of the time
- System consists of 400 repairables and 600 discardables
- Repair time and lead time for reorders are assumed to be 6 months
- Contract value $C = 500$ MUSD

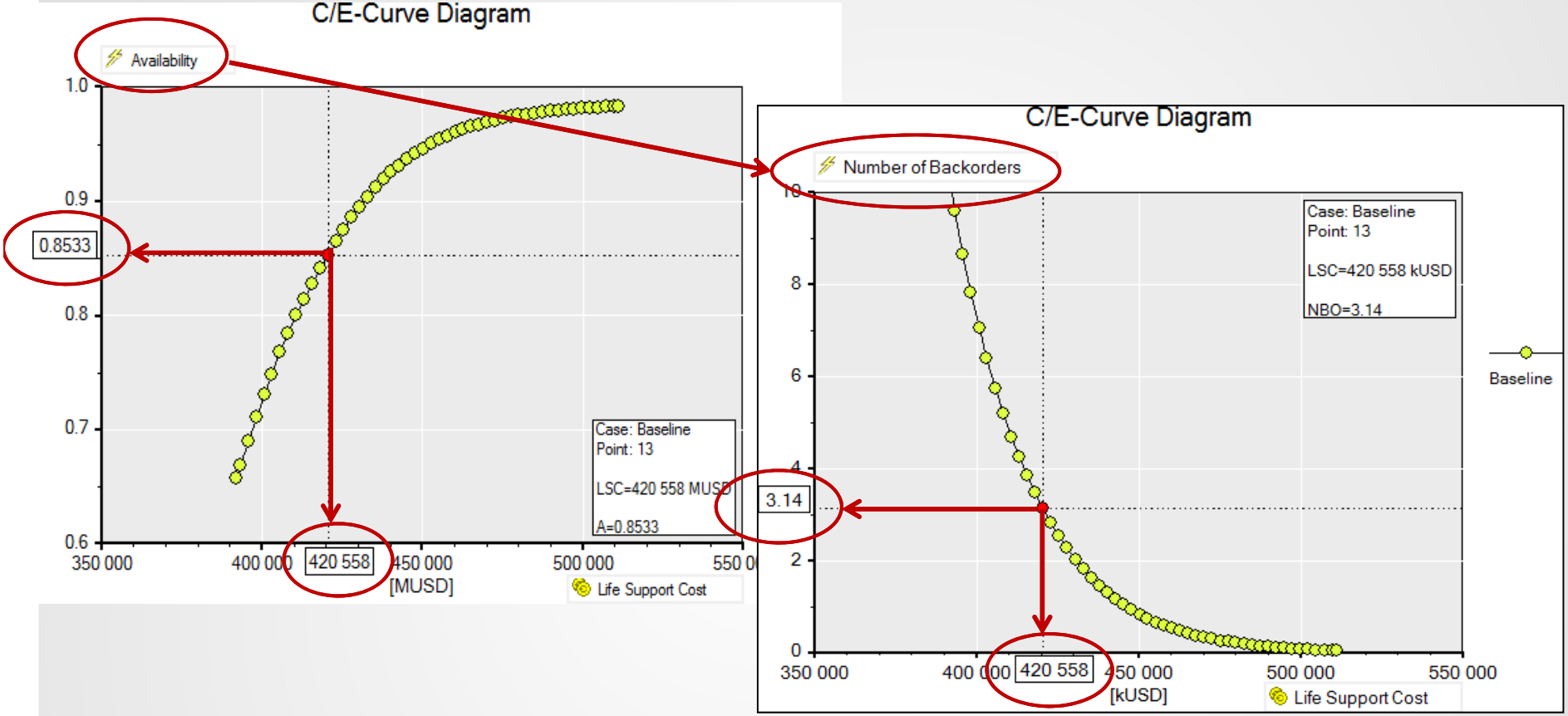
Example

Our task: Set the PBL contract terms

- Formulate a PBL contract based on backorders as the performance parameter to give the right incentives:
  - Supplier makes a profit if doing things right
  - Supplier loses money if doing things wrong

Example

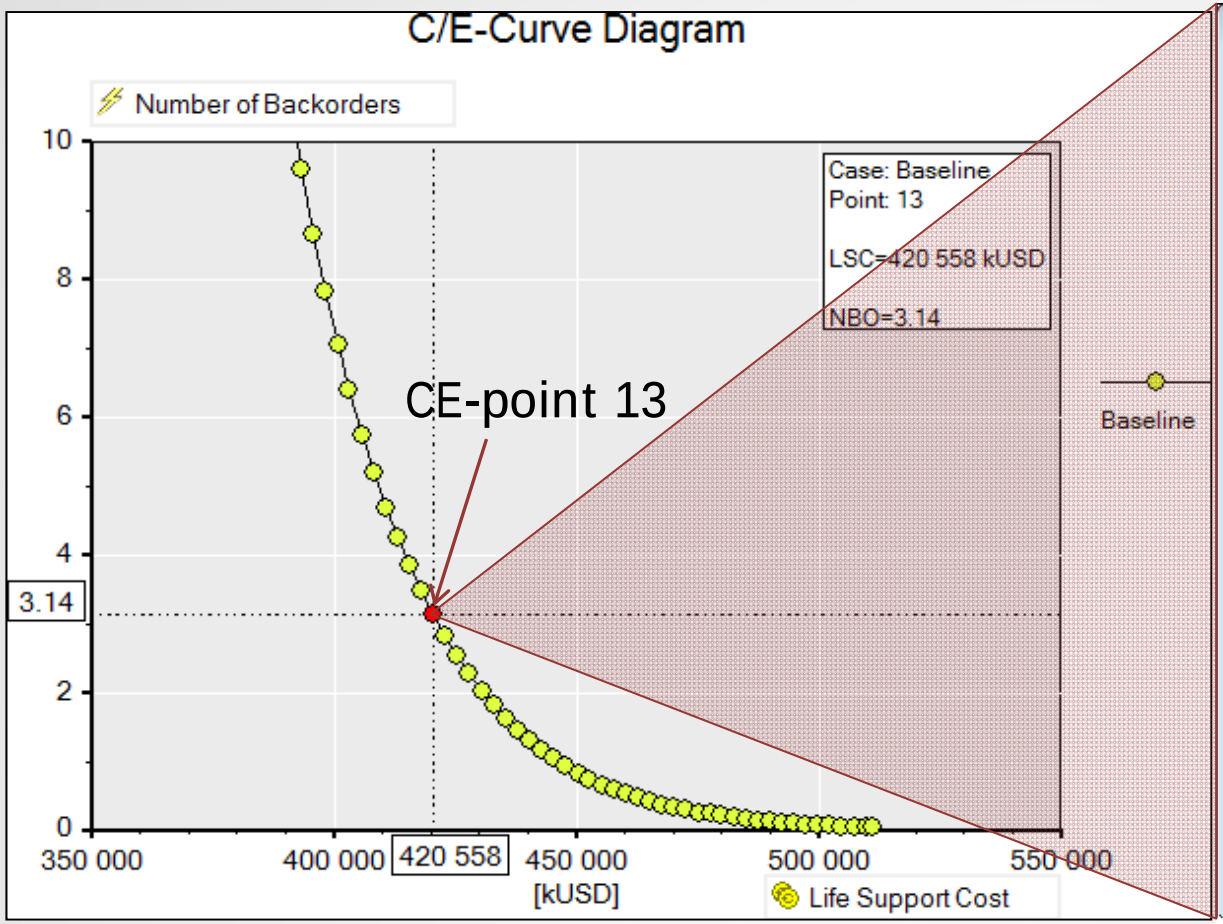
Finding the right performance requirement



The operational requirement A_0>85% can be met if the average number of backorders is $B \approx 3$

Example

Spares optimization – Baseline



Report Window (Baseline.opo) <Stock_ItemStation (POINT: 13)>

STSIZ / Station: Stock allocation

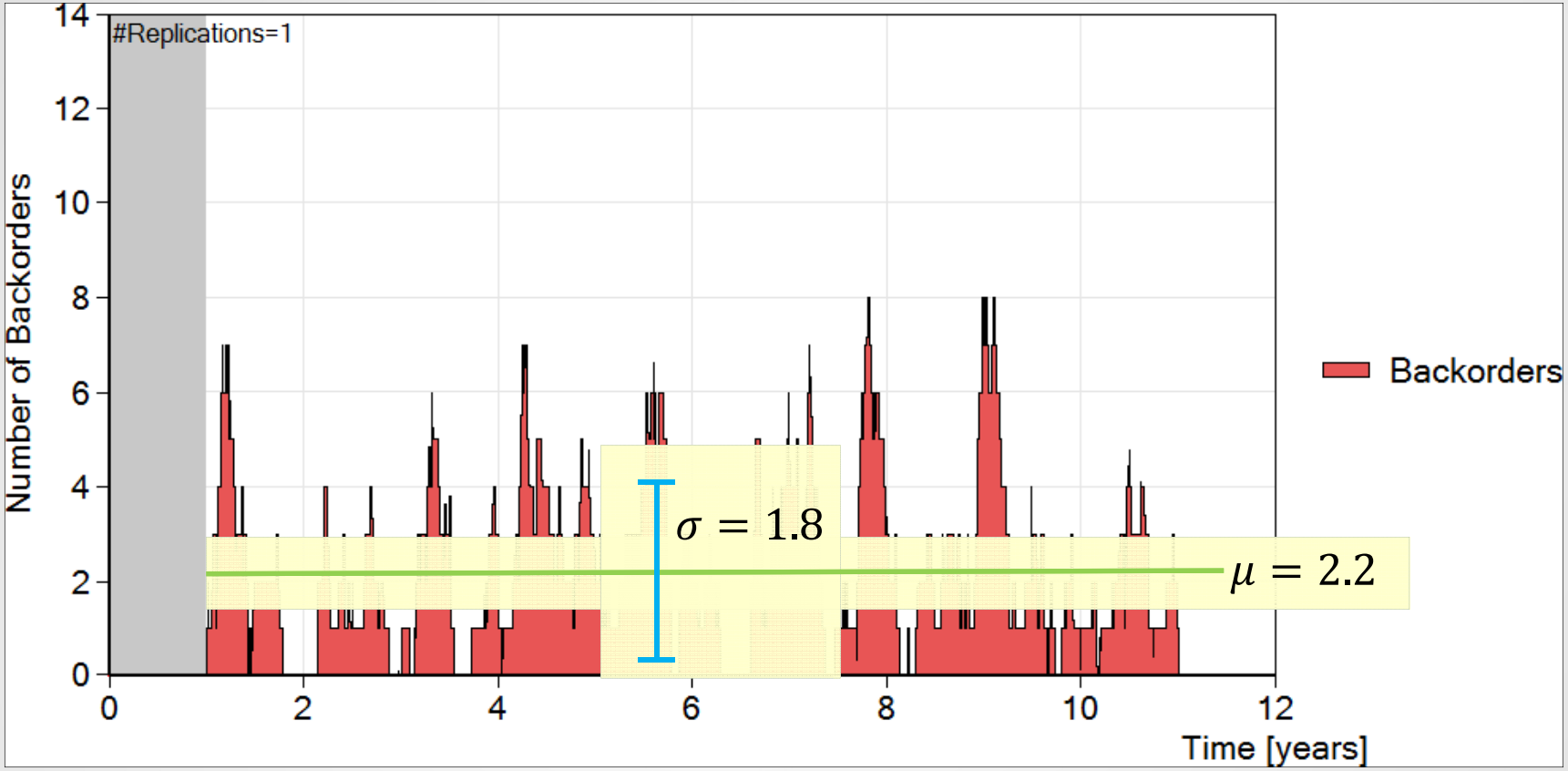
	IID: Item identifier	STID: Station identifier / QTY: Total number of each station: STORE
1	LRU1	3
2	LRU2	4
3	LRU3	3
4	LRU4	4
5	LRU5	5
6	LRU6	6
7	LRU7	1
8	LRU8	7
9	LRU9	3
10	LRU10	3
11	LRU11	3
12	LRU12	4
13	LRU13	5
14	LRU14	2
15	LRU15	5
16	LRU16	4
17	LRU17	2
18	LRU18	3
19	LRU19	2
20	LRU20	3
21	LRU21	2
22	LRU22	6

Optimized stock to be used in the simulations

Example

SIMLOX simulations – Baseline

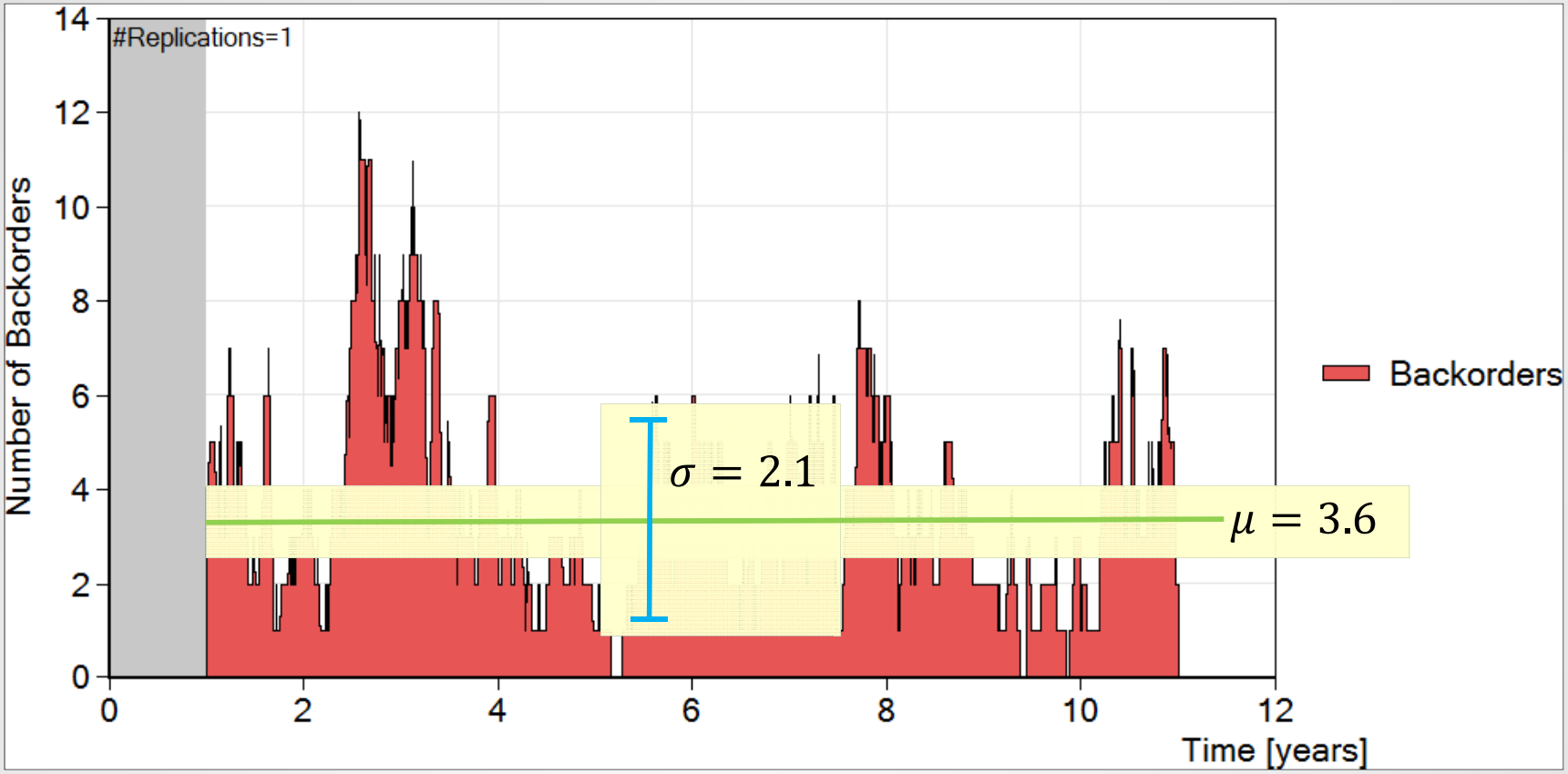
1 replication…



Example

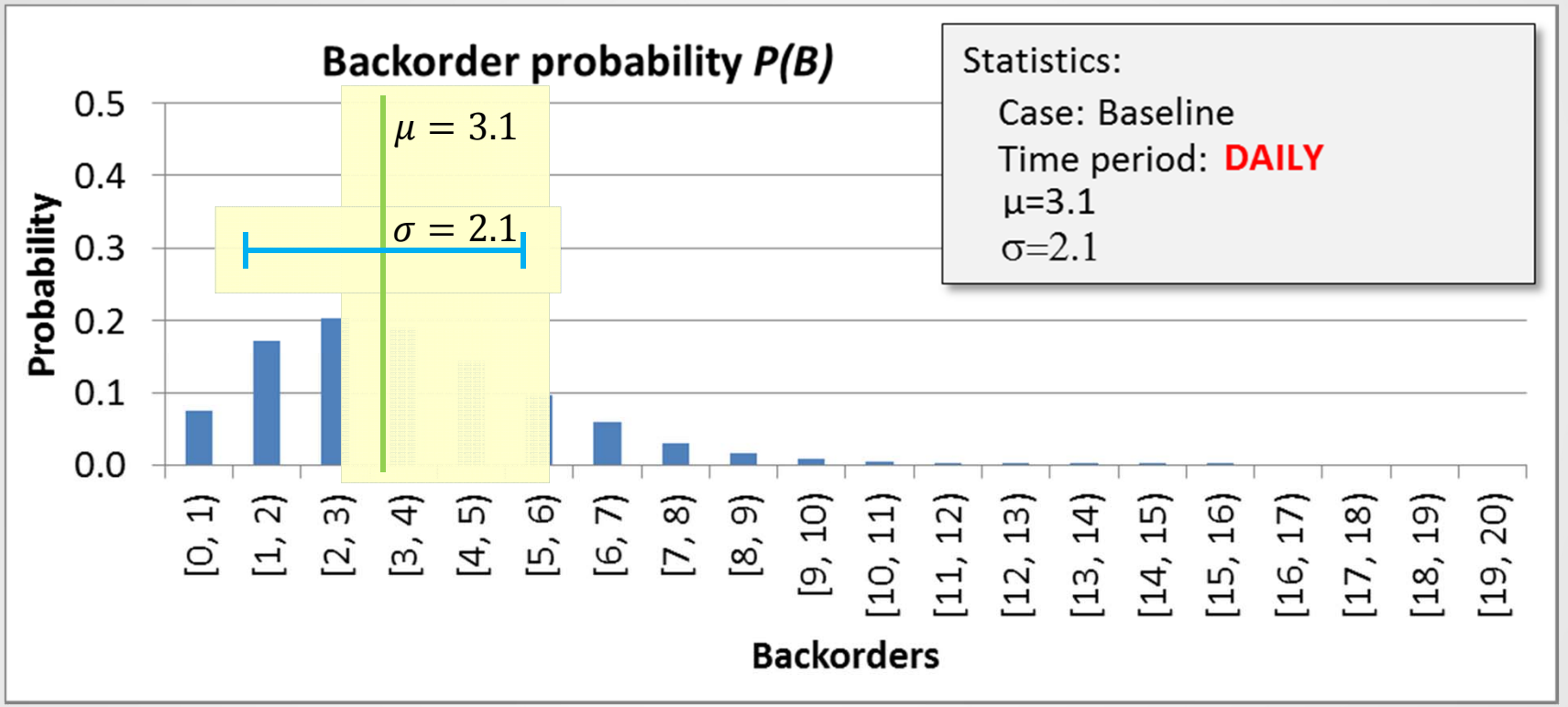
SIMLOX simulations – Baseline

Another replication…



Example

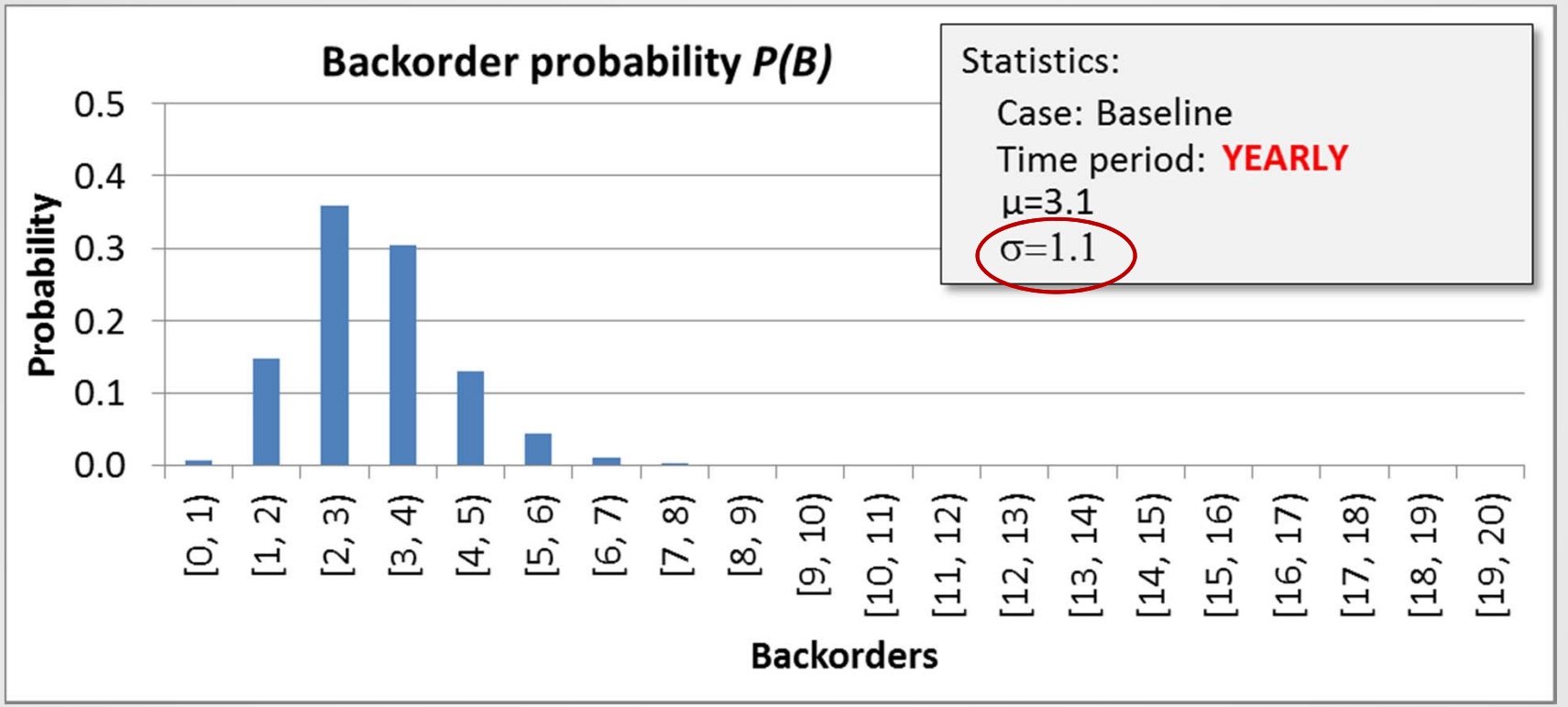
Backorder probability



- Graph generated from SIMLOX simulation data covering a period of 1000 years (100 replications)

Example

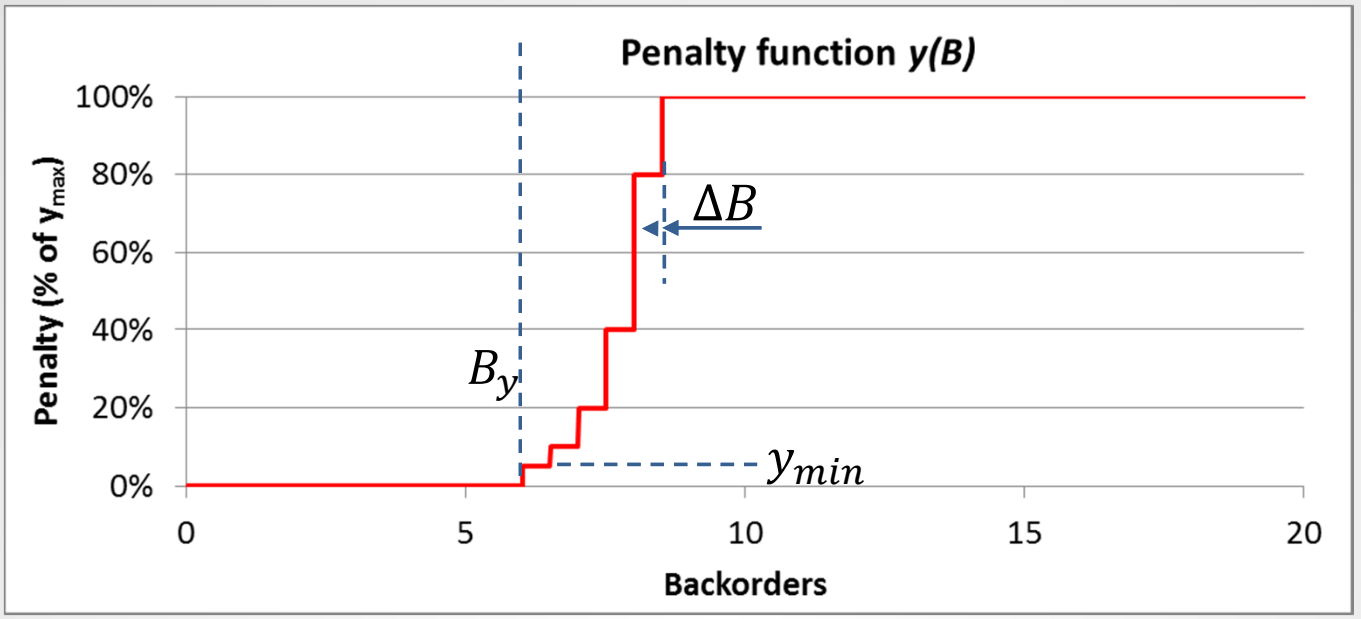
Backorder probability



- $Variation$ decreases as the time period is increased.
- The time period should be *long enough* to remedy defects in the support concept but *not too long* (slow feedback loop)

Penalty function

Example

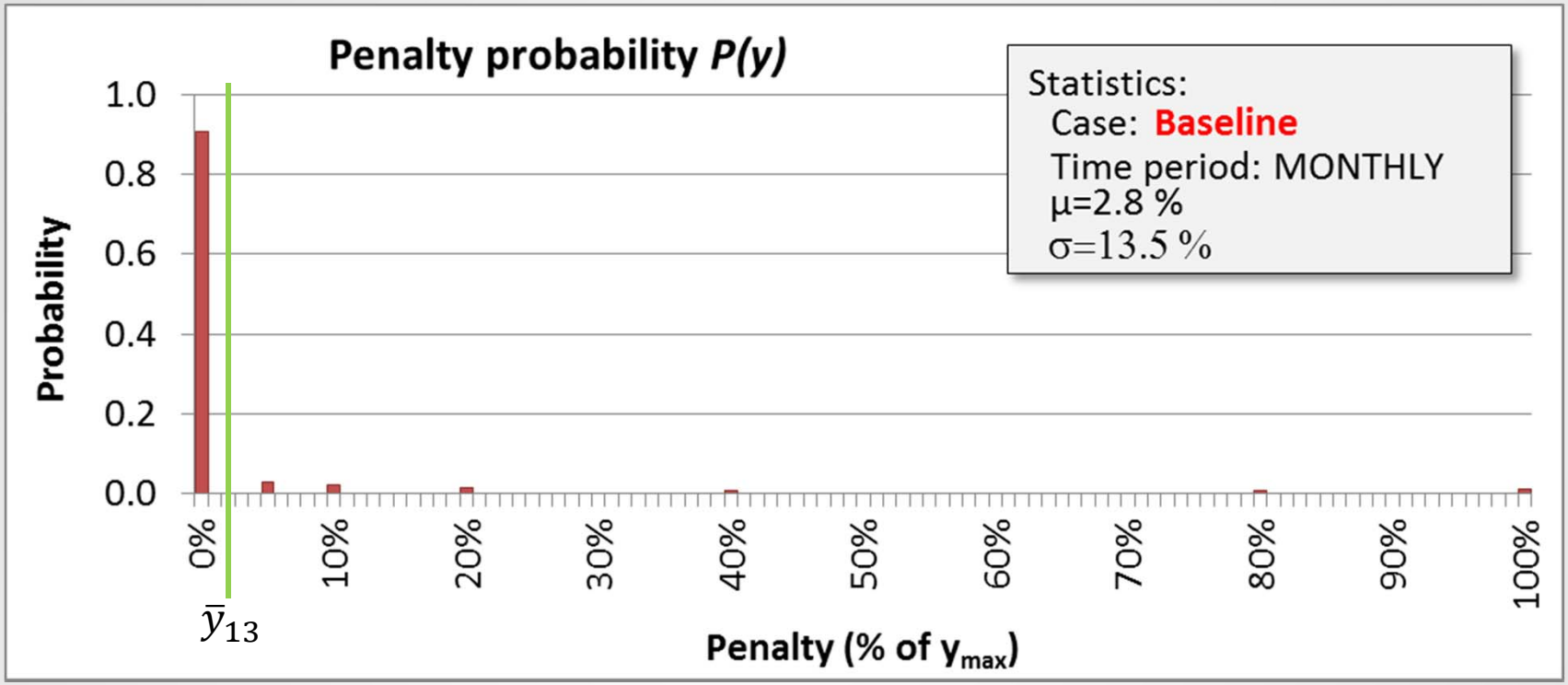


$$y(B) = \begin{cases} \min\{y_{max},\ y_{min}(1+f_y)^{\left\lfloor \frac{B-B_y}{\Delta B} \right\rfloor}\}, & B \geq B_y \\ 0, & B < B_y. \end{cases}$$

y_{min}:	Minimum penalty per time period T
y_{max}:	Maximum penalty per time period T
f_y:	Penalty increase fraction
B_y:	Backorder penalty threshold
ΔB:	Backorder step size

Penalty probability – Baseline (CE-point 13)

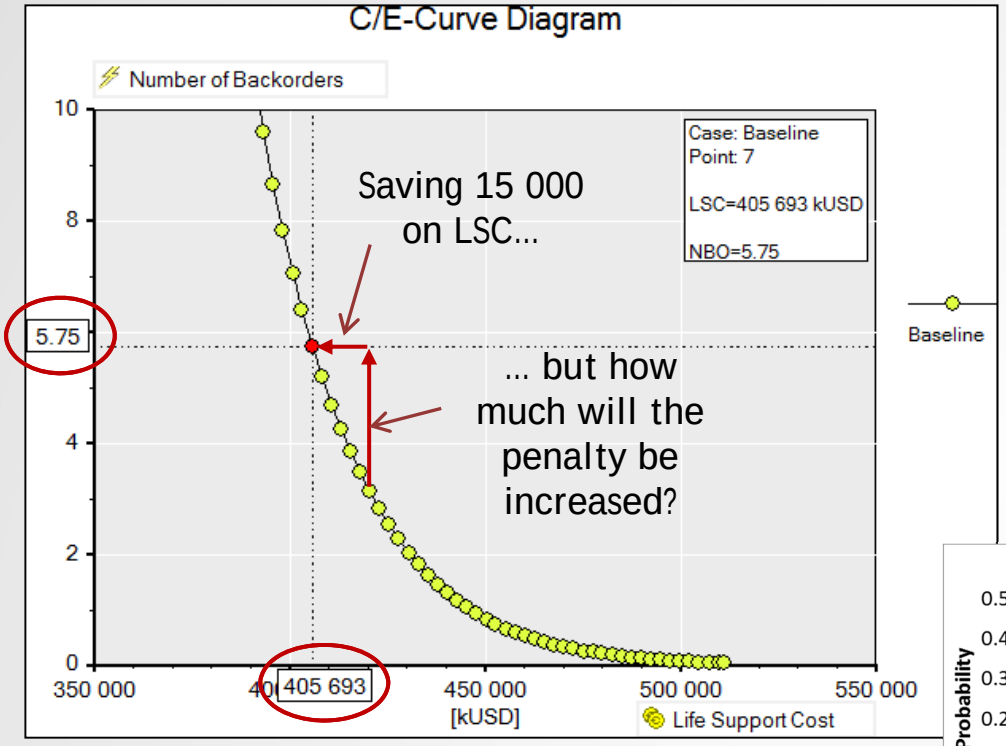
Example

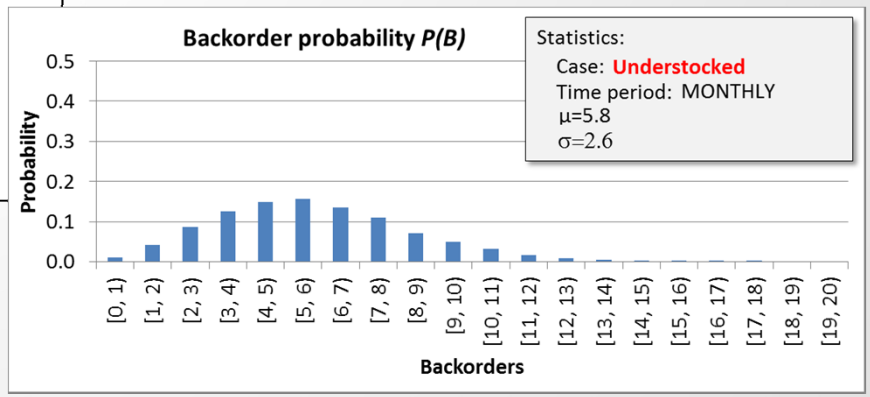


- Average monthly penalty: $\mathbf{2,8\%\ of\ } y_{max}$

Example

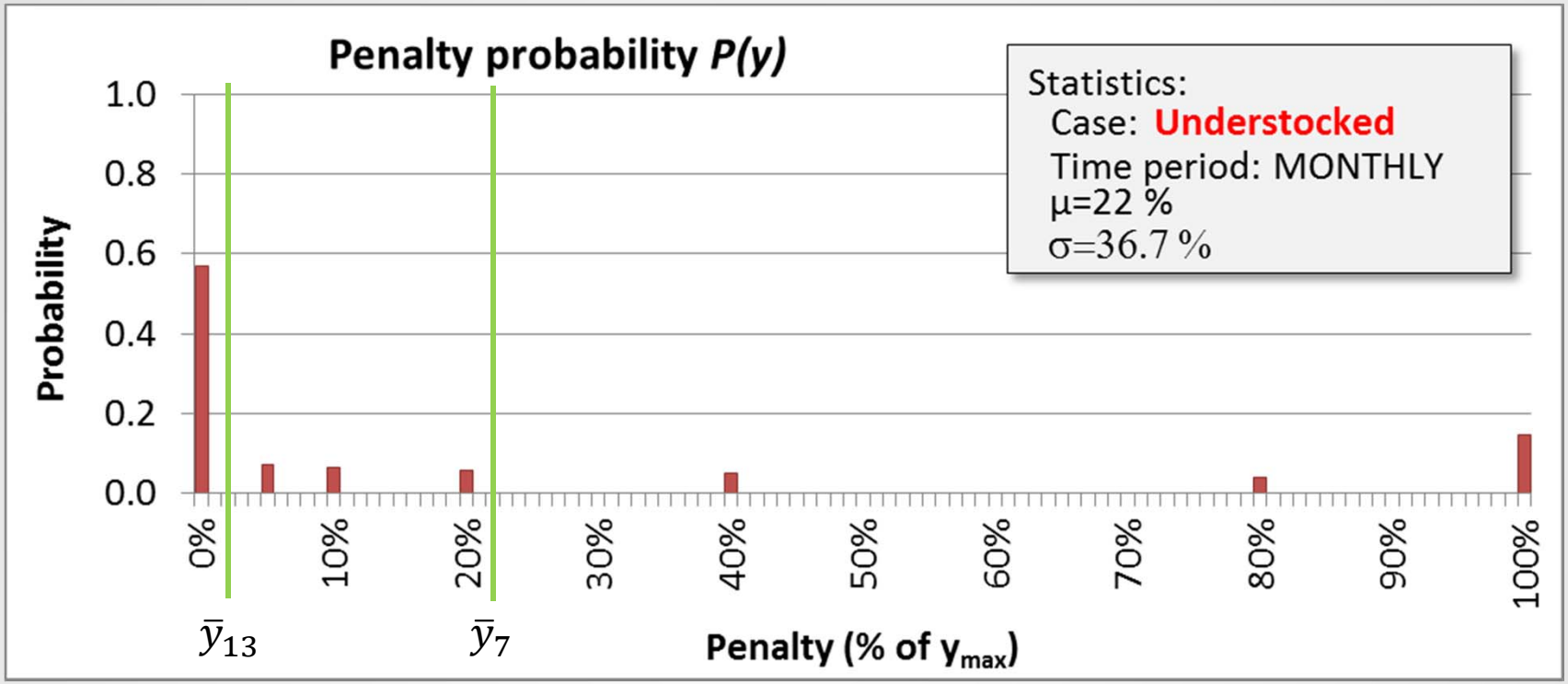
Understocked scenario





Penalty probability – Understocked
(CE-point 7)

Example

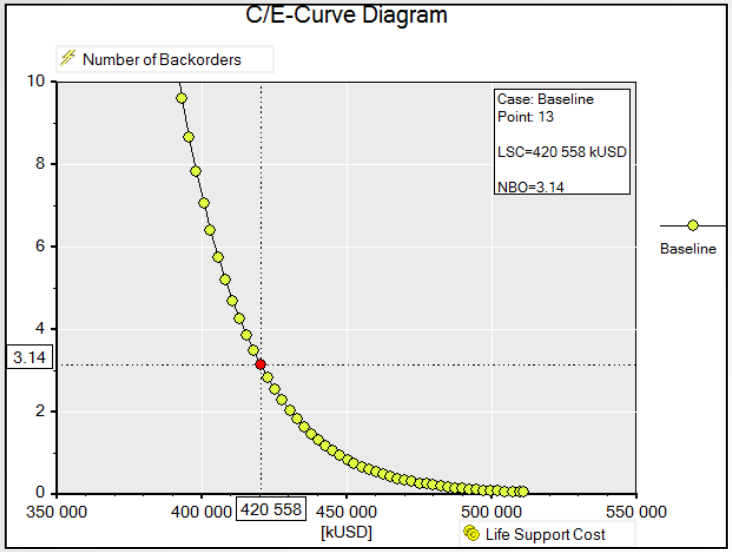


- Average monthly penalty: $\mathbf{22\%\ of\ } y_{max}$
- Almost a 10-fold increase compared to the baseline scenario.

Penalty + LSC

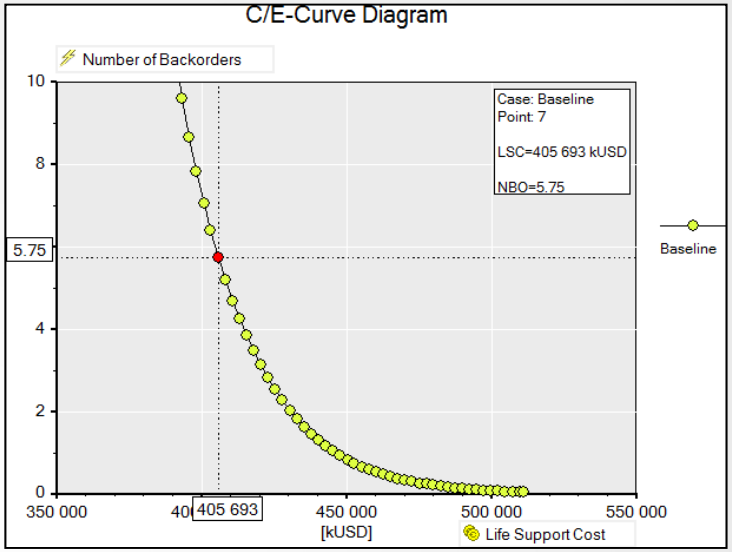
Example

Baseline



- $LSC_{13} = 421$ MUSD $(= 0.84C)$
- Total penalty = 14 $MUSD$ $(= 0.03C)$

Understocked

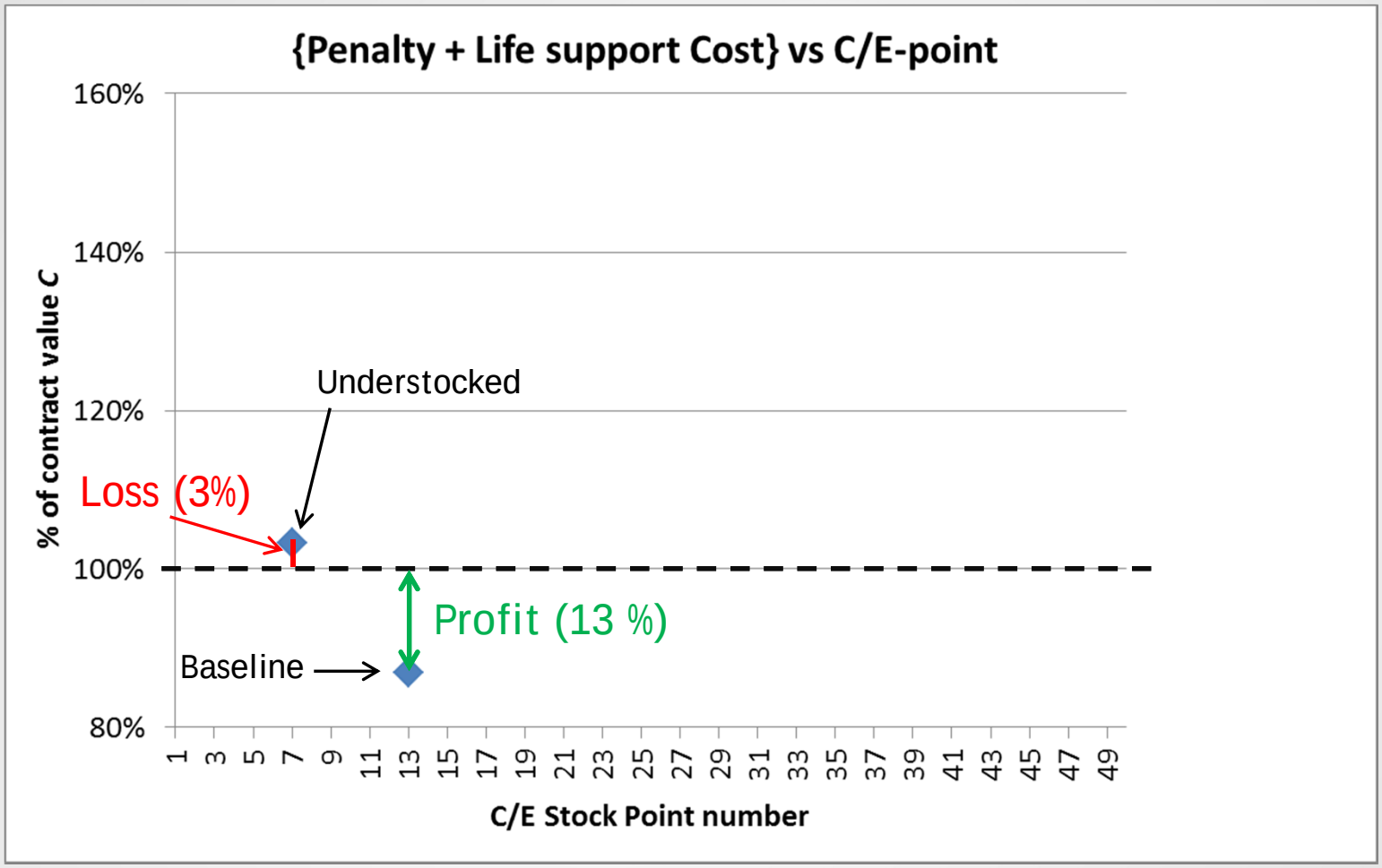


- $LSC_7 = 406$ MUSD $(= 0.81C)$
- Total penalty: 110 $MUSD$ $(= 0.22C)$

- **Total cost = $435\ MUSD$ $(0.87C)$**
- **Total cost = $516\ MUSD$ $(1.03C)$**

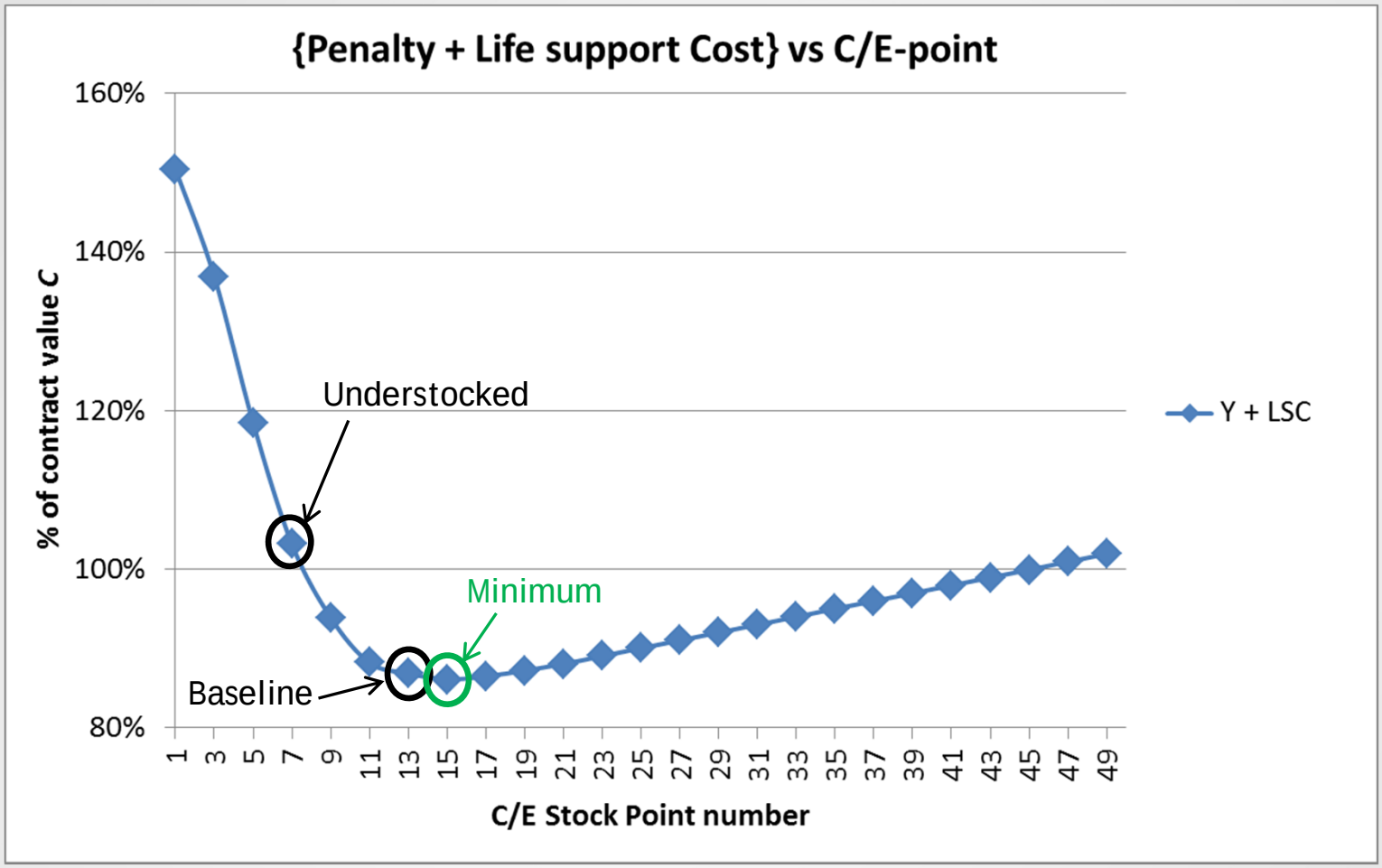
Example

Penalty + LSC



Example

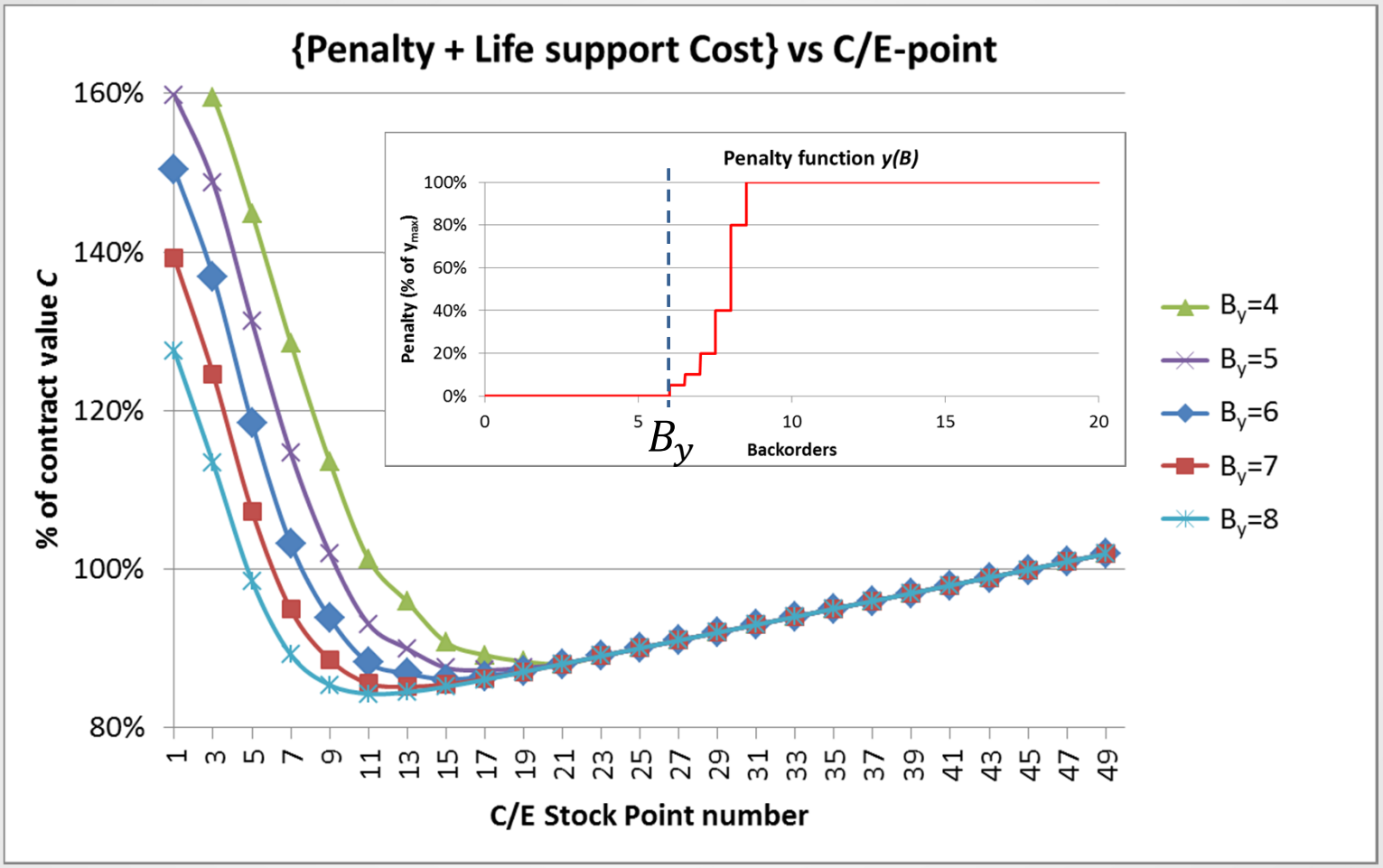
The complete curve…



- Curve generated from SIMLOX simulation data covering a period of 25 000 years(!)

Example

Varying the backorder threshold B_y



- $B_y = 4$ encourage to overstock (or otherwise risking a loss while doing a god job)
- $B_y = 8$ encourage to understock (profiting while doing a poor job)

Summary

- Modeling & simulation are essential in understanding the consequences of a PBL contract and in designing contract terms that gives the supplier incentives to meet the objectives
- If not taking into account the inherent variations there is a risk that cost-inefficient support strategies are implemented
  - Miss-allocation of resources
  - System operation requirements not met
- The proposed method provides a decision maker with better decision support
- The method makes it easy for both customers and suppliers to evaluate the probable reward in a PBL contract and assess the risks for not meeting the contract objectives.
- The same methodology can also be used by the supplier to design and optimize his logistic support solution

Reference Projects

- Nordic Standard Helicopter Program – NH90
- Saab Dynamics
- BAE Systems Hägglunds

Reference

Better PBL Contracts - An Analytical Approach

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ABSTRACT

Successful Performance Based Logistics (PBL) can reduce total ownership costs for government while maintaining or increasing capability. The chance of success depends heavily on the terms in the PBL contract. Performance targets, incentive models and measurement approach must be carefully selected in order to give the supplier both motivation and freedom to provide logistics functions that will enable high system performance.

...good insight to the physics ...ved and what can...

Thank you for your attention

If you want to know more, visit us at the WPI Services exhibit.

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