

# ***Saving Energy in Fractionation Operation***

**Texas  
Technology  
Showcase  
2006**



## ***Presenter***

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**Doug White**

**Principal Consultant  
and Vice President,  
APC Services**

**Process Systems and  
Solutions**

**Emerson Process  
Management**

**Houston, Texas**



# ***Fractionation Energy***

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- **Over 40000 distillation/ fractionation columns in the US alone**
- **Consume 40% - 60% of the total energy used in chemical and refining plants**
- **Consume 19% of the total energy used in manufacturing plants in the US**

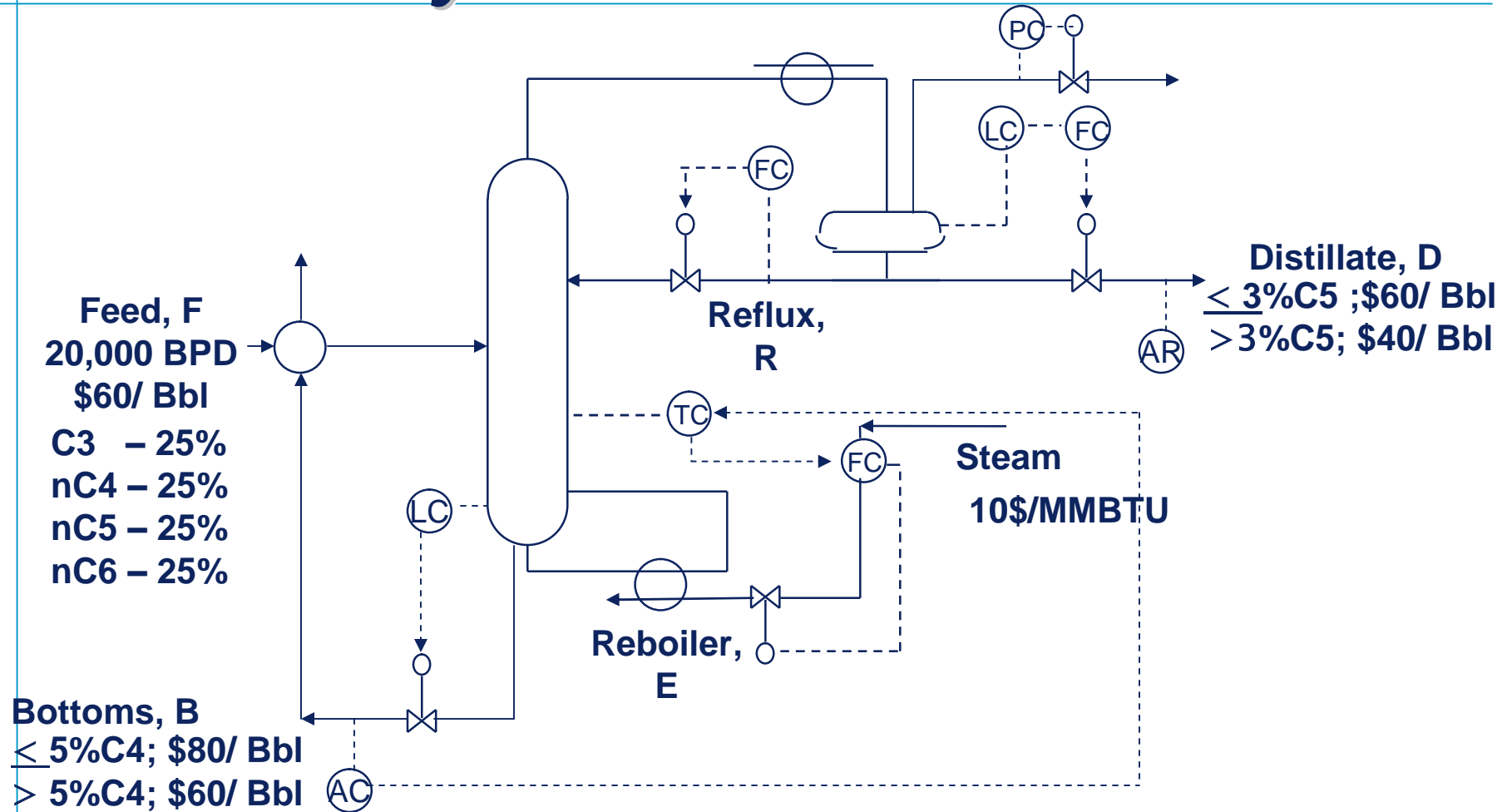
Reference: Office of Industrial Technology:  
Energy Efficiency and Renewable Energy;  
US Department of Energy  
Washington, DC  
“Distillation Column Modeling Tools”

## ***Presentation Objectives***

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- **Present general approaches to saving energy in fractionation/ distillation through improved control**
- **Present techniques for economic analysis that recognize non-linear character of distillation operation and effects of product blending**

# Case Study

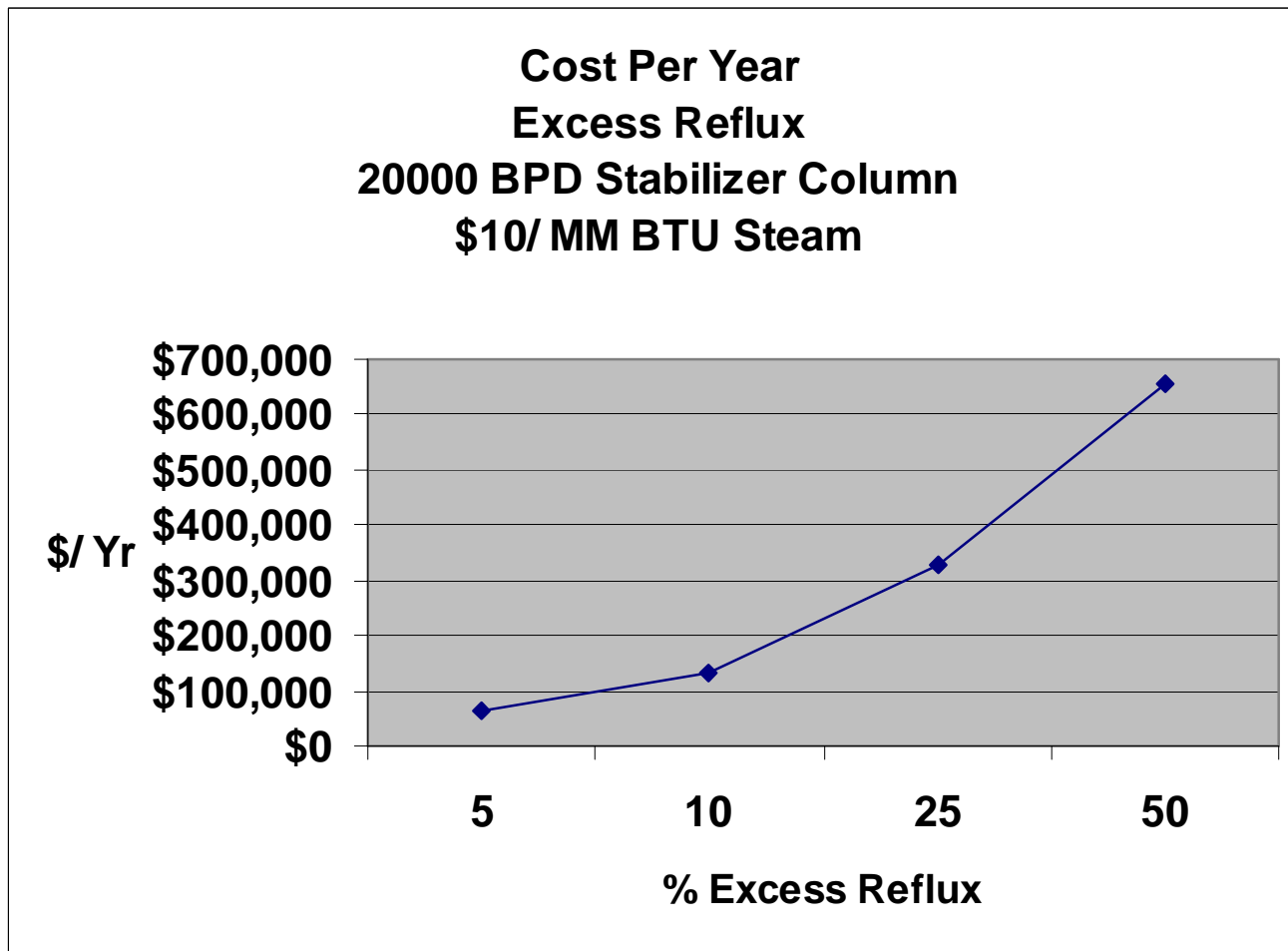


## ***Saving Energy in Fractionation***

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- **Closer Control to Specifications**
- **Optimize Energy Usage versus Recovery**
- **Minimize Pressure**

# Distillation Column Control Savings

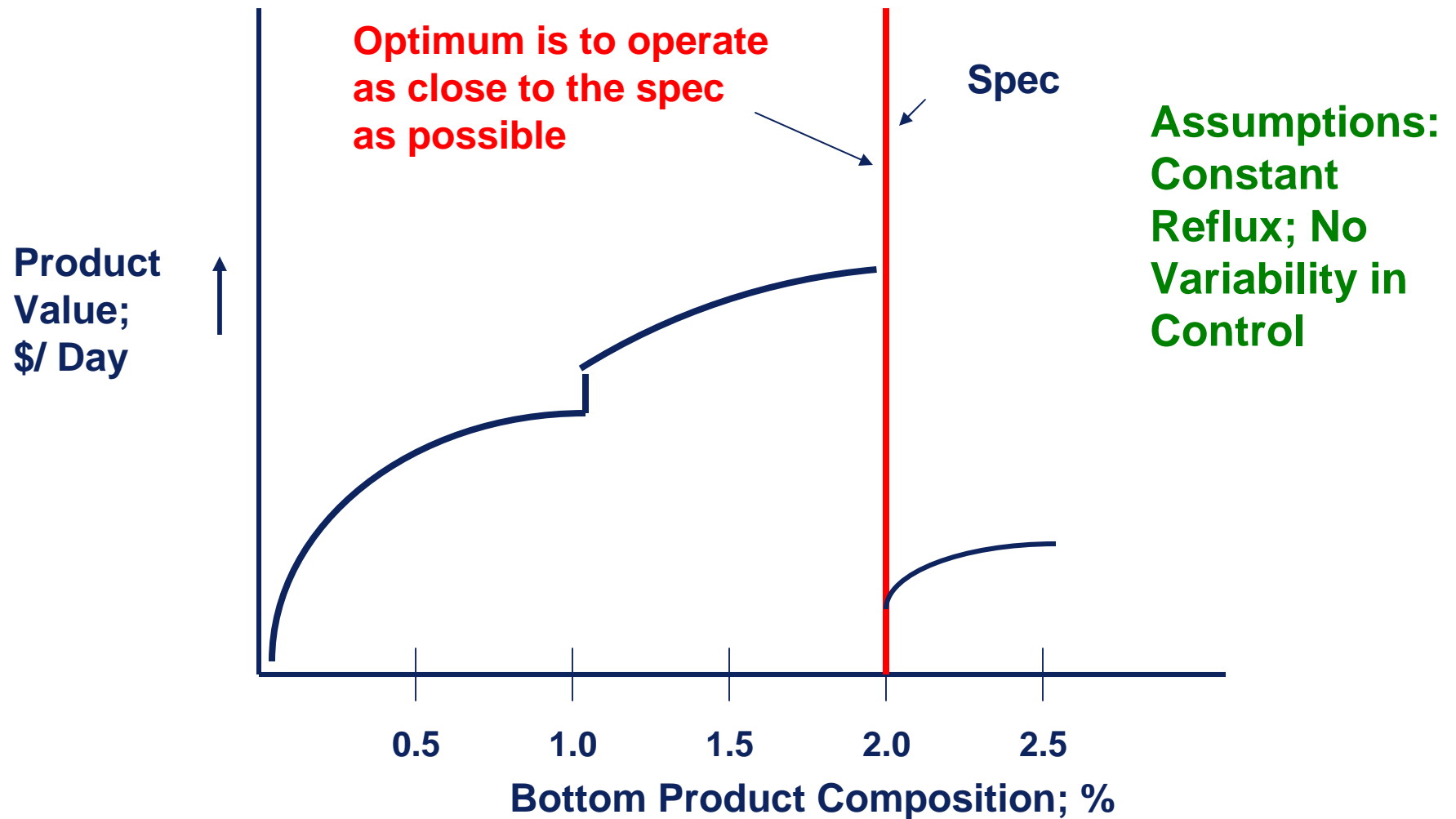




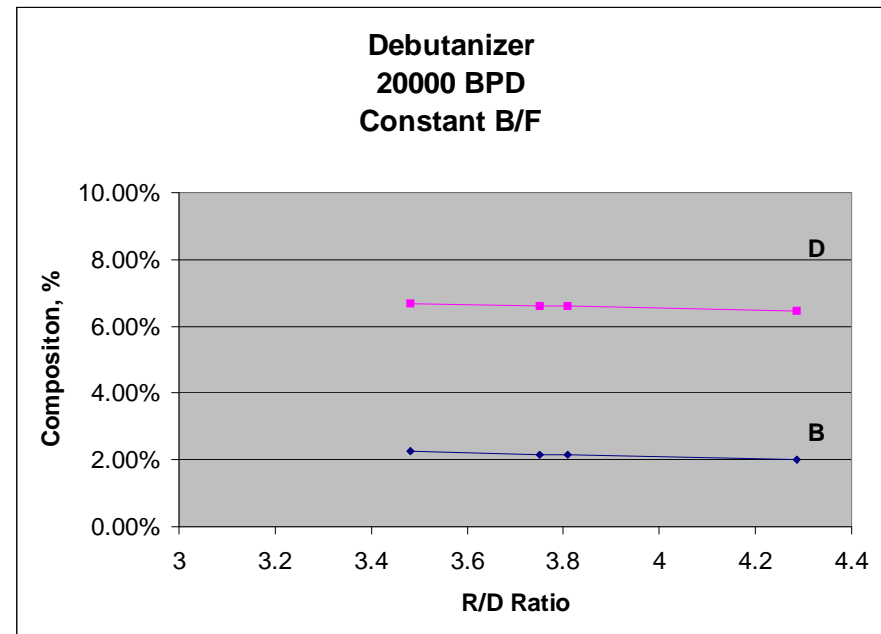
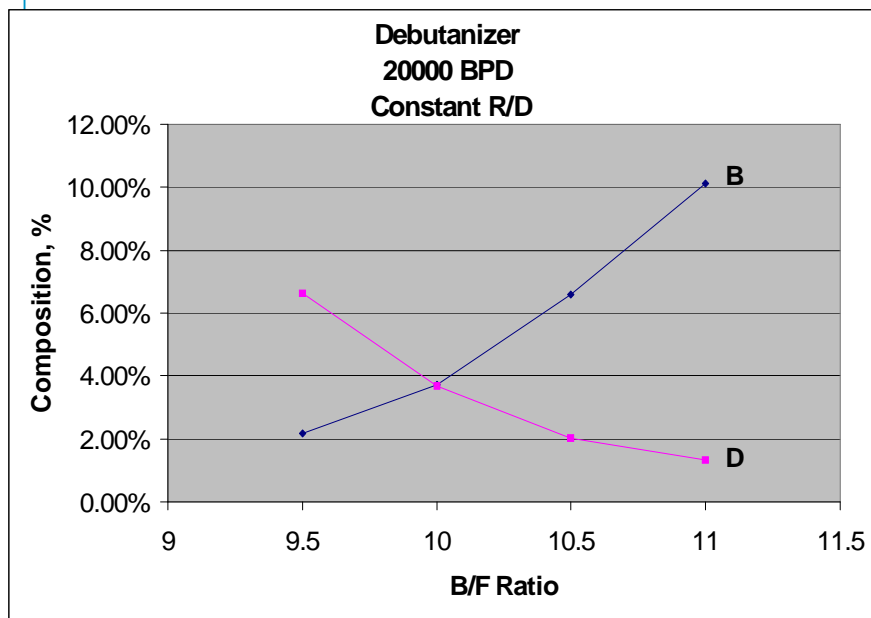
# ***Material Balance***



# Product Value

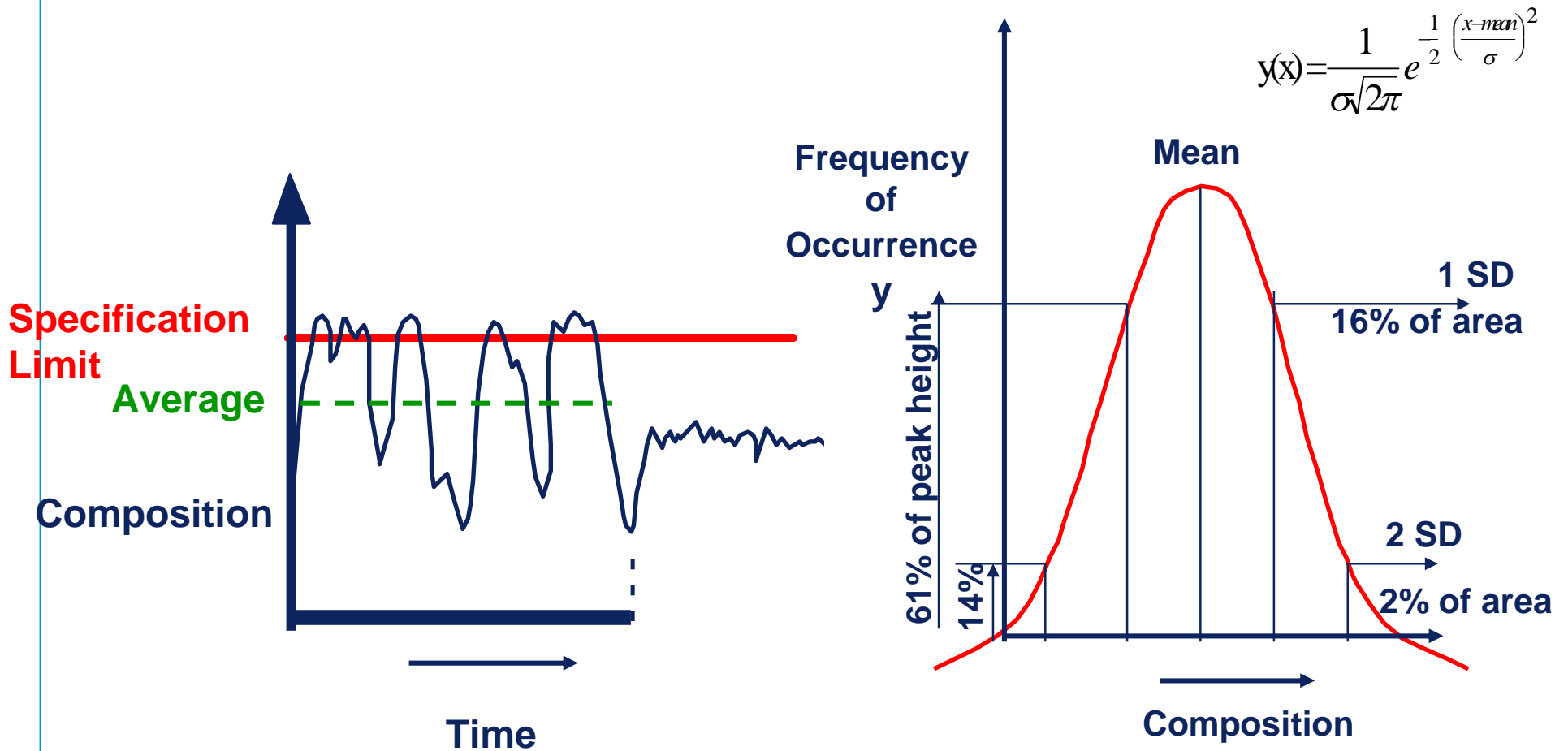


# Debutanizer – Material Balance Effects

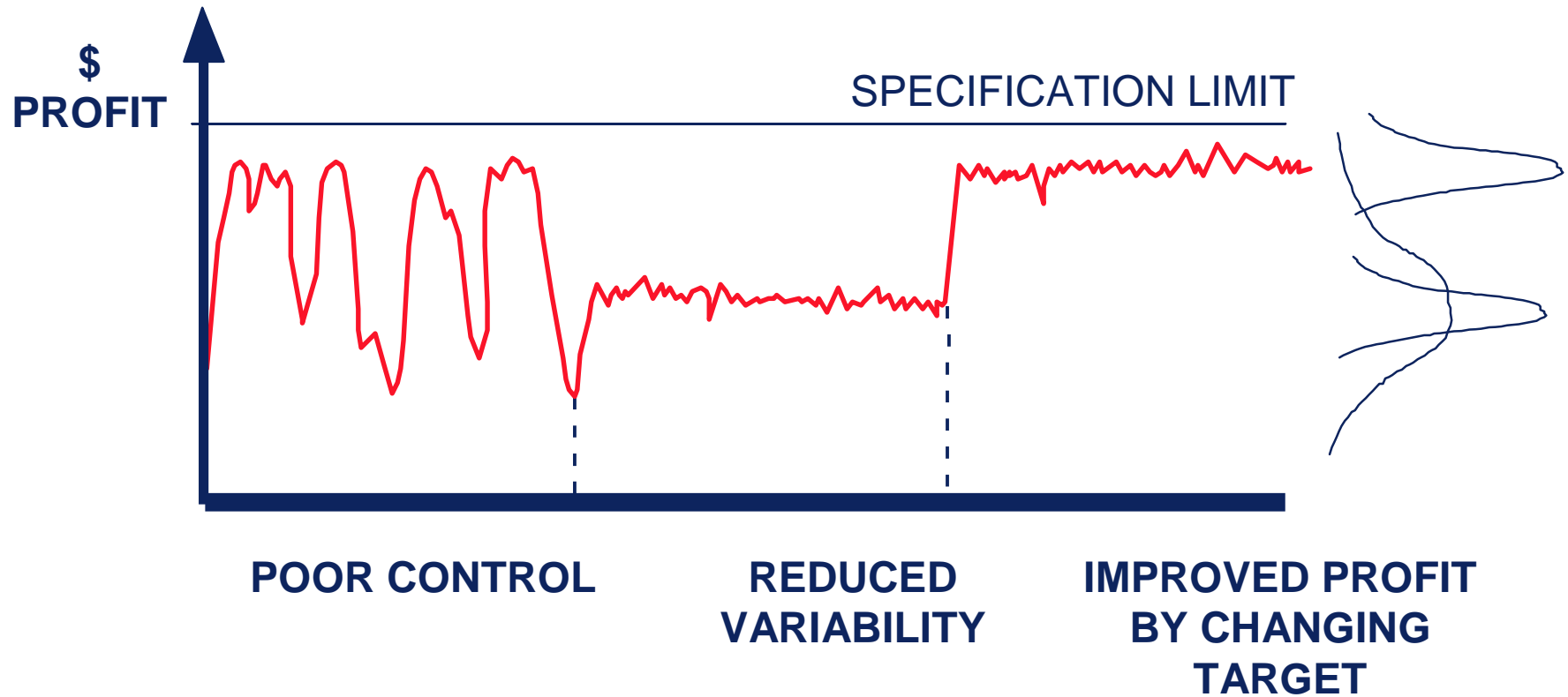


**Material Balance Control Has Strongest Effect on Composition**

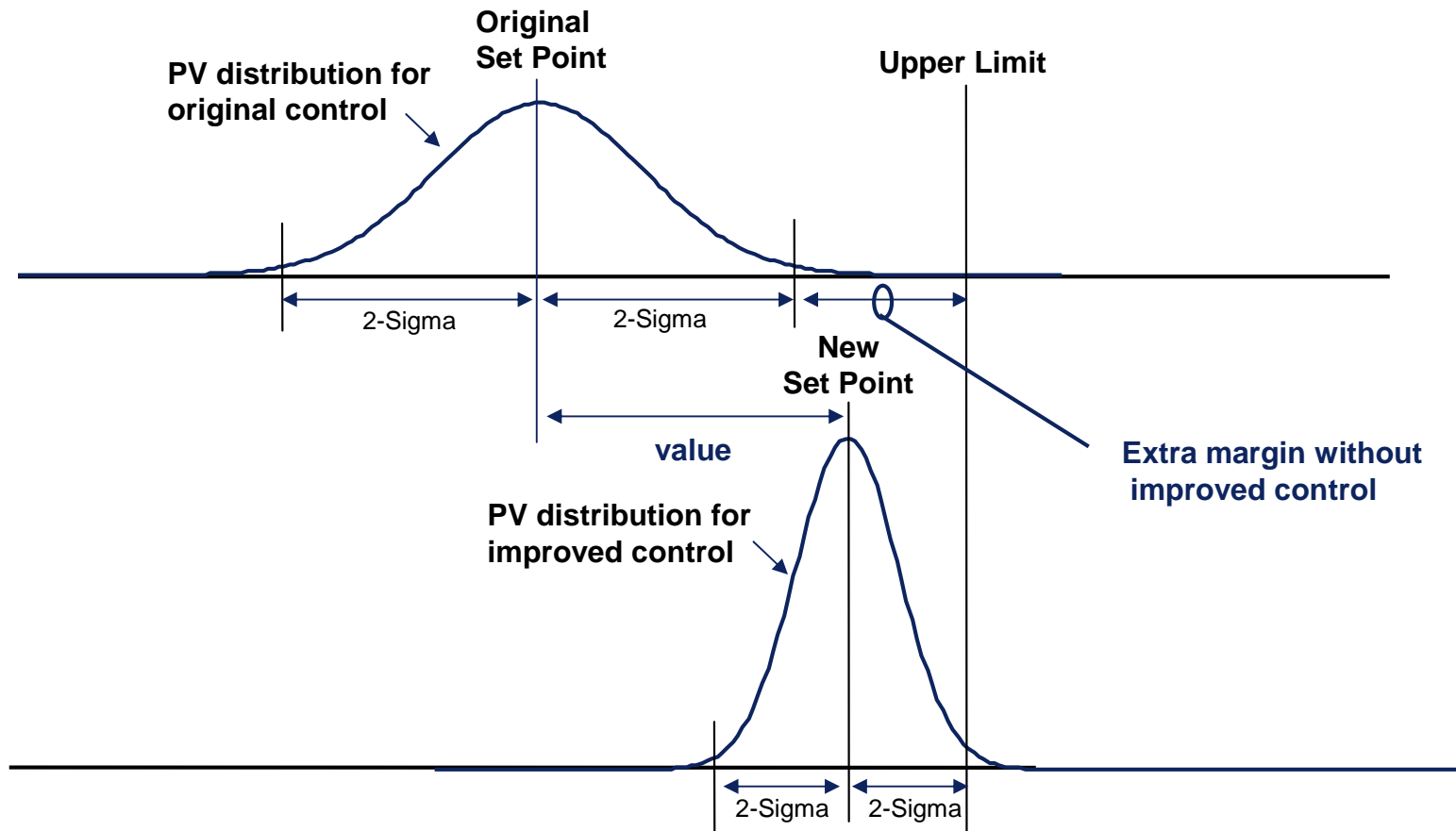
# Effect of Variability – Standard Analysis



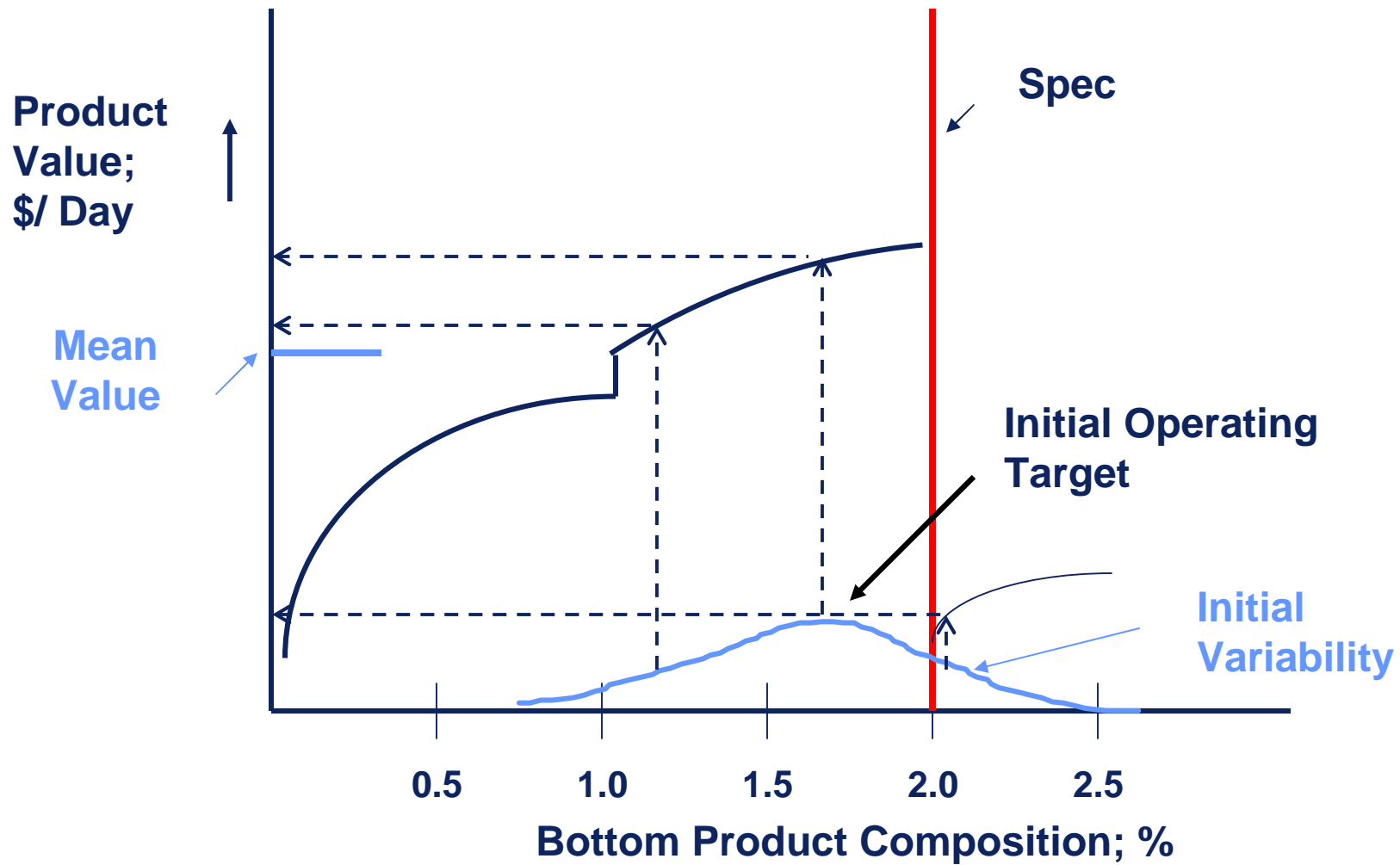
# ***Effect of Reduced Variability***



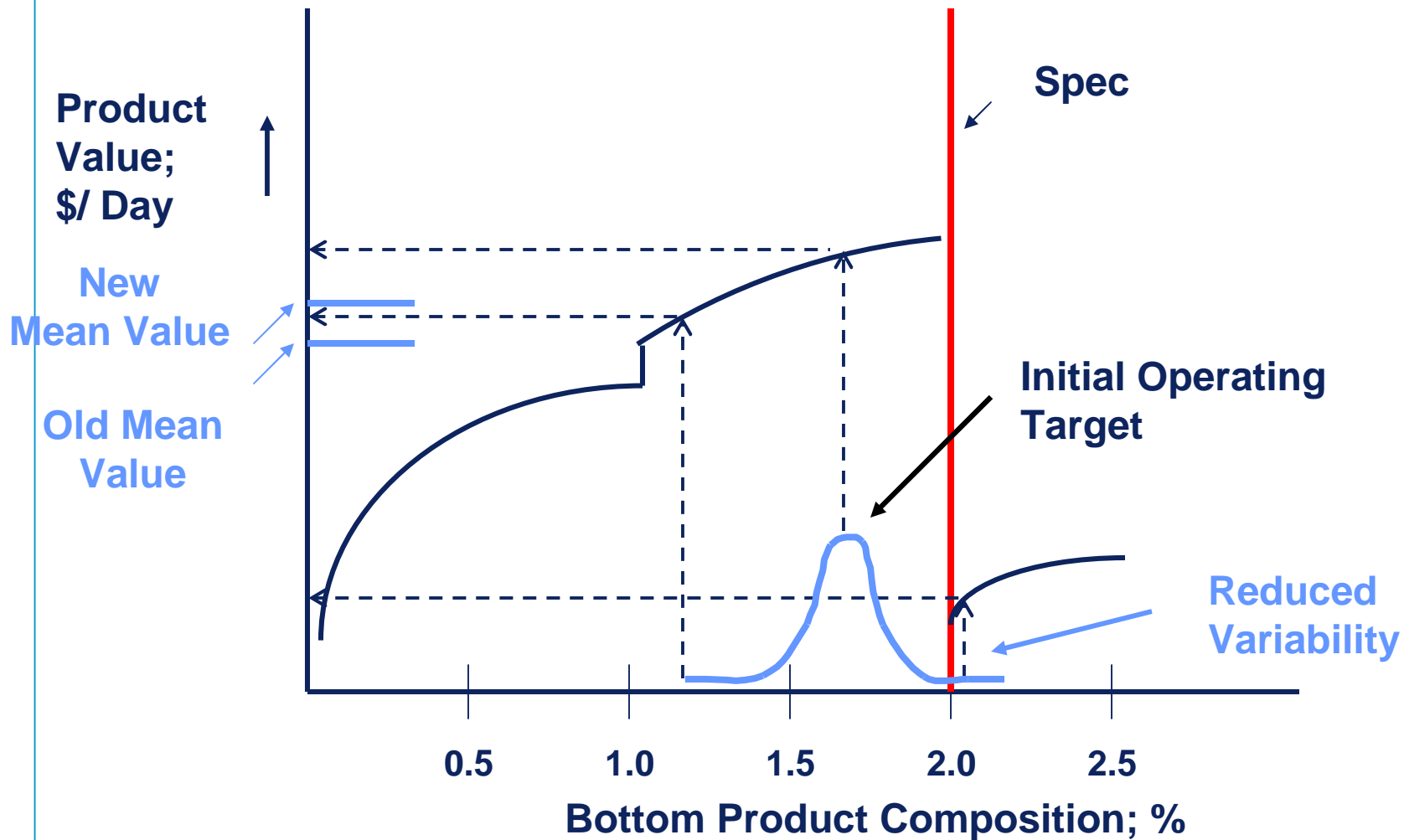
# Reduced Variability Options



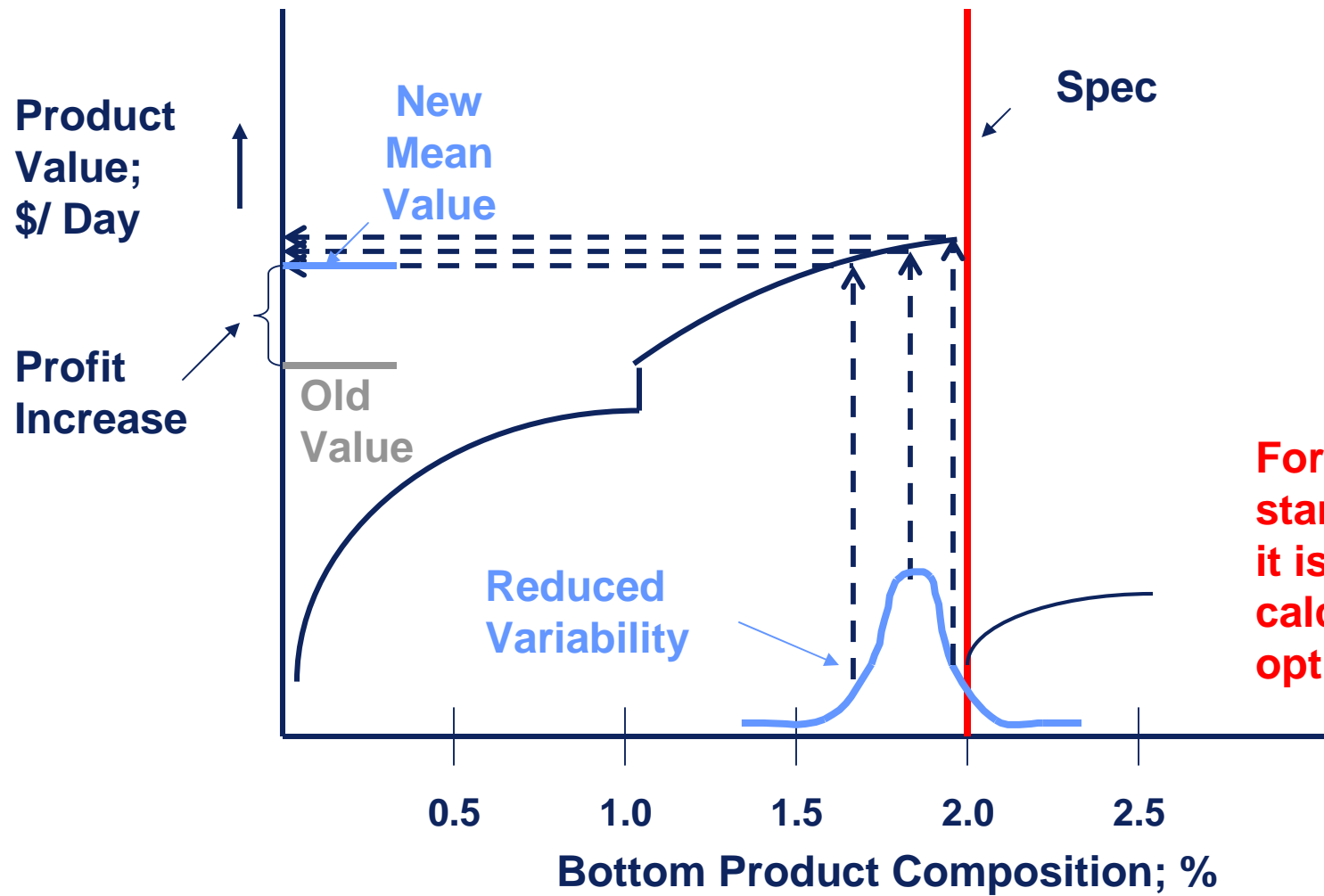
# Product Value with Variability



# Product Value with Variability Reduced – Same Setpoint



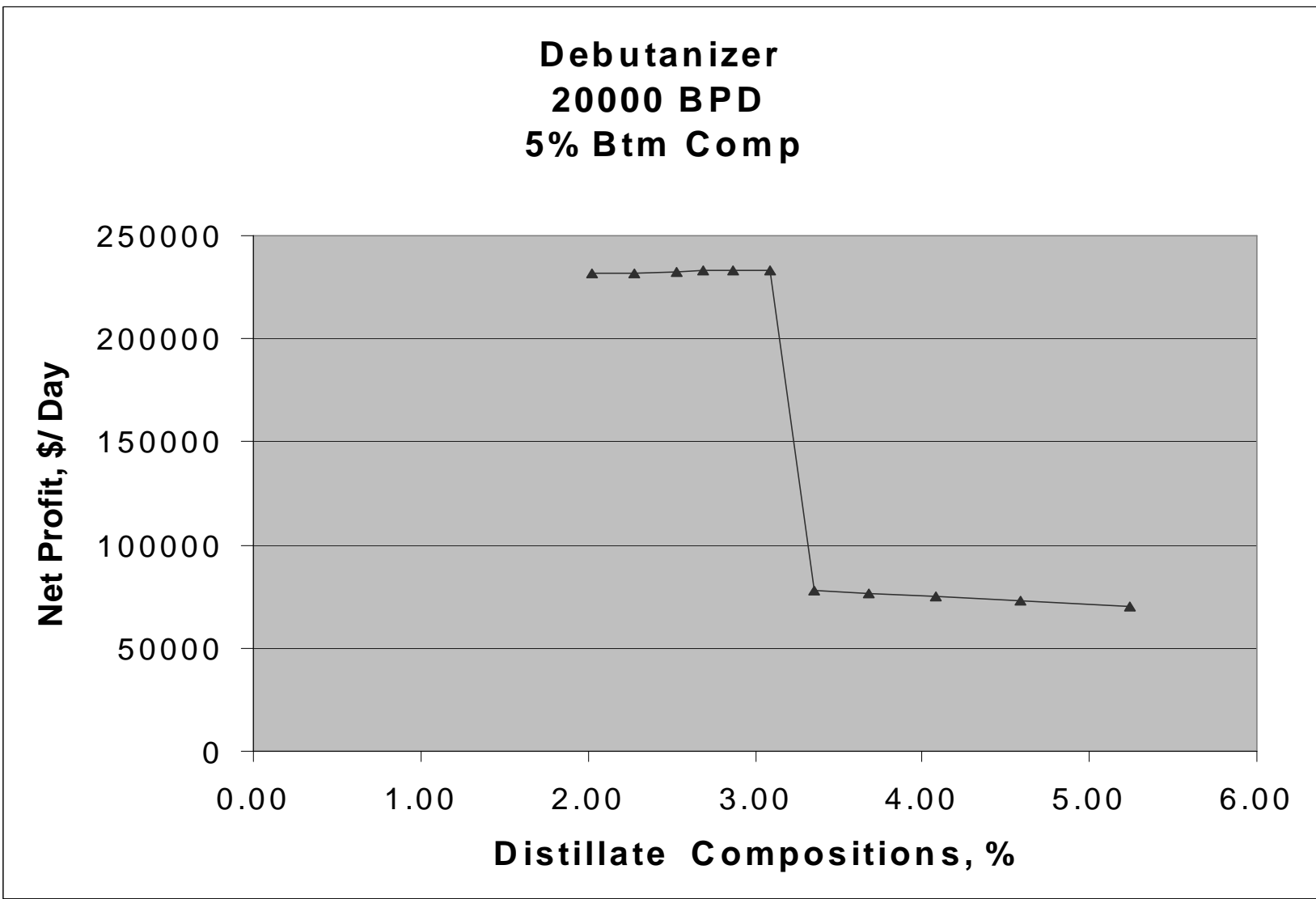
# Product Value with Variability



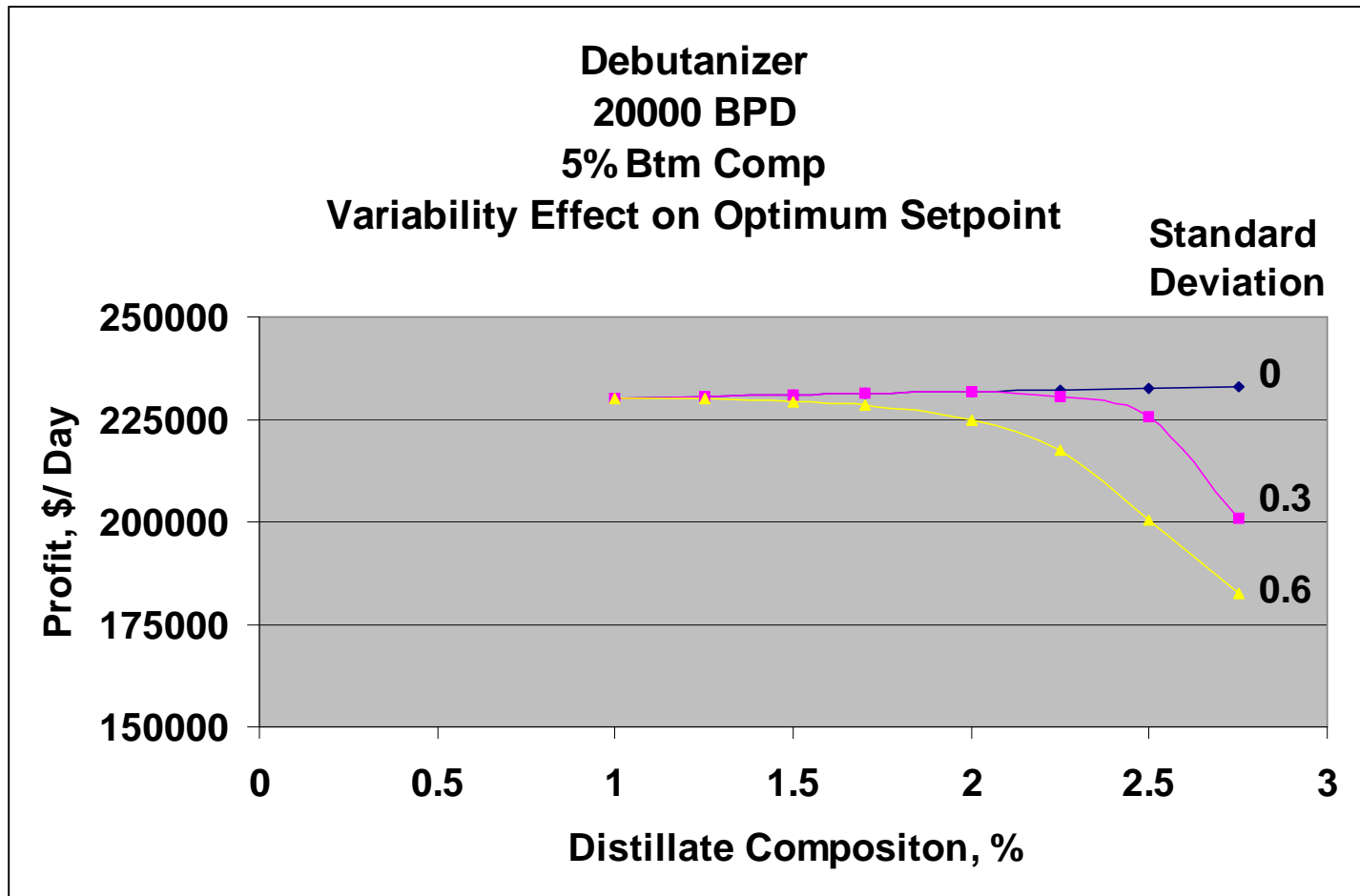
**For any given standard deviation it is possible to calculate the optimum setpoint.**



# Debutanizer - Net Profit Curve



# Debutanizer – Optimum Setpoint With Variability

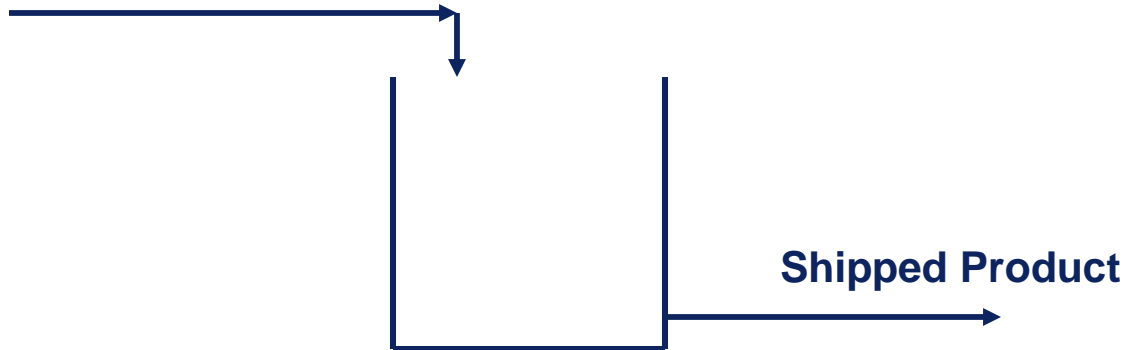


Optimum Setpoint Depends on Variability

# ***Effect of Blending***

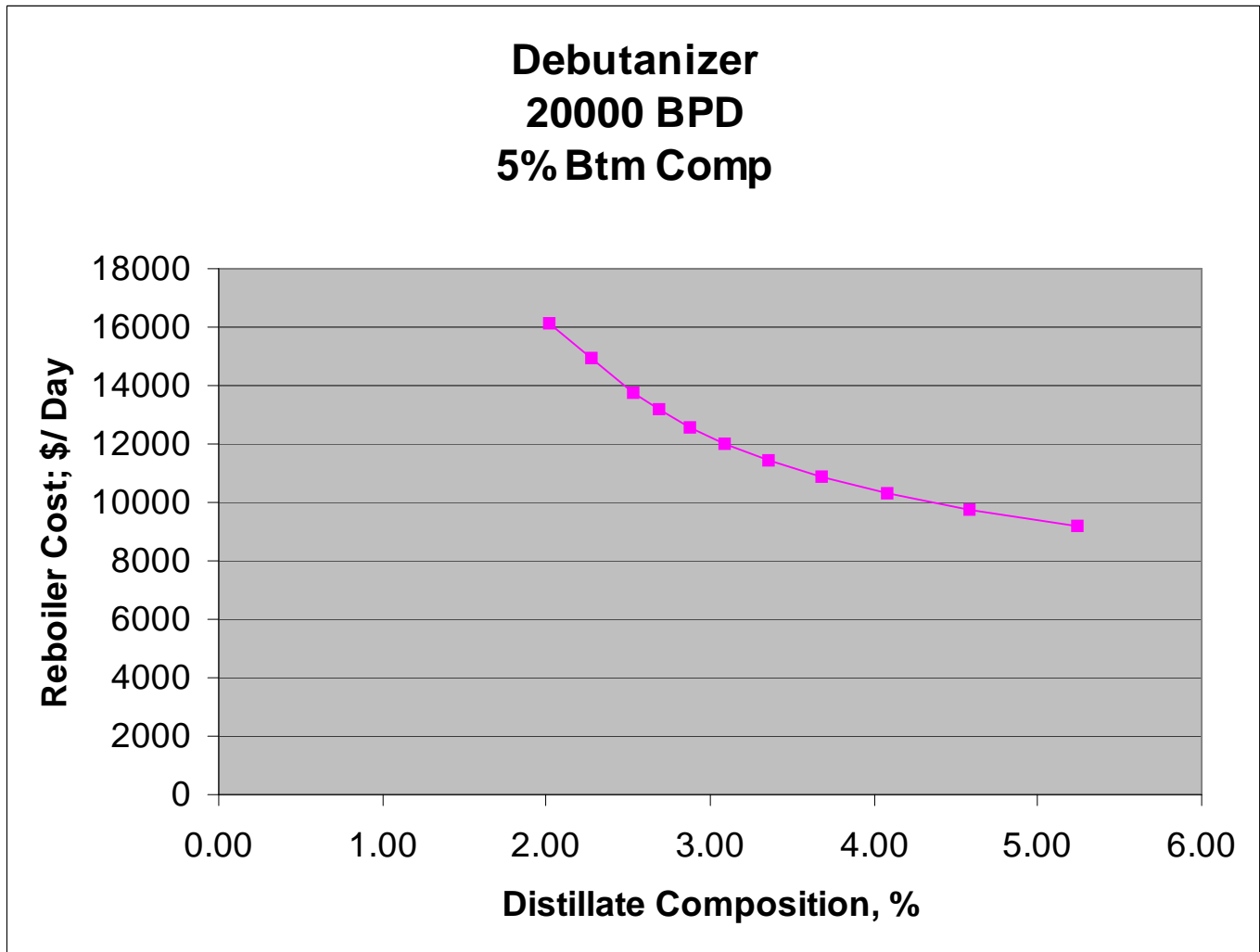
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Column Product



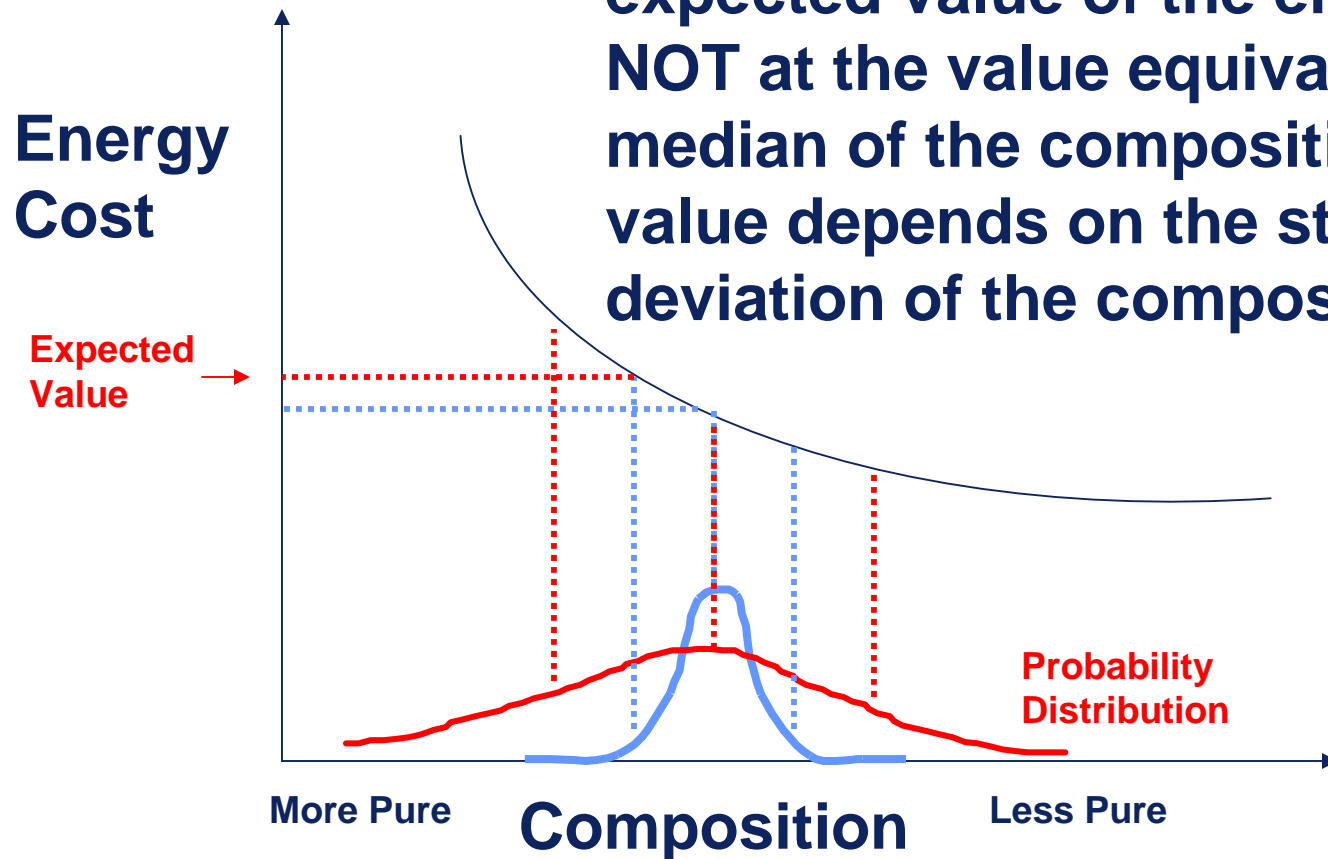
**Proposition: Since actual specification is on shipped product rather than column product directly, small excursions over the specification don't matter and can be handled by blending.  
Is this correct?**

# Debutanizer – Nonlinear Energy Effects

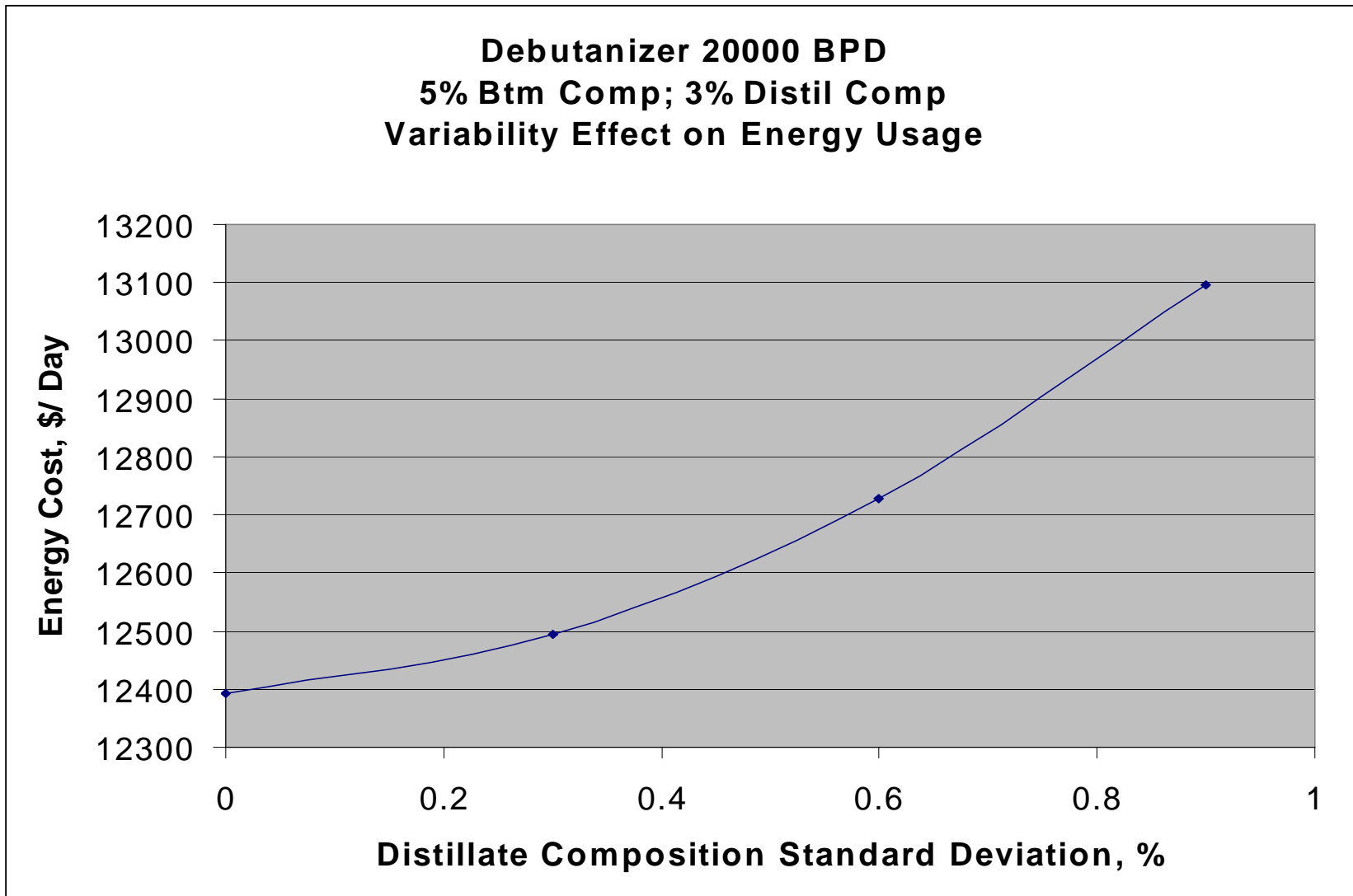


# Non-Linear Effects

For nonlinear relationship, the expected value of the energy cost is NOT at the value equivalent to the median of the composition; It's value depends on the standard deviation of the composition



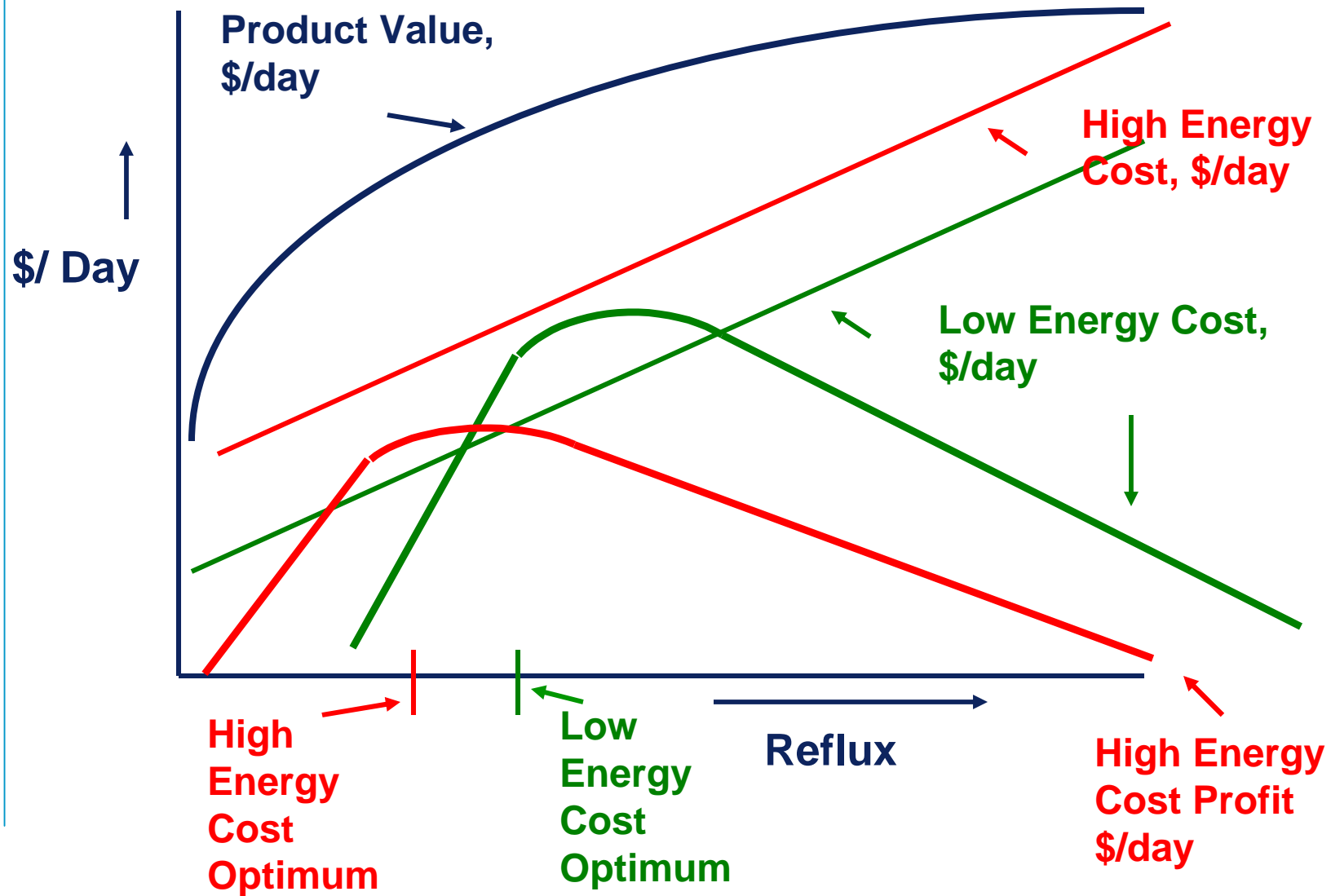
# Variability Vs Energy





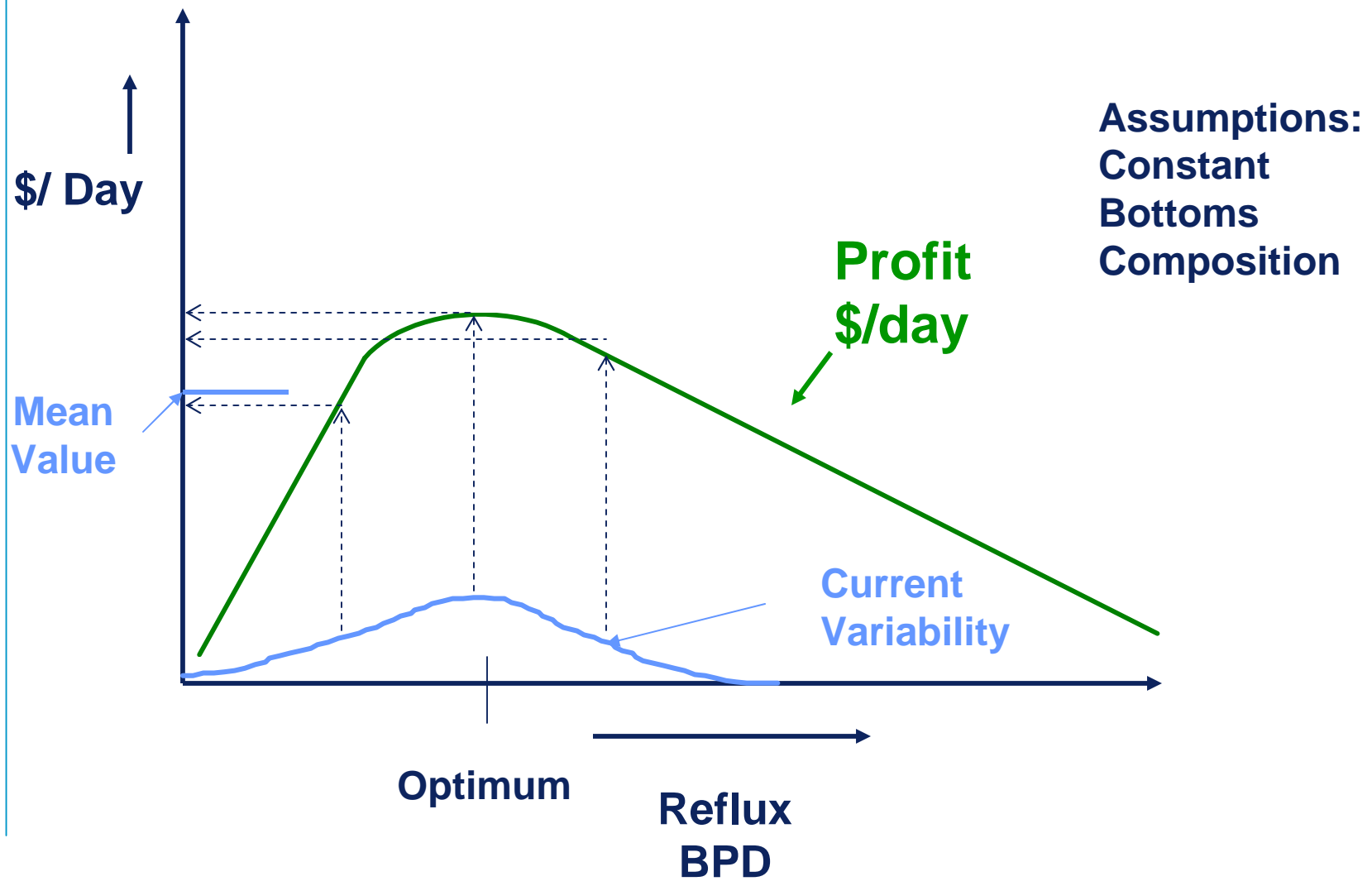
# ***Energy Balance Control***

# Profitability

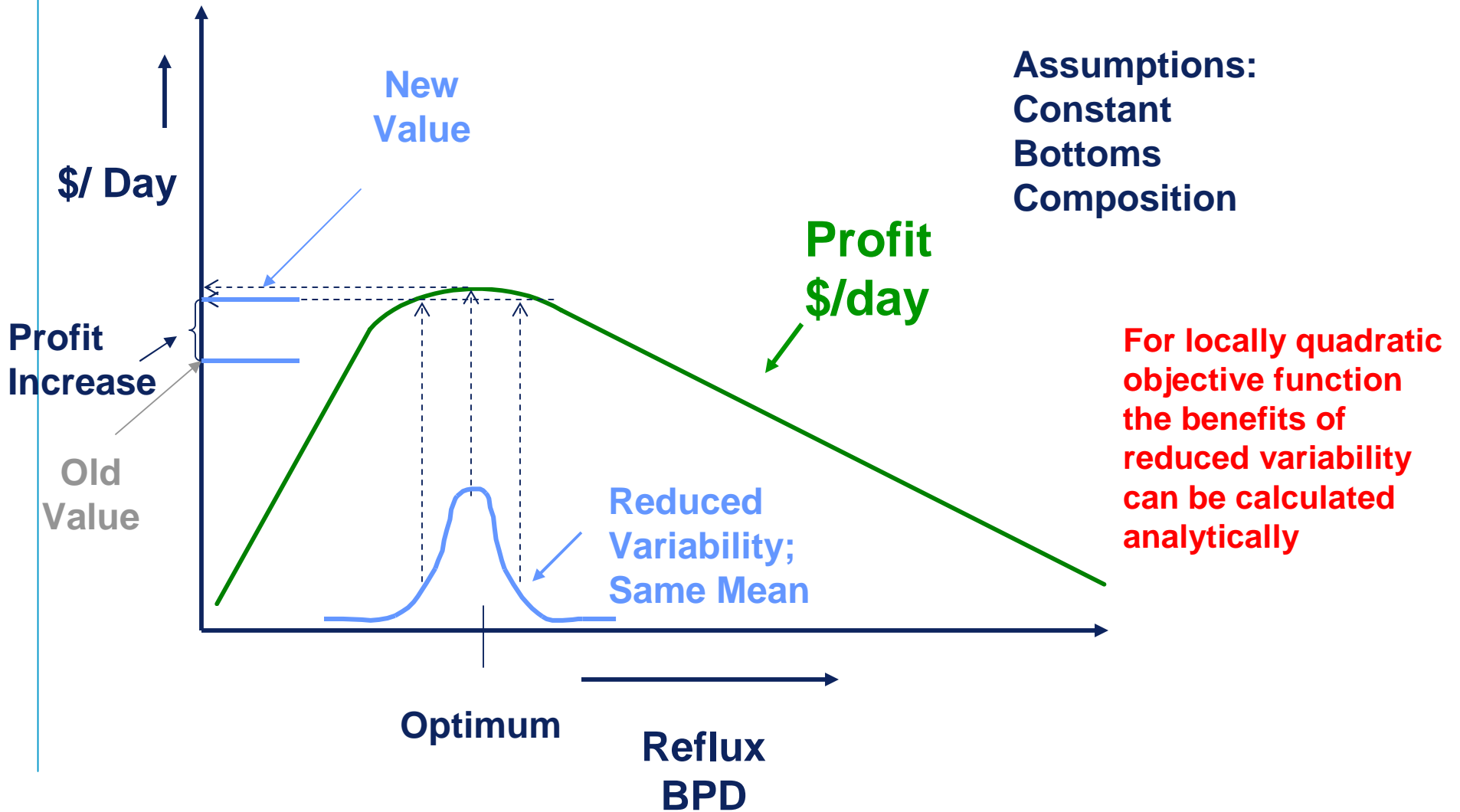




# Profitability with variability



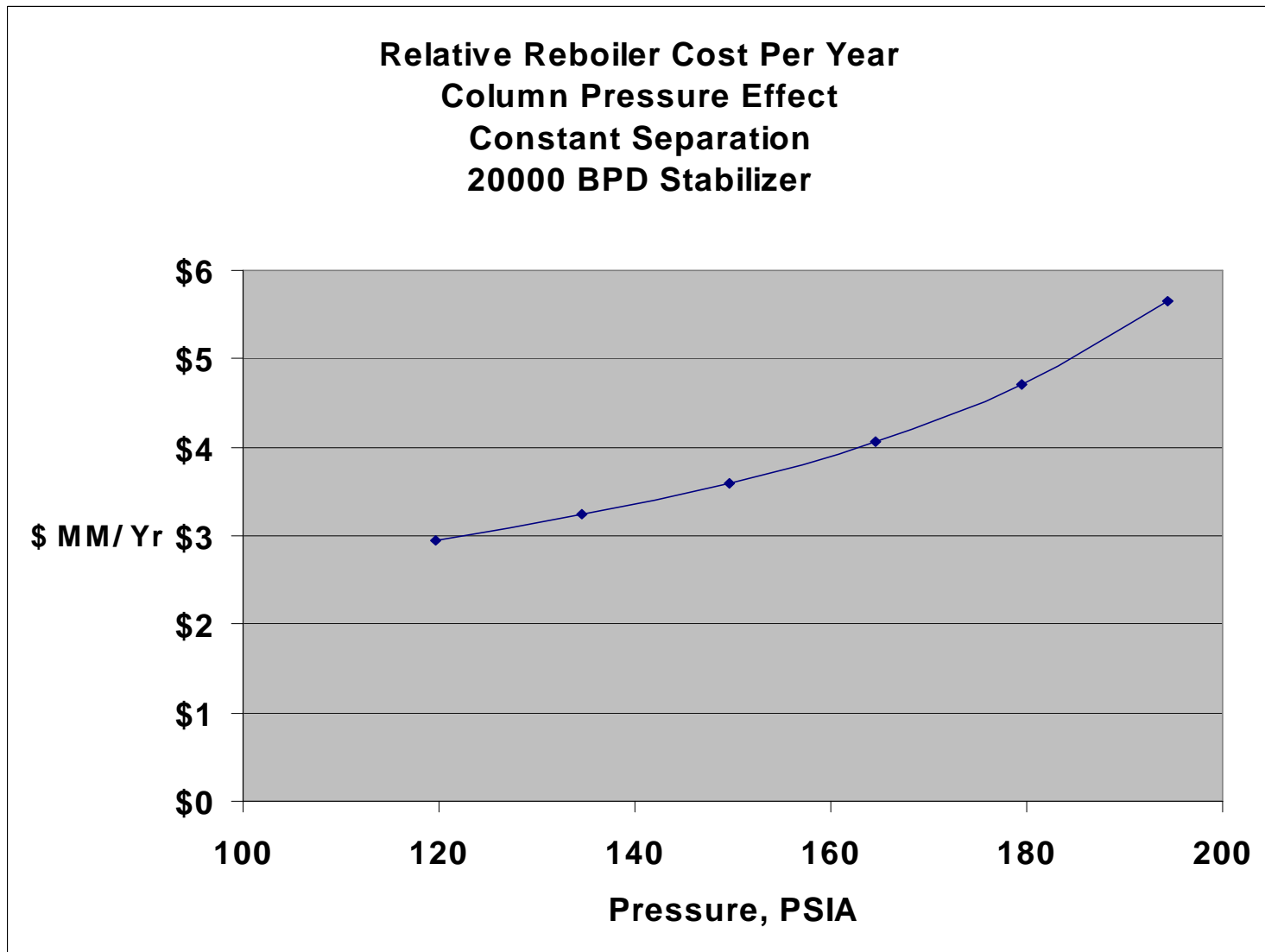
# Profitability with variability





# ***Pressure Effects***

# Column Pressure Effect



## ***Summary - Saving Energy in Fractionation***

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- **Closer Control to Specifications**
- **Optimize Energy Usage**
- **Minimize Pressure**

# ***Questions? Comments?***

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**doug.white@emersonprocess.com**

**More material on subject:**

**<http://www.emersonprocess.com/solutions/services/aat>**