

filter-technics

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Energy Analysis for Life-Cycle Costing



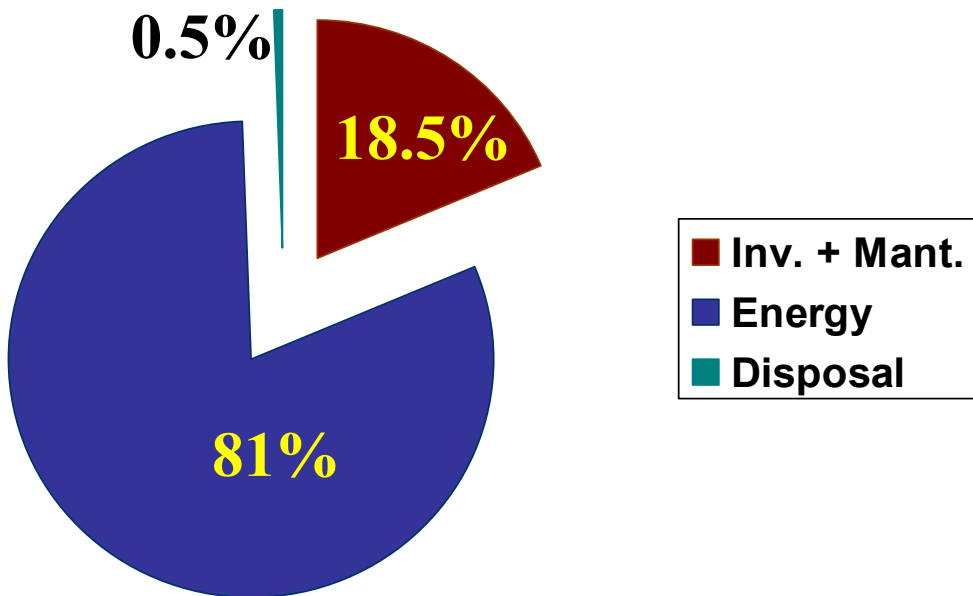
Life-Cycle Cost Components

Life Cycle Cost = Investment

+ LCC_{Maintenance}

+ LCC_{Energy}

+ LCC_{Disposal}



Carlsson, Thomas; "Indoor Air Filtration: Why Use Polymer Based Filter Media", *Filtration+Separation*, Volume 38 #2, March 2001, pp 30-32.

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Energy Analysis Theory

Energy Costs

**Energy required to overcome filter
system resistance**

$$\text{Energy Consumption (kWh)} = \frac{Q \Delta P t}{\eta 1000}$$

Q = Air Flow (m³/sec)

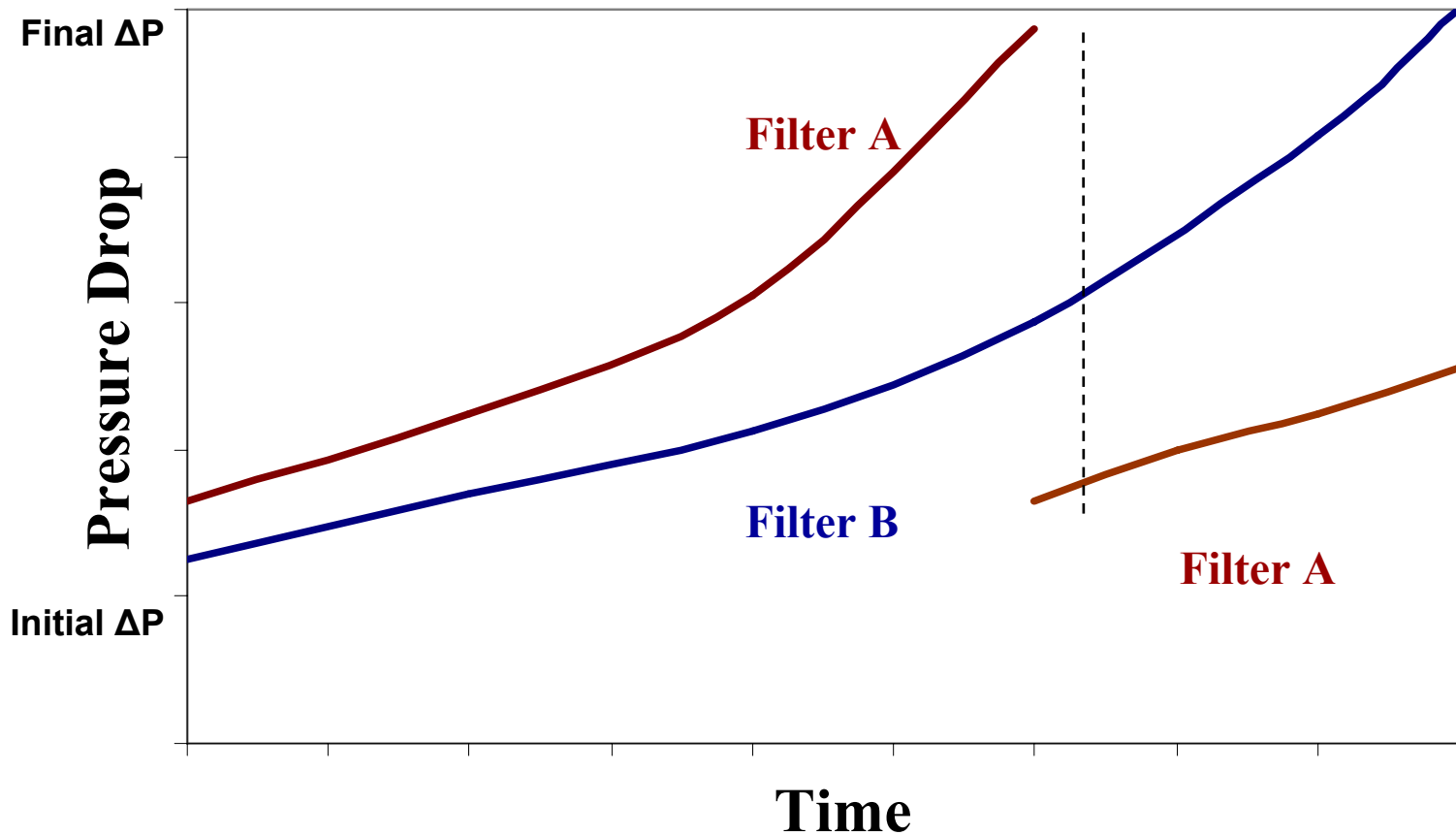
t = Time in Operation (hrs)

ΔP = Avg. Pressure Loss (Pa)

η = Fan Efficiency

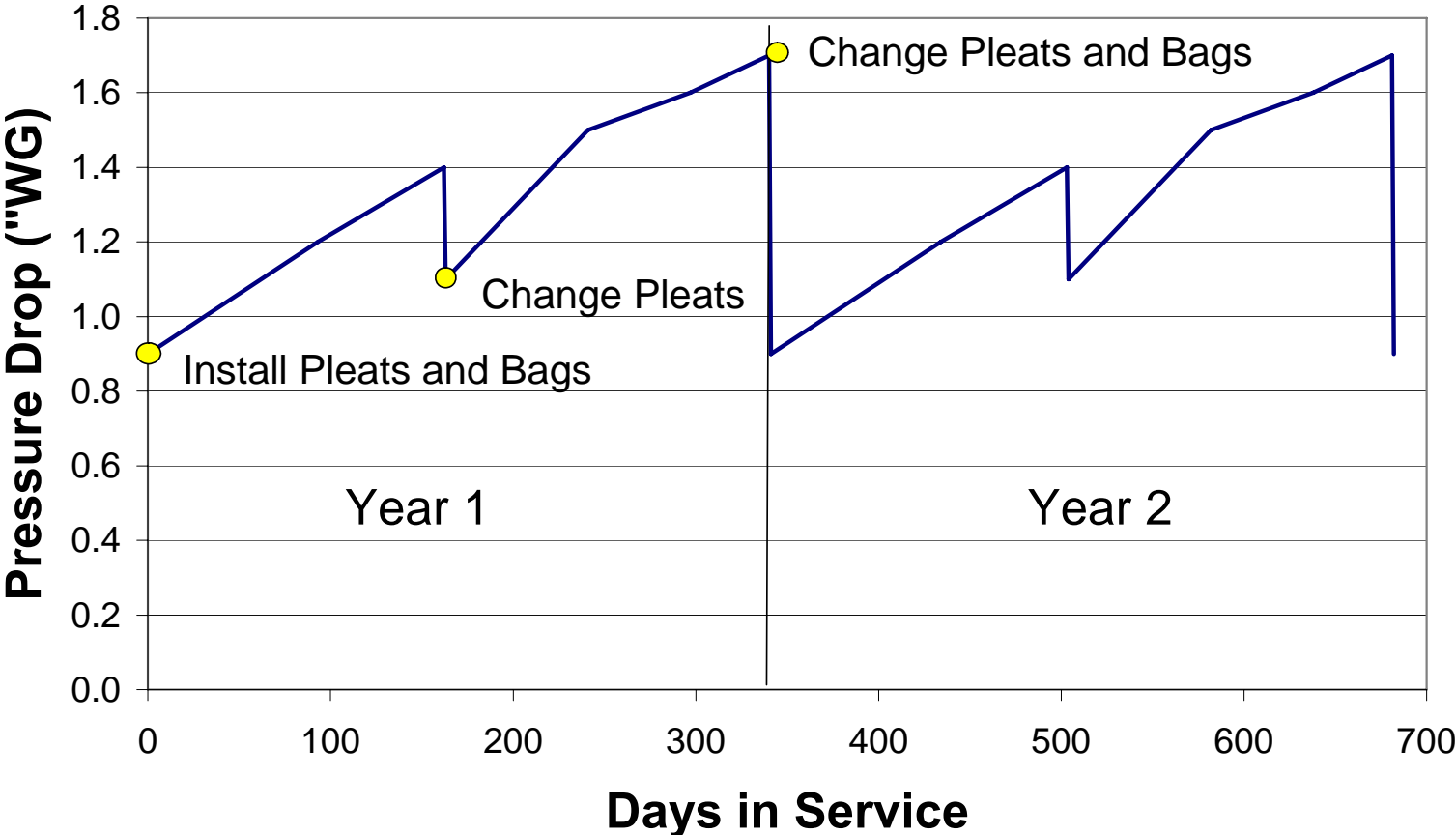
Pressure Drop

Theoretical Pressure Drop Curves



Pressure Drop

Case Study: Pressure Drop Curve



Pressure Drop

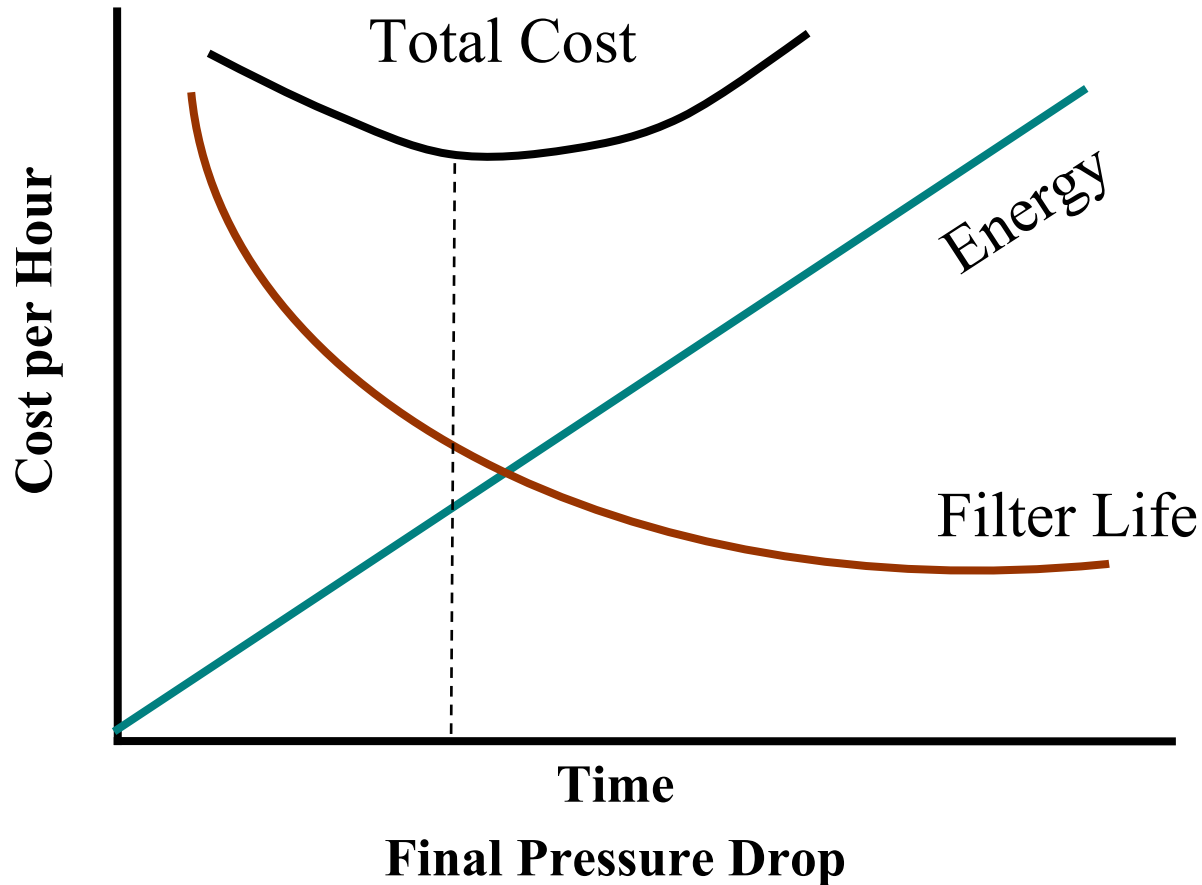
Average Pressure Drop

	System A	System B	Difference
Initial ΔP =	0.20''	0.30''	0.10''
Final ΔP =	1.00''	1.00''	0.00''
Average ΔP =	0.60''	0.65''	0.05''

Average ΔP changes at $\frac{1}{2}$ the rate of the initial ΔP

Life Cycle Costing

Optimum Final Pressure Drop





Life Cycle Costing

- Proper application of Life Cycle Costing finds the balance between energy costs and initial filter costs. The lowest total cost of a filtration system is determined by identifying the optimum final pressure drop of the system
- Optimum final pressure drop is the point where the sum of the amortized cost of the filter and the energy cost at that specific pressure drop is at a minimum.