“It’s What’s Inside that Counts”

Drive Basics

Adjustable Frequency Drive Description:

- Solid State Device
- Controls the Frequency and Voltage
- Speed Range Depends on the Motor
- HP Range - Fractional to 10,000

Drive Basics

Why Use Adjustable Speed Drives?

- Soft Start Capability
- Allows for Process Changes
- Improves Product Quality

Drive Basics

Adjustable Frequency Drive Definition (AFD):

- An Adjustable Frequency Drive controls an AC motor. It converts the incoming line constant voltage and frequency to an adjustable voltage and frequency. The adjustable voltage and frequency is applied to a squirrel cage induction motor.

Drive Basics

AFD Capabilities:

- Controllable Acceleration
- Controllable Deceleration
- Controllable Speed
- Torque Limiting
- Inrush Current Limiting

Drive Basics

AFD Capabilities (Continued)

- Controlled Jog / Thread
- Electronic Overload
- Programmable Settings
- Output Contacts and Signals
- Multiple Control Methods

Drive Basics

How Do Induction Motors Work With Drives?

- Control of Speed and Torque
- Control of Frequency and Voltage

Drive Basics

Advantages:

- Uses Squirrel Cage Motor
- High Input Power Factor
- Low Operating Cost
- Soft Start and Stop
- Easy to Retrofit

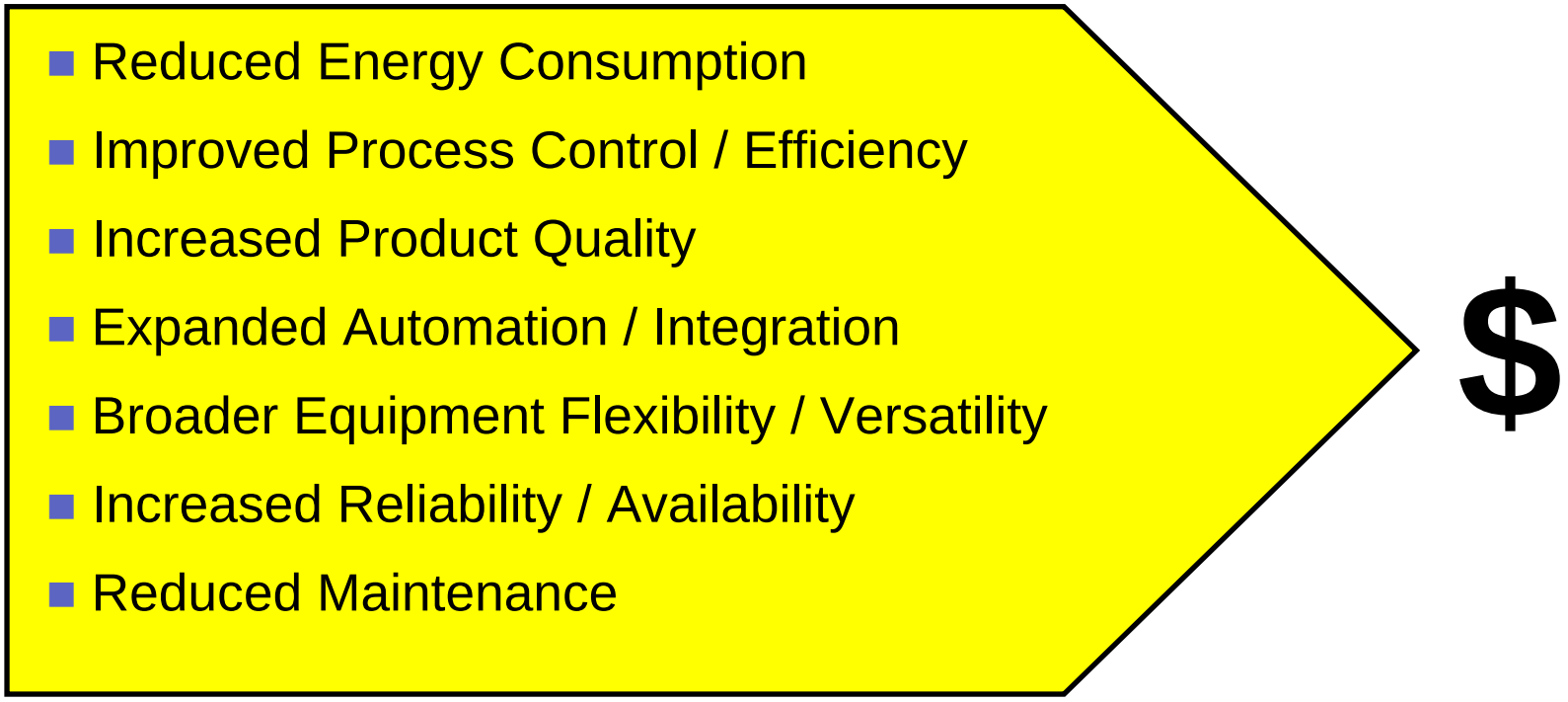
Drive Basics

Advantages (continued):

- Multiple Motor Capability
- Electronic Reversing
- Master Reference Capability
- Closed Loop Capability
- Bypass Capability

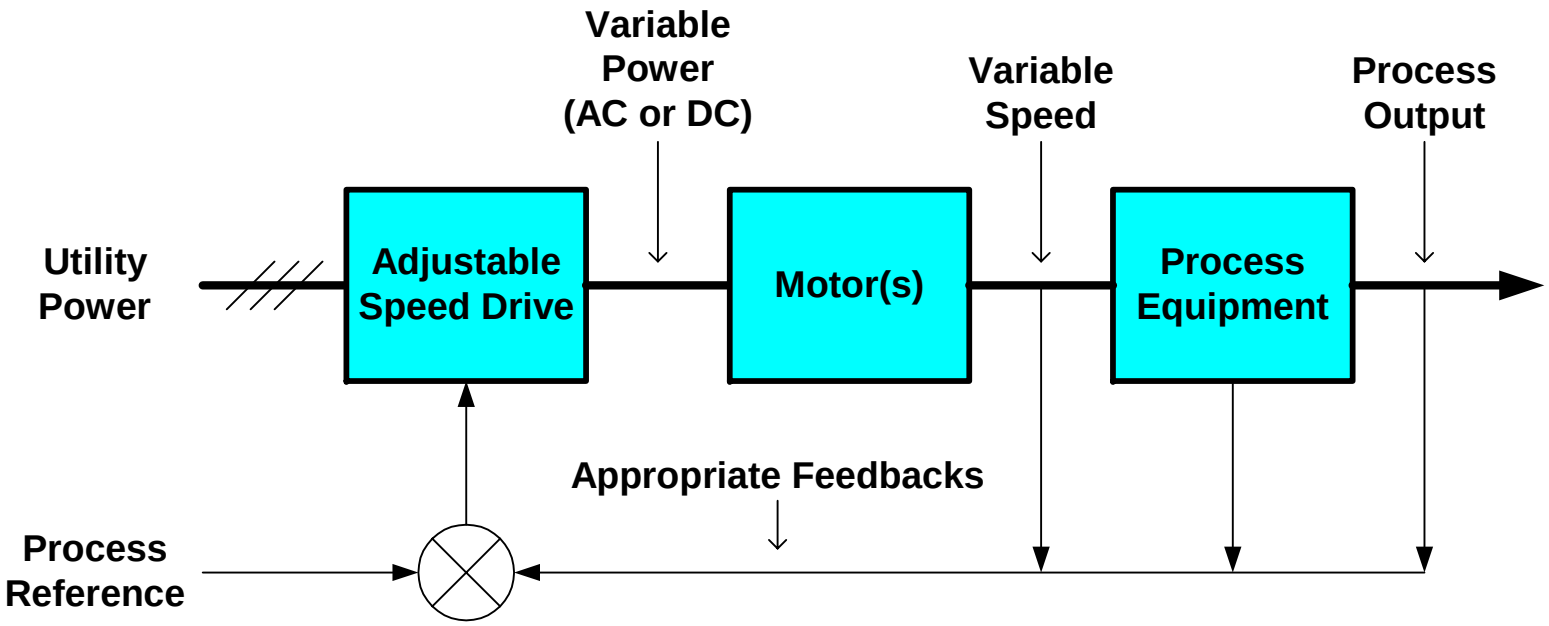
Drive Basics

- Why Use Adjustable Speed Drives?



Drive Basics

Typical Adjustable Speed Drive Configuration



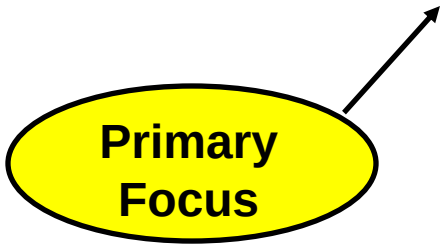
Variable speed is used to replace inefficient mechanical regulator devices such as valves, dampers, clutches, etc.

VS Drives Process Advantages

- **Speed vs. mechanical control ⇒**
  Increased process efficiency,
  Reduced energy usage,
  Lower operating costs
- **Accurate speed regulation ⇒**
  Increased flow / volume accuracy,
  Product quality improvement
- **Dynamic Speed Response ⇒**
  Minimized process disturbances,
  Product quality improvement
- **Higher input power factor ⇒**
  Lower operating costs

Applications, Types

- Constant Torque
- Constant Horsepower
- Variable Torque

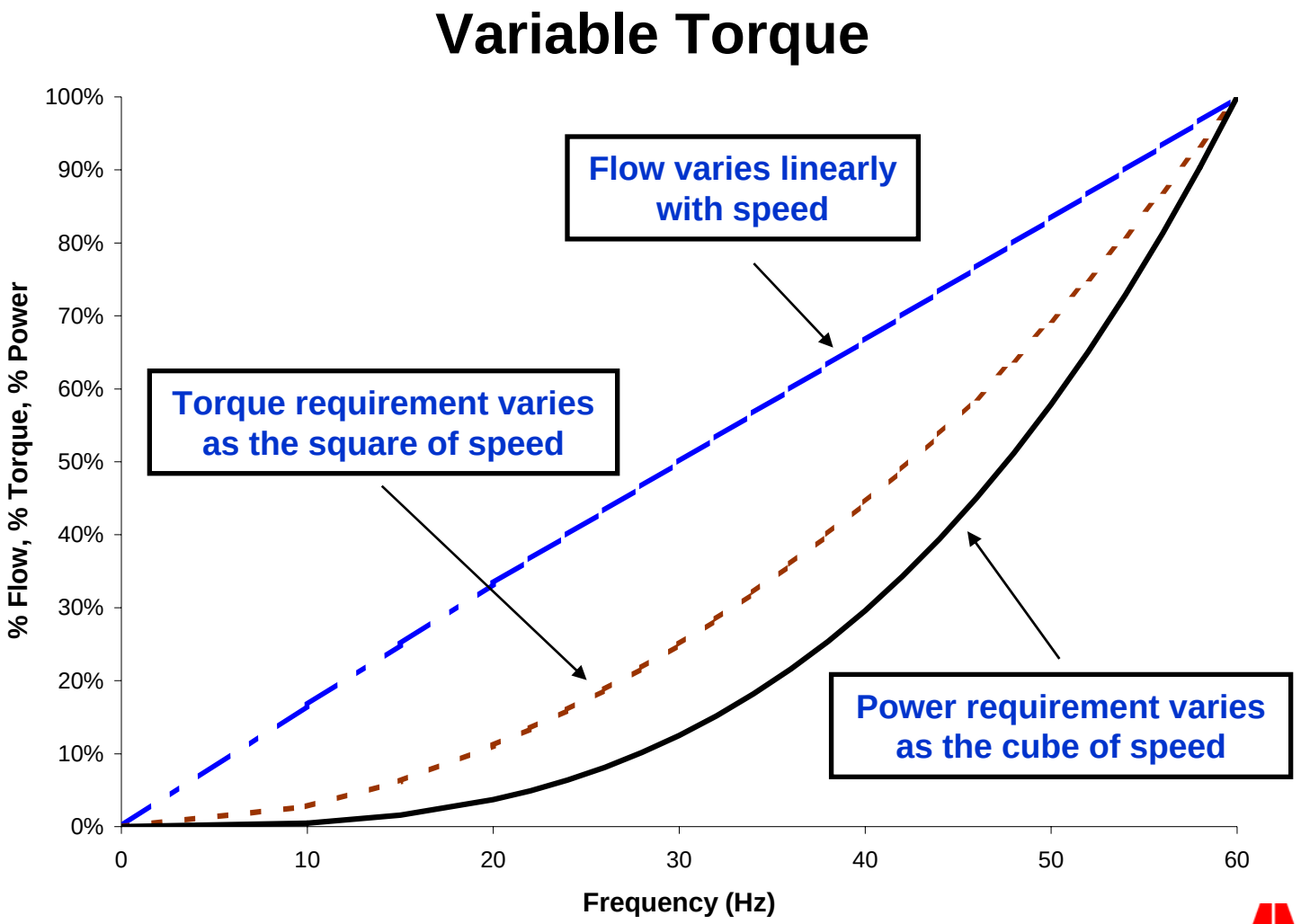


Applications, Types

Variable Torque Loads

- Fans
- Centrifugal Pumps
- Centrifugal Blowers
- Mixers (material dependent)

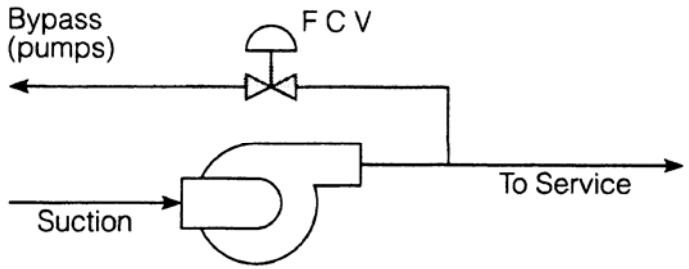
Applications, Types



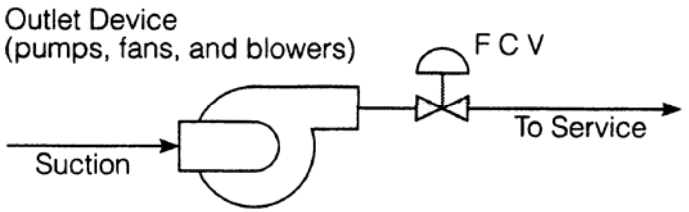
Applications, Types

Conventional Flow Control

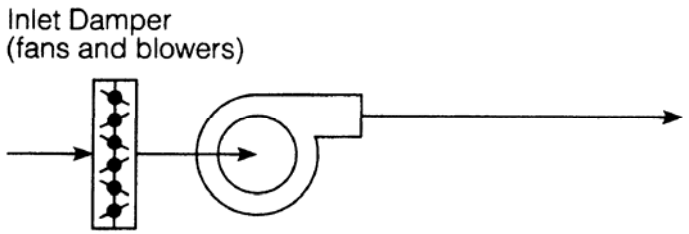
Bypass



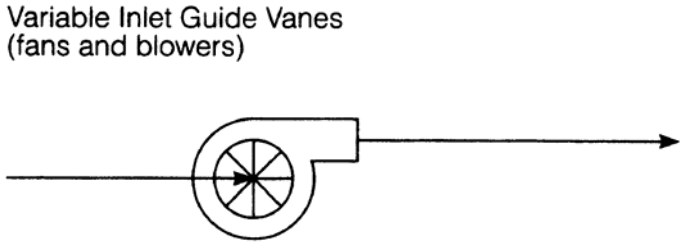
Outlet



Inlet

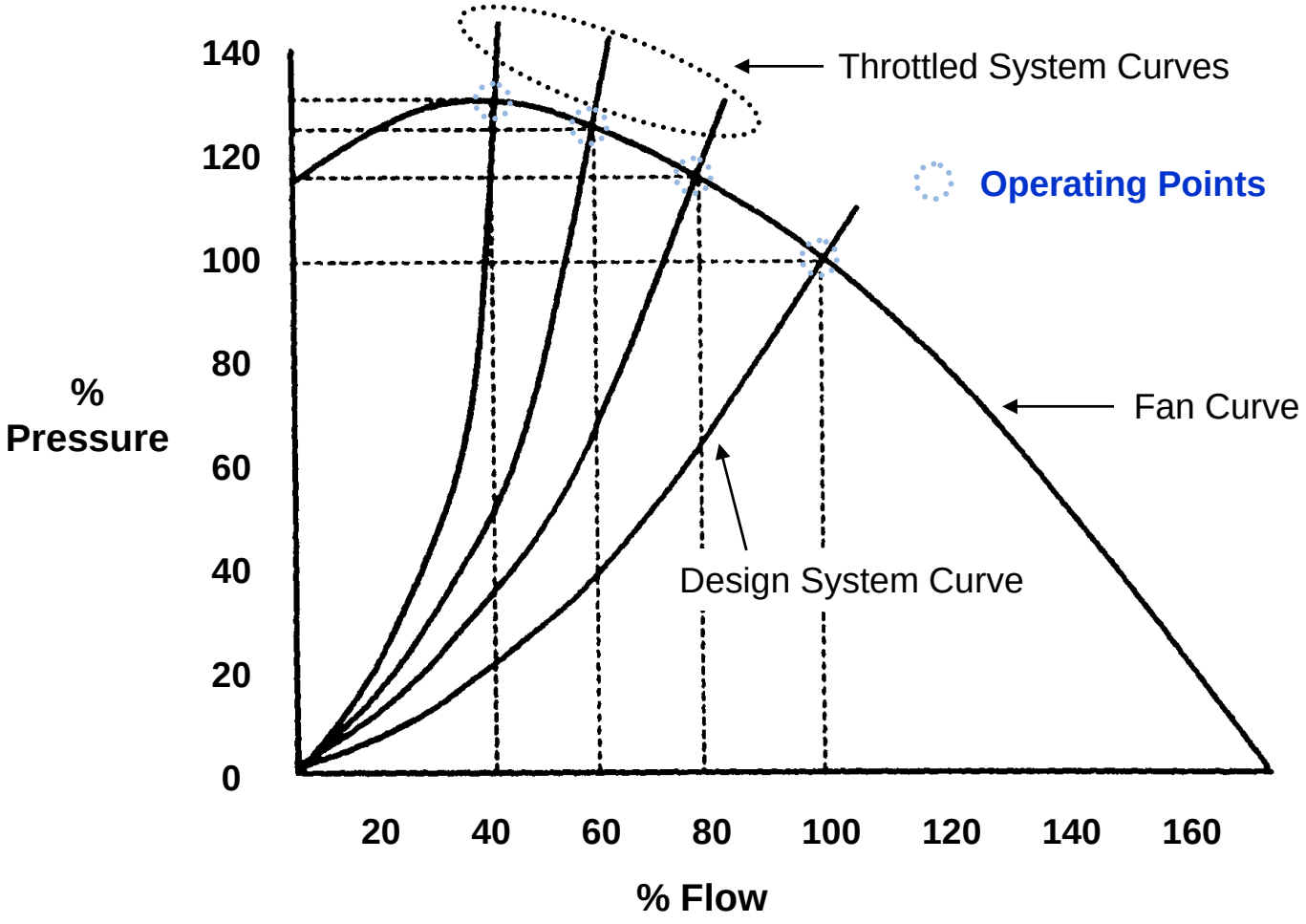


Inlet Vane



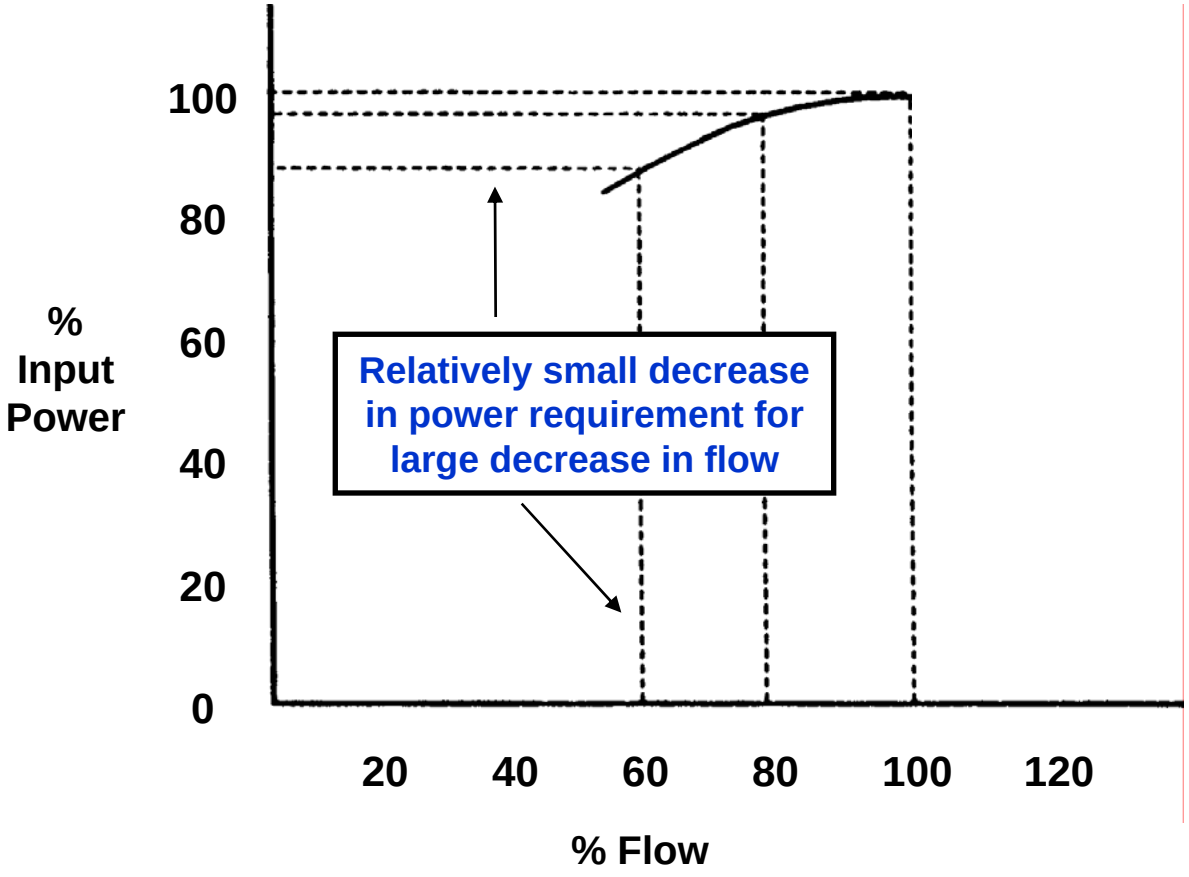
Applications, Fans and Blowers

Outlet Control - Operating Points



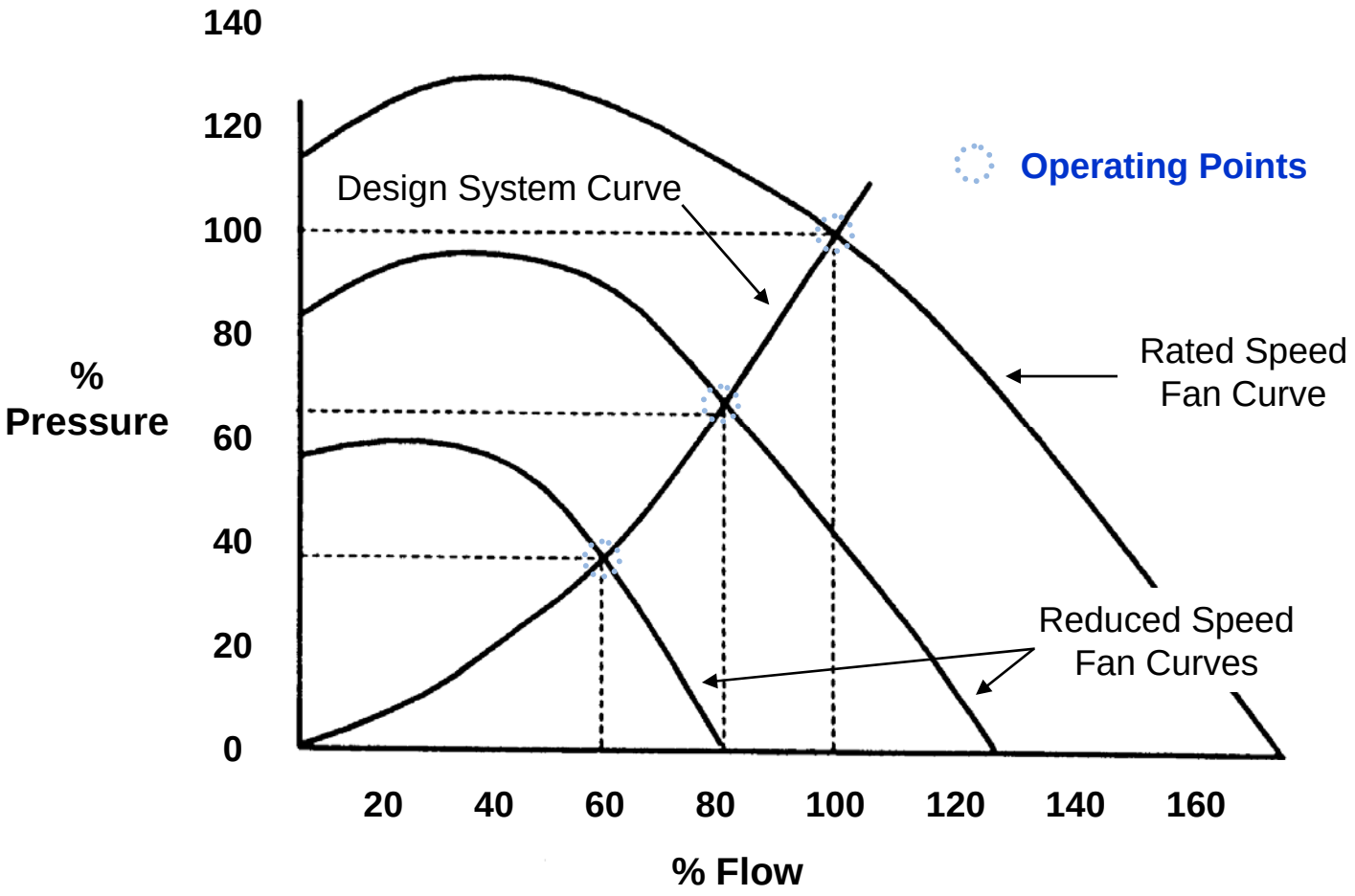
Applications, Fans and Blowers

Outlet Control - Power Requirement



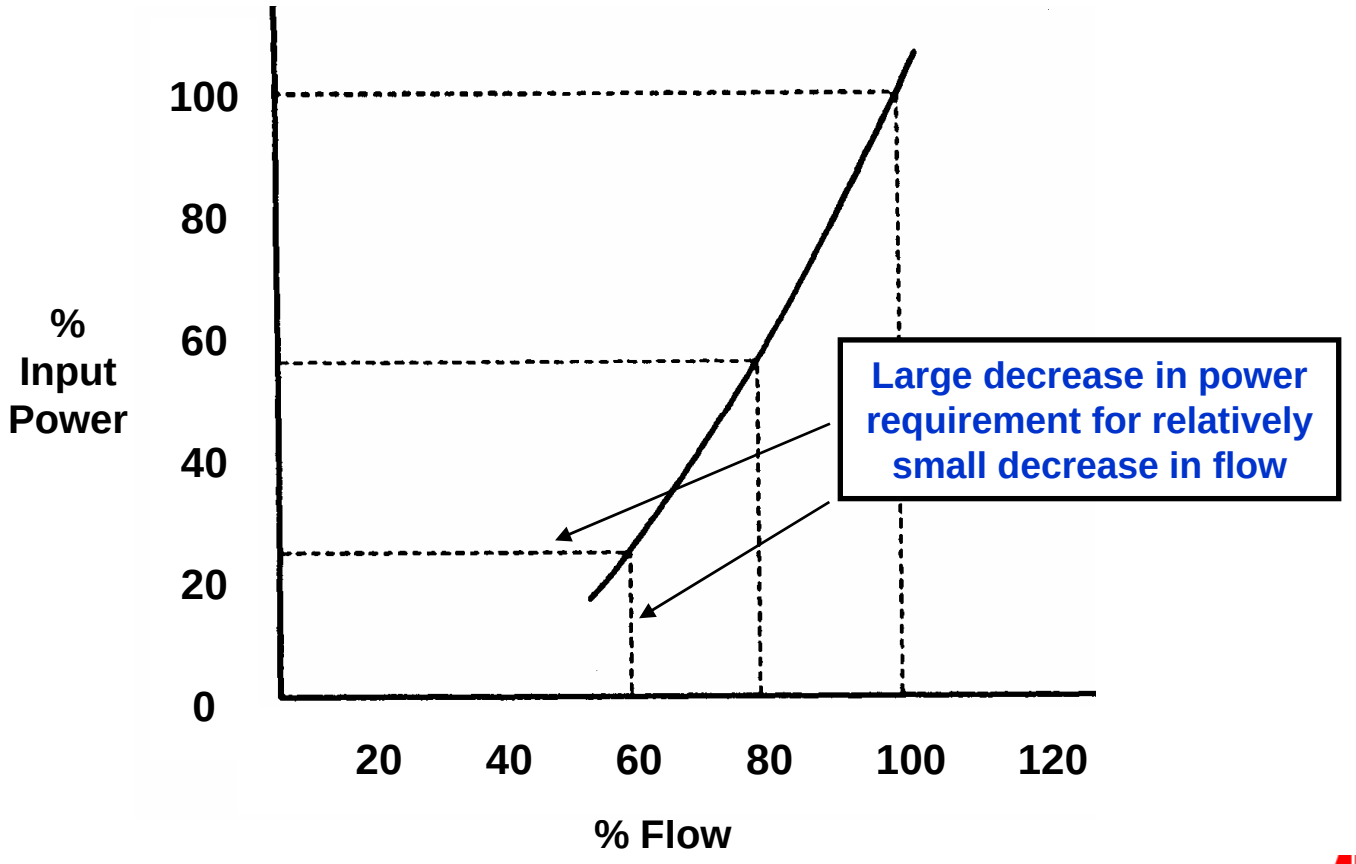
Applications, Fans and Blowers

Variable Speed - Operating Points



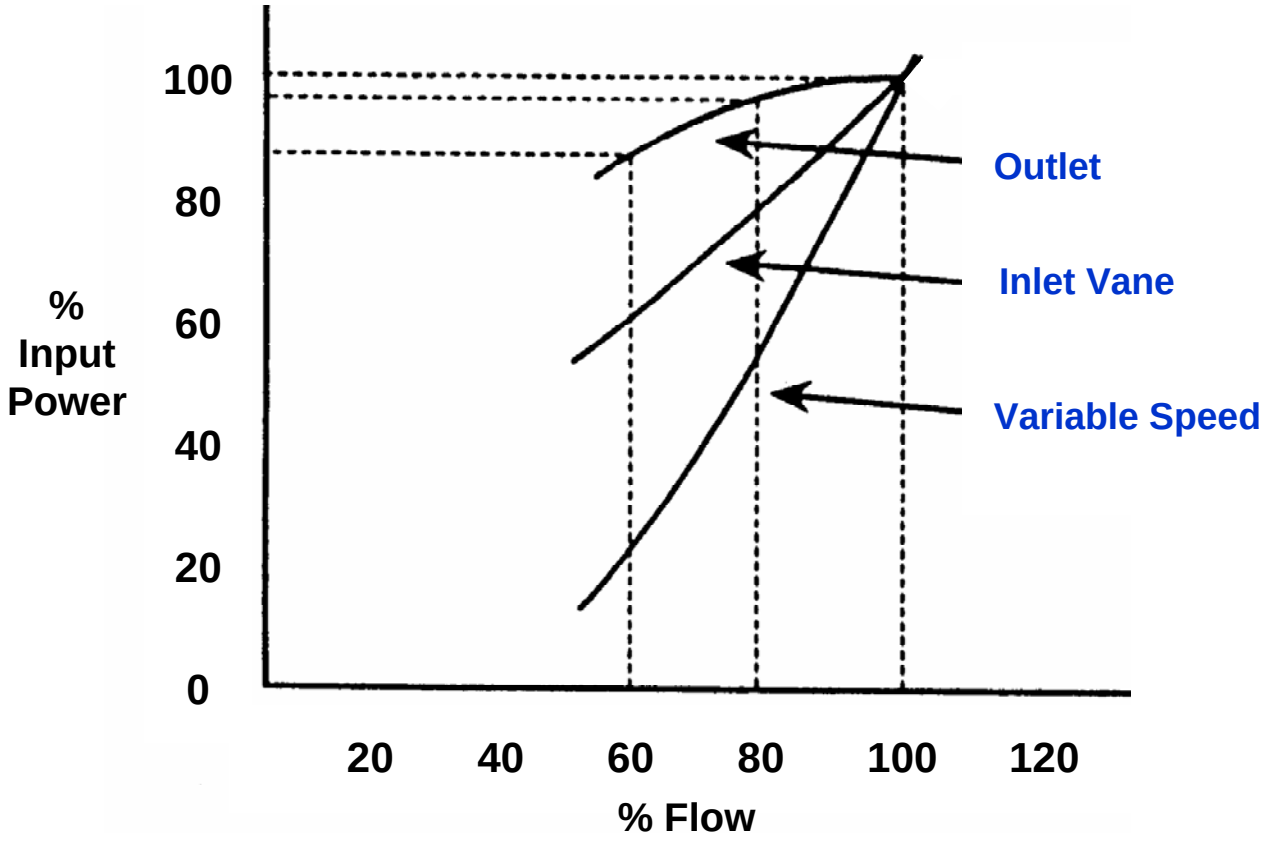
Applications, Fans and Blowers

Variable Speed - Power Requirement



Applications, Fans and Blowers

Power Requirement Comparisons



Applications, Economic Justification

Representative Sample:

- Fan, Variable Speed vs. Damper Control

Three Criteria:

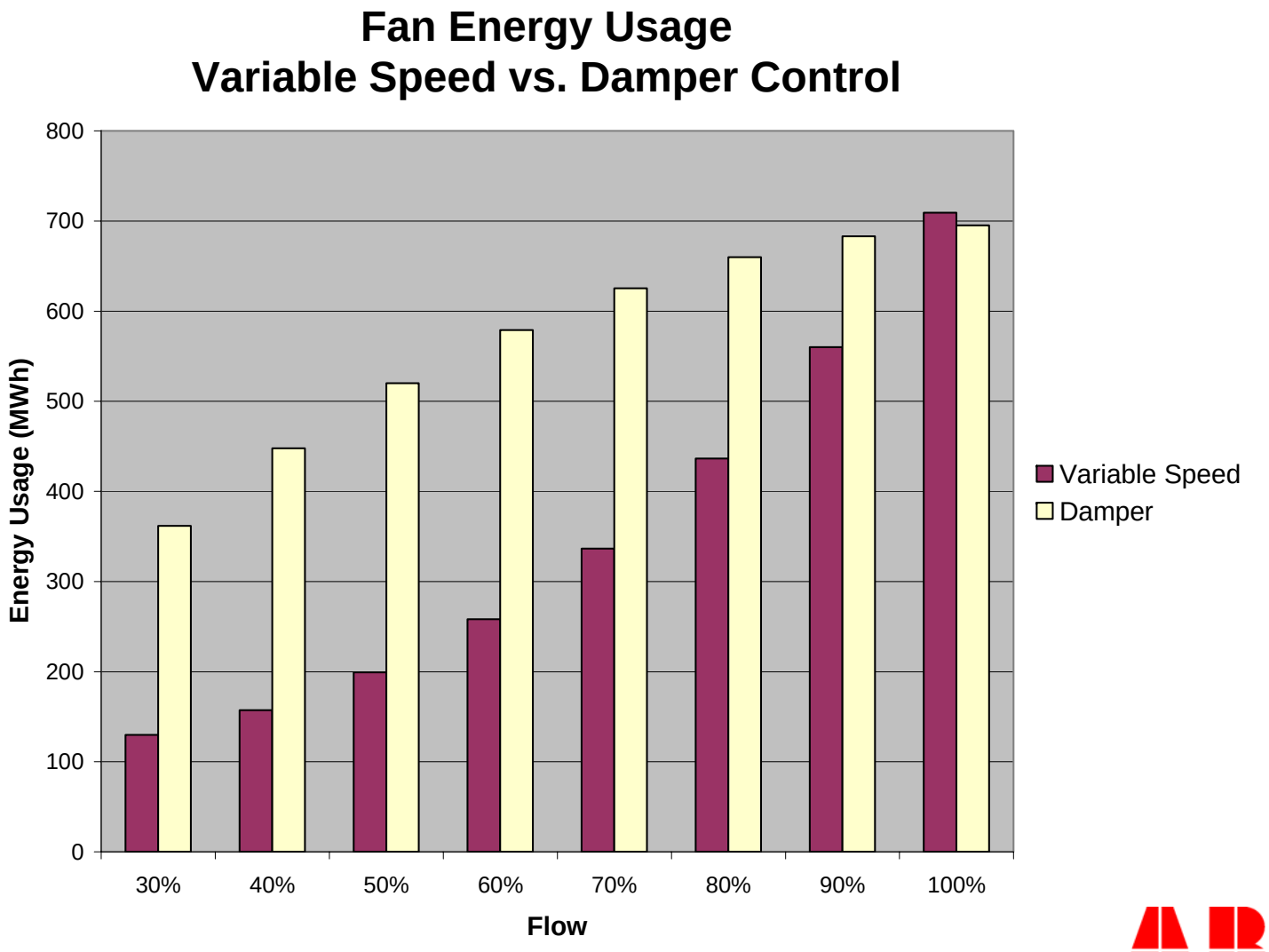
- Energy Usage
- Efficiency Improvement
- Annual Savings

Applications, Economic Justification

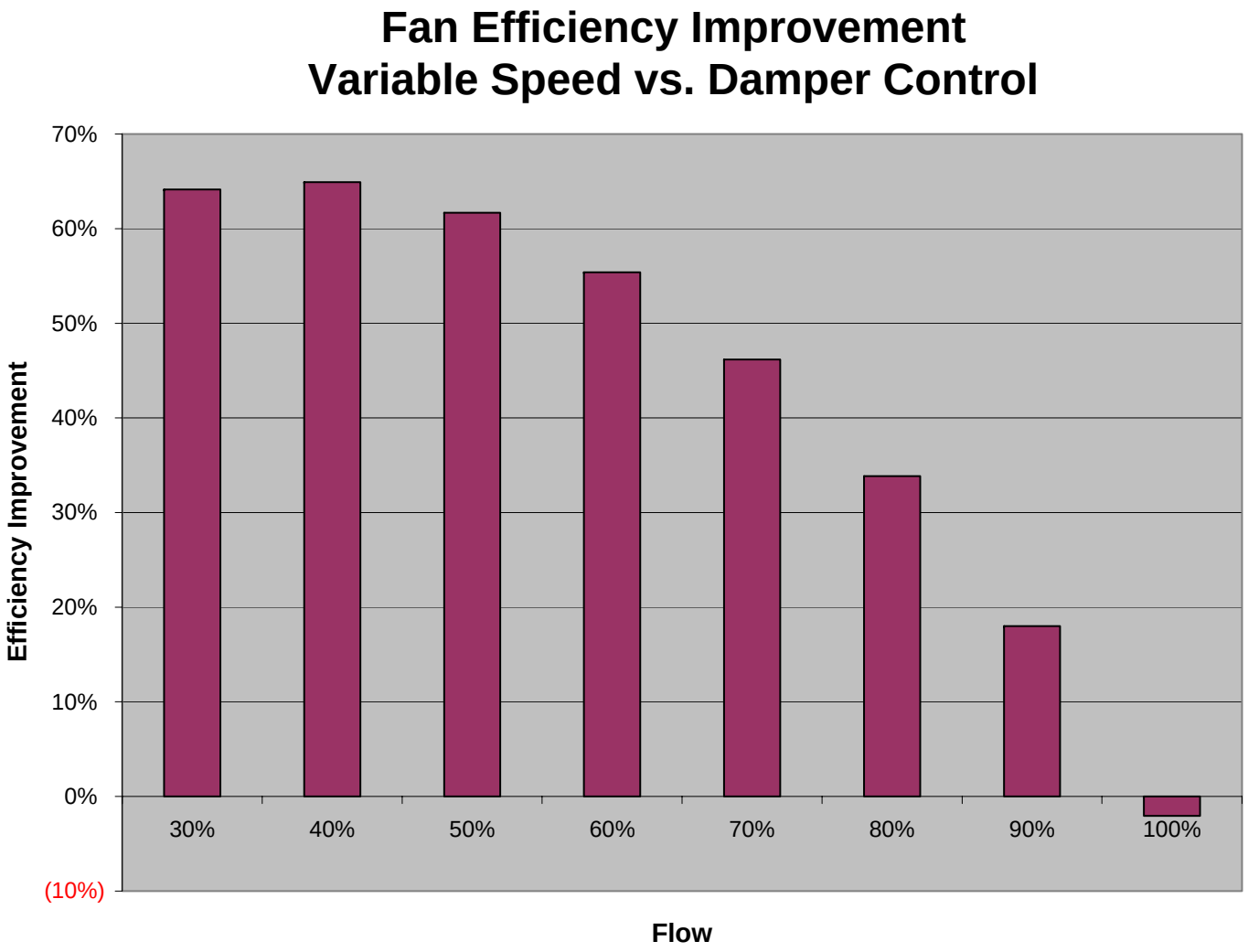
Base Assumptions :

- Full rated flow = 178,000 CFM @ 3 “H_2O
- Fan / blower efficiency = 85%
- Motor efficiency = 94%
- Drive efficiency = 98%
- Rated shaft power = 100 hp
- Cost per kWh = $ 0.10

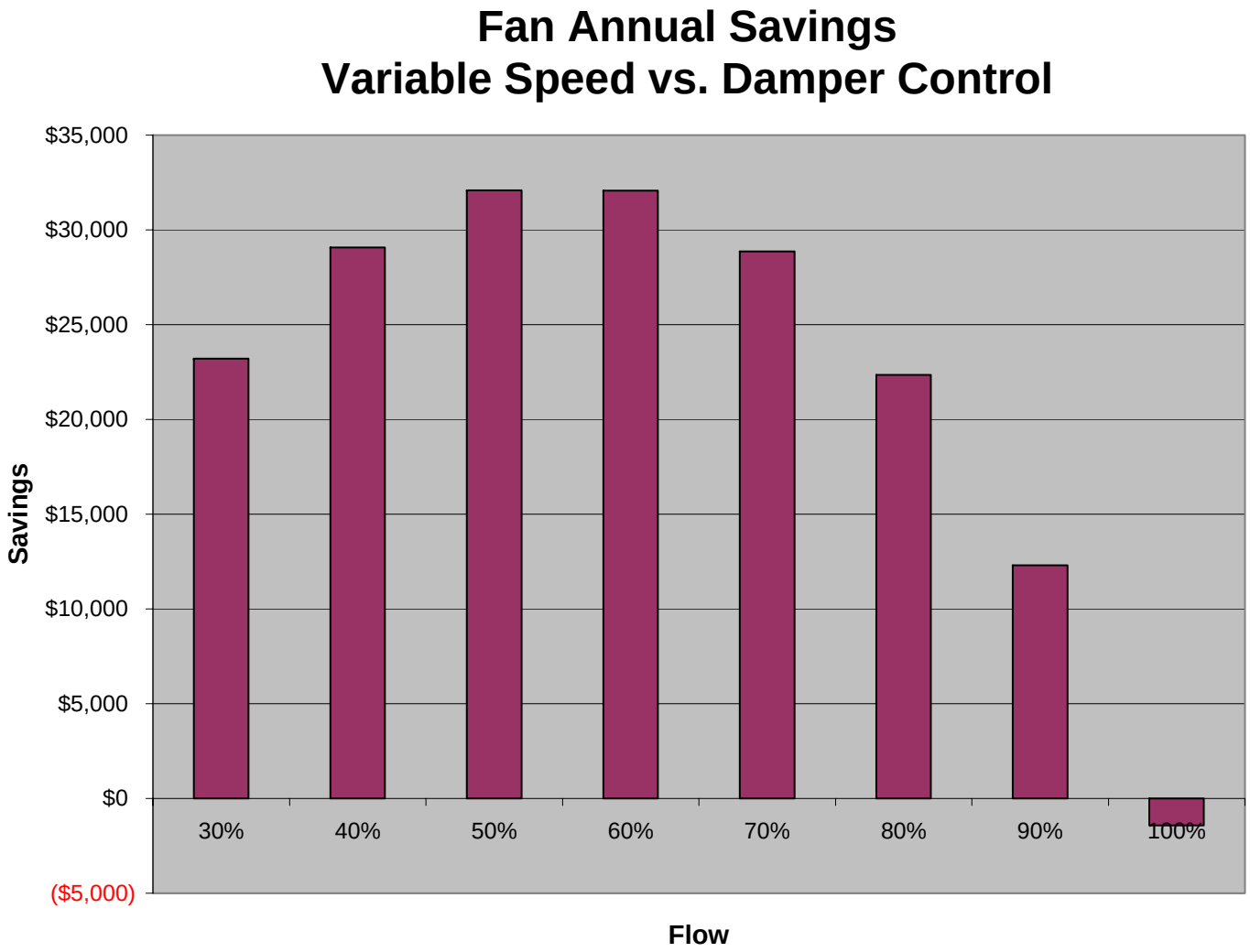
Applications, Economic Justification



Applications, Economic Justification



Applications, Economic Justification



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