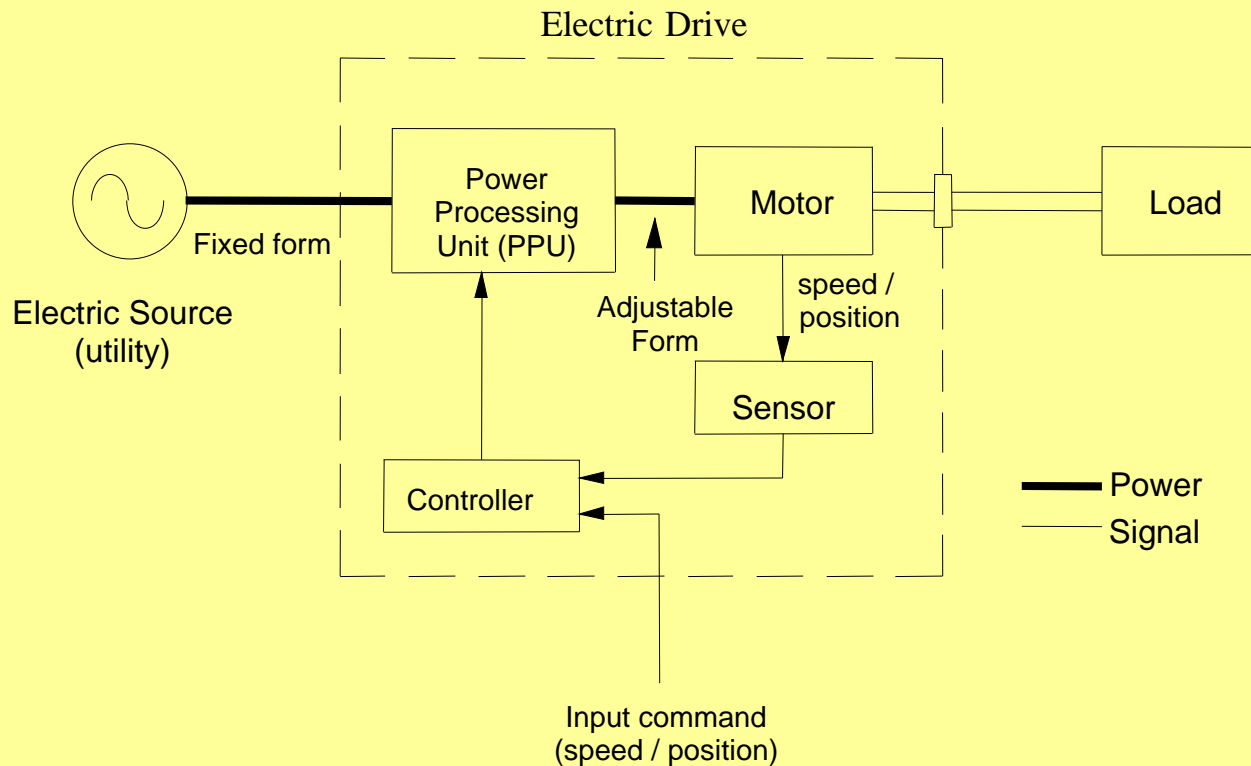


# Introduction to Electric Drives

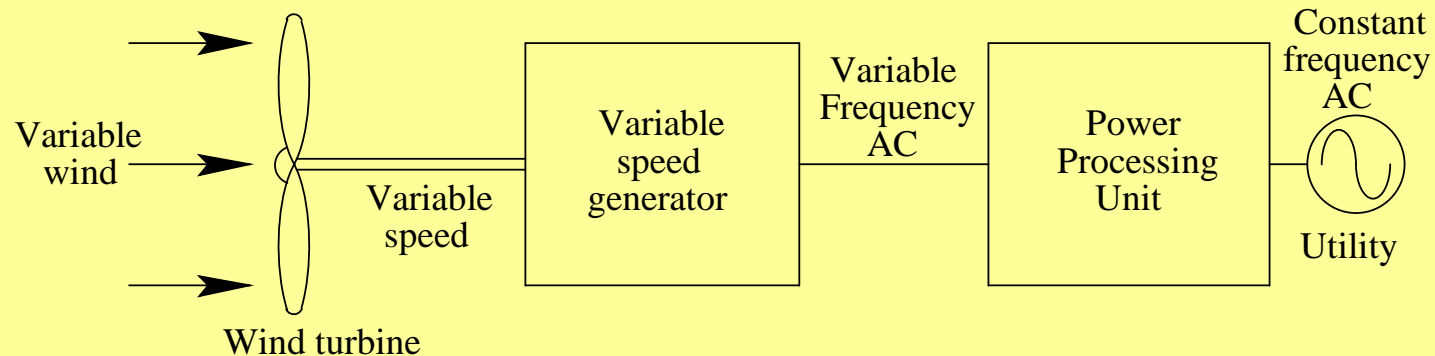
- Structure
- Applications
- Multi-Disciplinary Nature

# Role of an Electric Drive



- ◆ Role of Electric Drive: Efficient conversion of power from electrical to mechanical and vice versa
- ◆ Role of PPU: Delivers appropriate form of frequency and voltage to the machine (as required by the load or the prime mover)

# Harnessing of Wind Energy



- ◆ Types of Generators:
  - ◆ PMAC
  - ◆ Induction
  - ◆ Doubly-fed Induction generators

# Transportation

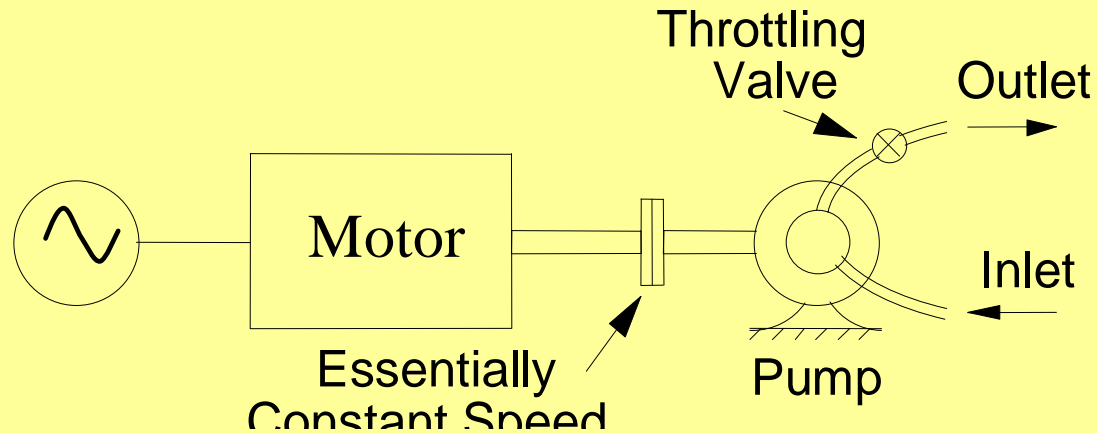


- ◆ Electric Trains, airplanes, Ships, etc
- ◆ Vehicles:
  - ◆ Electric Vehicles
  - ◆ Hybrid-Electric Vehicles
  - ◆ Pluggable Electric Vehicles

# Application for Energy Conservation

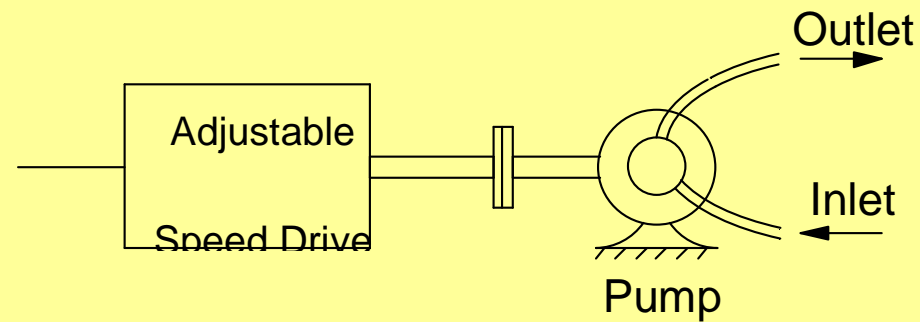
- Heat Pumps and air-conditioners - cycled operation
  - ◆ 30% improvement in efficiency by running compressor at appropriately reduced speed using an ASD

# Traditional Pump-Driven Systems



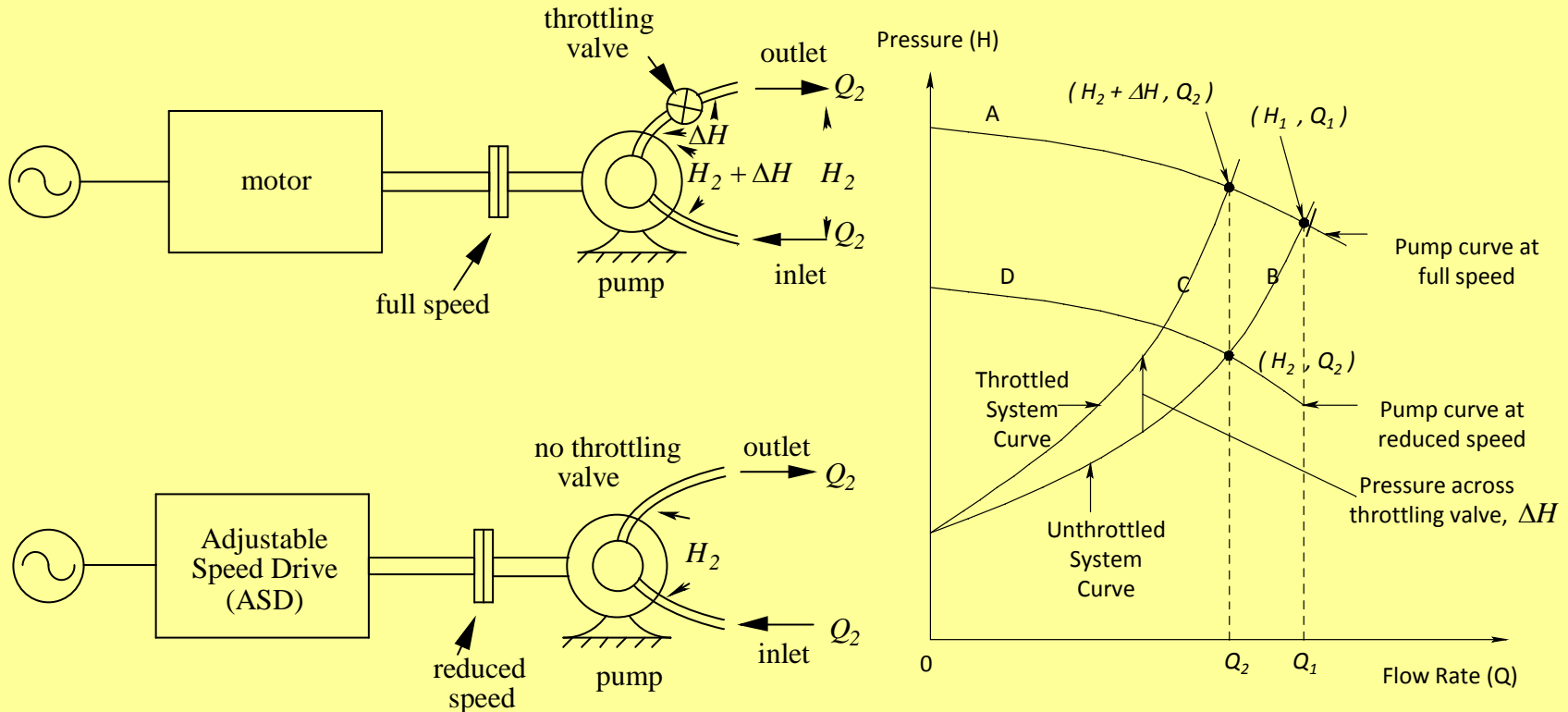
- Constant frequency AC - essentially constant pump speed
- Inefficient - Heat generated in pump and throttling valve
- Not amenable to automation

# Adjustable Speed Drives (ASDs)



- Driven at appropriate speed
  - ◆ No need for the throttling valve
  - ◆ High Efficiency

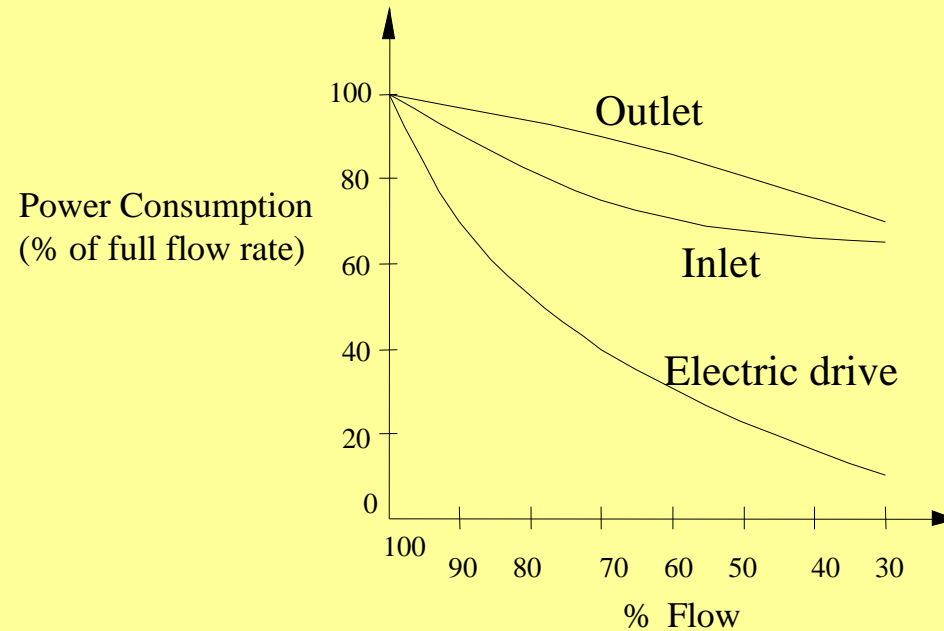
# Energy Conservation in Pumps



- ◆ Throttling introduces extra pressure drop,  $\Delta H$
- ◆ ASD reduces pump speed to match load requirement

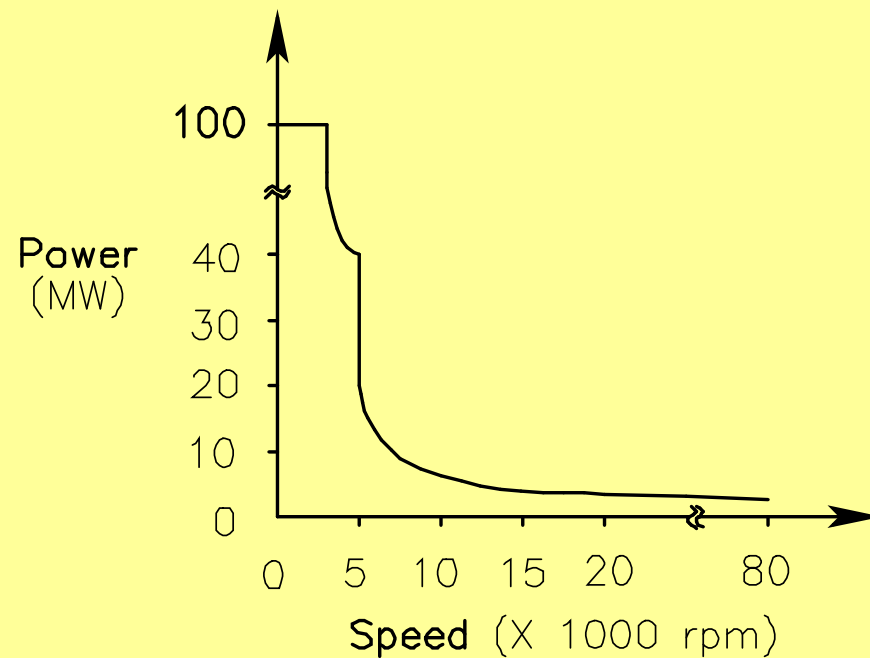


# Energy Conservation in Blower Systems



- Relative power consumption using three methods to reduce blower flow rate

# Power and Speed Range



- ◆ A very wide range of speed and power

# MULTI-DISCIPLINARY NATURE OF DRIVE SYSTEMS

- Theory of Electric Machines
- Power Electronics
- Control Theory
- Real-Time Control Using DSPs
- Mechanical System Modeling
- Sensors
- Interactions of Drives with the Utility Grid

# Summary

## Introduction to Electric Drives

- Structure
- Applications
- Multi-Disciplinary Nature