Energy Efficiency across Winery Services

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Energy Efficiency

- Energy Efficiency Best Practice
- Wineries of the Future
- Big Energy Project
- **Energy Efficiency Opportunities Program (EEO Act 2006)**
- Overview of key measures
- Detailed look at opportunities for further savings in pumping energy use

Energy use in Wineries

- Electricity
  - Refrigeration : 40-60%
  - Pumping : 10-35%
  - Lighting : 8-20%
  - Compressed air : 3 – 10%
  - Forklifts, Process Eqpt : 3-15%
  - Packaging / Bottling : 8-30%

Source: A Guide to Energy Efficiency Innovation in Australian Wineries

Energy use in Wineries

- Gas (LPG, NG)
  - Hot water
  - Steam
  - Forklifts
- Greenhouse gas emissions
  - Electricity : 60-75%
  - NG/LPG : 12-20%
  - Fermentation, Waste : 13-33%
    - Source: A Guide to Energy Efficiency Innovation in Australian Wineries

Energy Efficiency – Refrigeration : Refrigerants

- Ammonia : good COP, environment friendly
- Freon family : acceptable COP, typically for smaller sizes and medium temperature duty
- CO_2 : As a Secondary refrigerant (beware the high pressures)

Energy Efficiency – Refrigeration : Compressors

- Ensure operation near full load for best efficiency
- Use thermal storage configured to fully utilise the available temperature range
- Operate at highest suction

Energy Efficiency – Refrigeration : Condensers

- Amply sized – low condensing
- Speed controlled fans
- Control fan speed based on ambient conditions
- Configure to allow condensing temperature to float

Energy Efficiency – Refrigeration:Heat Exchangers

- Ammonia to brine, brine jackets for wine tanks, brine to wine
- Optimise size
  - to allow high suction / high brine temperature
  - to minimise pressure drop : reduced pumping power

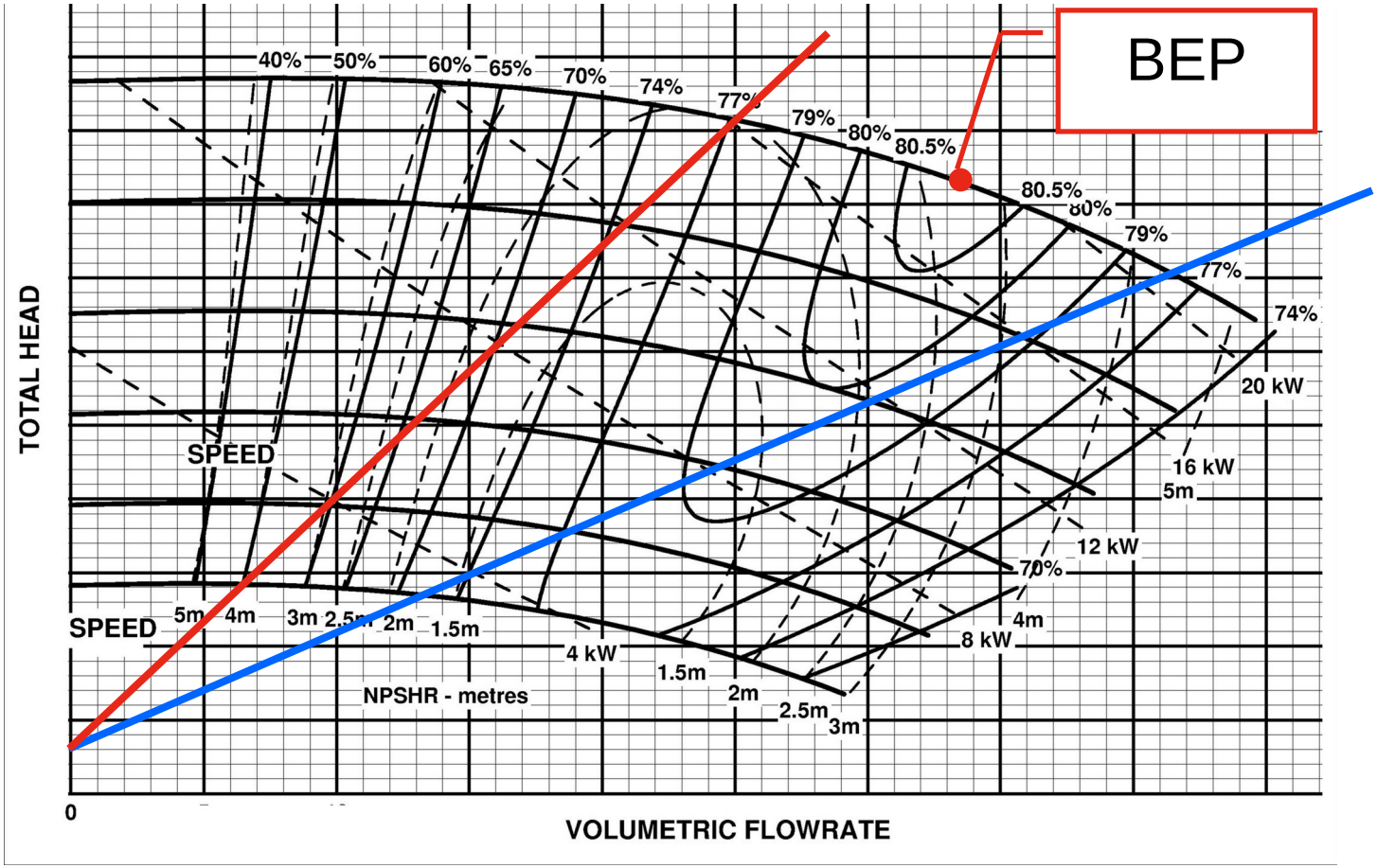
Energy Efficiency – Refrigeration - Pumping

- Large contributor to energy use
- VSD controlled pumps :
  - Significant periods of operation at partial load
  - VSDs typical loss 2 - 5%
  - Not for pumps which always run at full load (primary brine)
  - Motor to be suitable for VSD control

Energy Efficiency – Pump Selection

- Key aspects help achieve savings to the full extent for centrifugal pumps
  - Appropriate pump selection
  - Appropriate speed control methodology

Energy Efficiency – Pump Selection



Energy Efficiency – Pump Selection

- Pump efficiency highest at the BEP (Best Efficiency Point)
- Efficiency Drops off on either side of BEP
- System curve to the right of BEP utilises best part of higher efficiency region

Energy Efficiency – Pump Selection

- For the additional savings, before buying a new pump for replacement or for new installation,
  - Accurately assess system curve
  - Select pump such that system curve intersects to right of BEP at peak duty

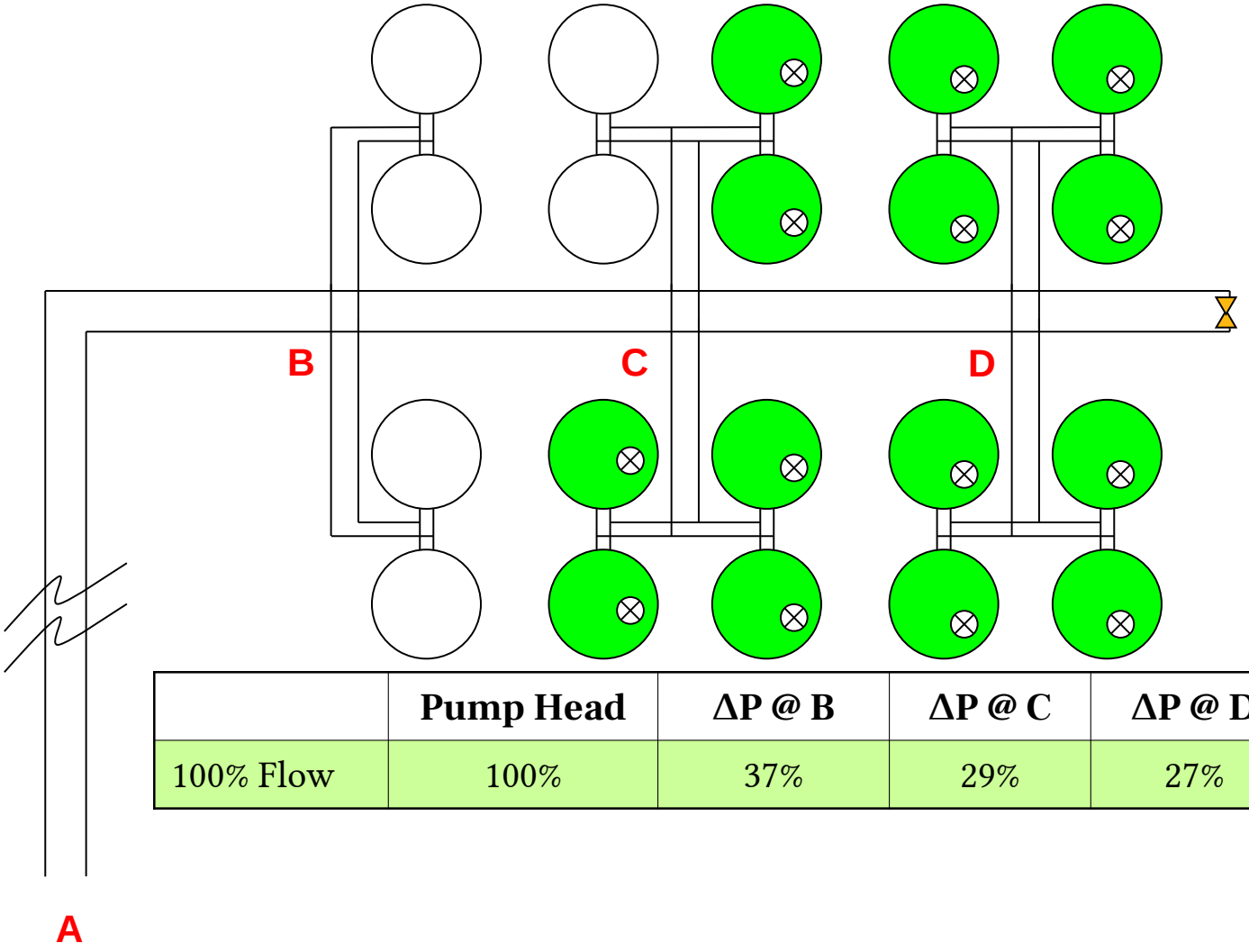
Energy Efficiency – Speed Control

- Pump speed control typically based on pressure (or differential pressure) at the discharge side
- Location of the pressure (DP) transmitter critical to achieve maximum benefit

Energy Efficiency – Speed Control

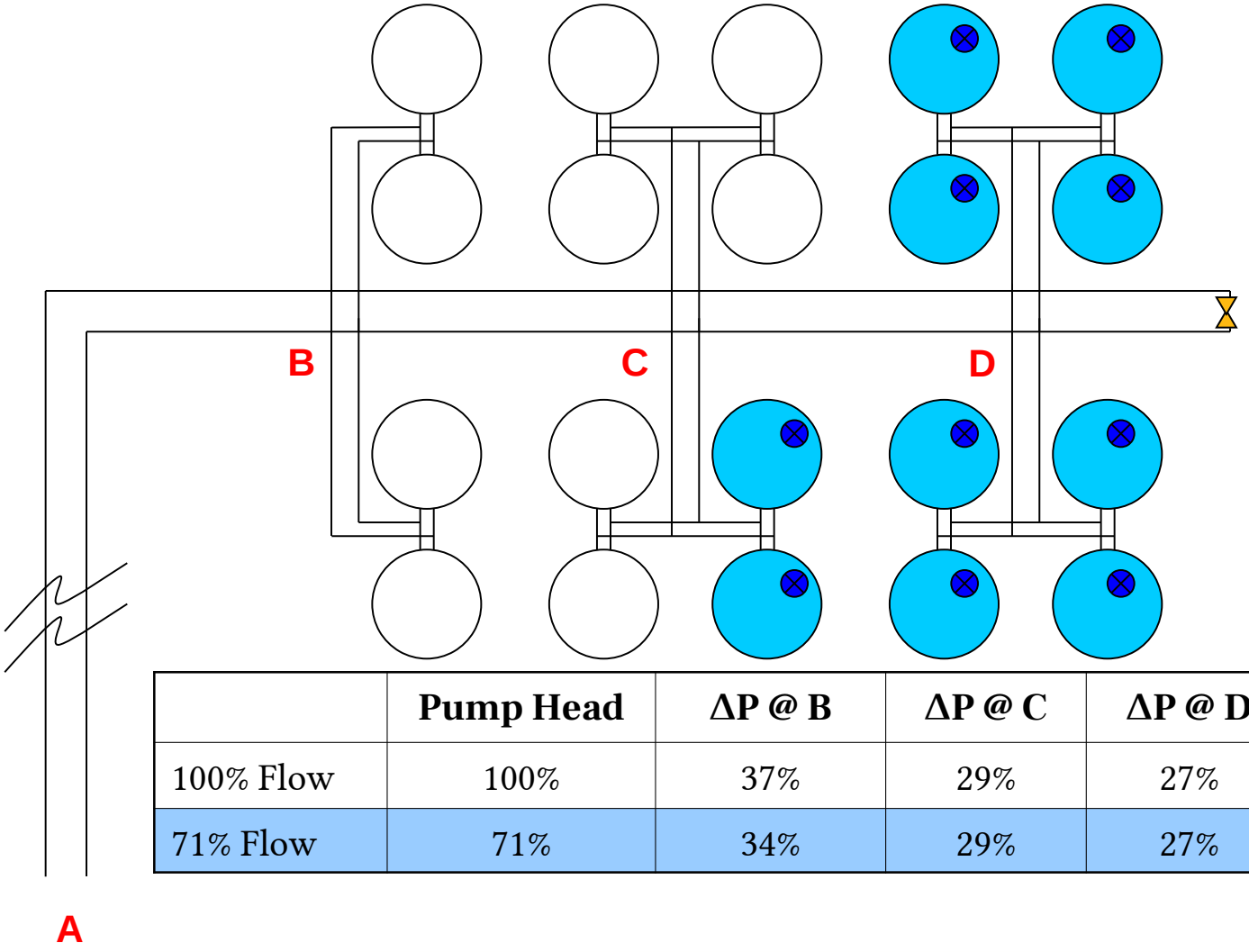
- Example of a tank farm with jacketed vessels
- Tank temperature control via solenoid valves on each jacket
- 20 tanks – Peak load scenario
  - 14 tanks on full cooling demand
  - Remaining 6 empty or have no simultaneous cooling call as part of diversified demand

Case 1 – 100% Flow



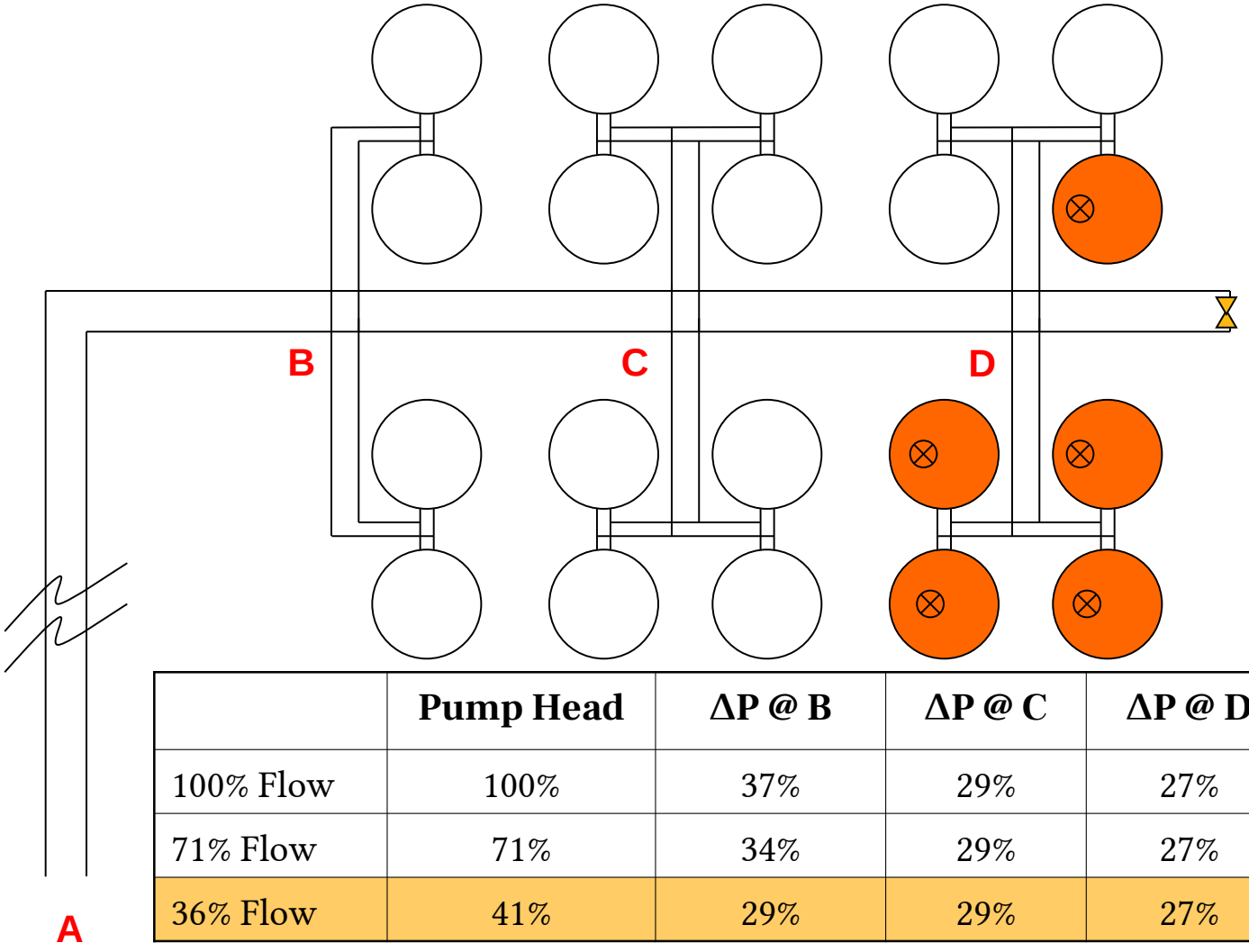
	Pump Head	ΔP @ B	ΔP @ C	ΔP @ D
100% Flow	100%	37%	29%	27%

Case 2 – 71% Flow



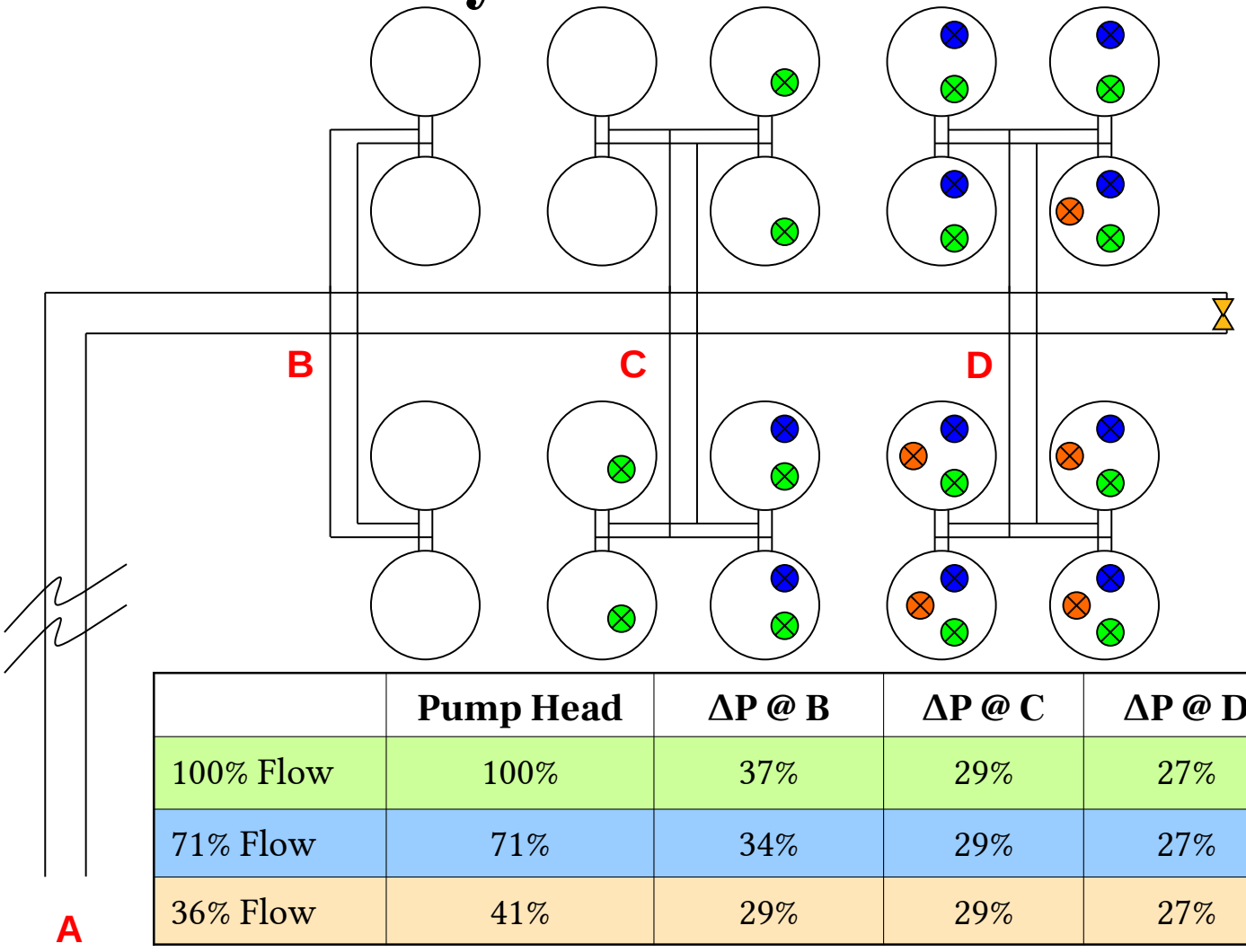
	Pump Head	ΔP @ B	ΔP @ C	ΔP @ D
100% Flow	100%	37%	29%	27%
71% Flow	71%	34%	29%	27%

Case 1 – 36% Flow



	Pump Head	ΔP @ B	ΔP @ C	ΔP @ D
100% Flow	100%	37%	29%	27%
71% Flow	71%	34%	29%	27%
36% Flow	41%	29%	29%	27%

Summary



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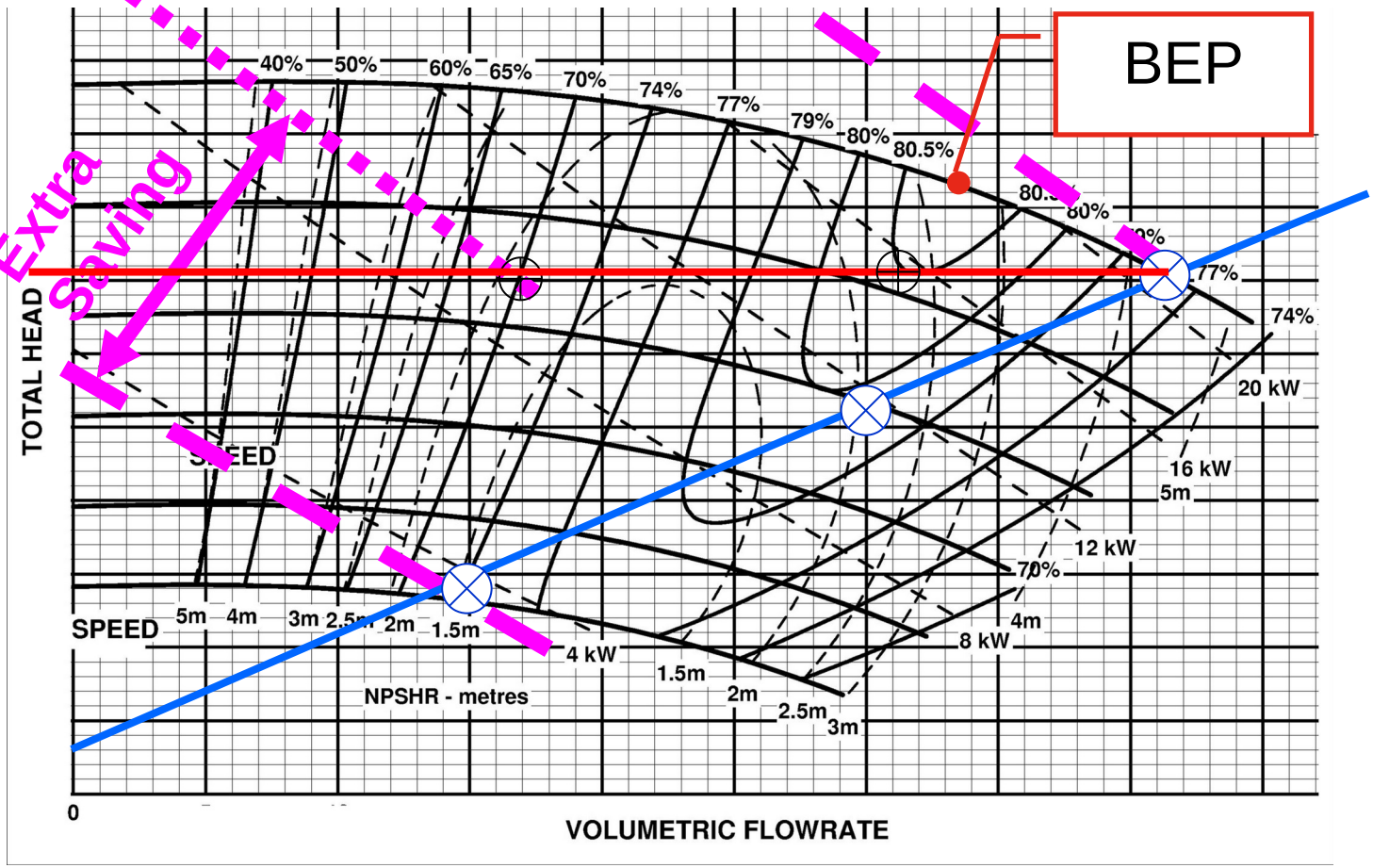
Energy Efficiency – Speed Control



Energy Efficiency – Speed Control

- Thus, closer the feedback location to the optimal point, more the savings achievable.
- $P \alpha N^3$

  Where
  - P = Power
  - N = Rotational speed
  - Lower the achievable speed, lower the power consumption

Energy Efficiency – Speed Control

For these additional savings –

- Assess the line pressure differentials at various demand scenarios
- Determine the optimal location for the pressure transmitter
- Relocate and save
- Beware minimum speed limitation for pump / motor

Energy Efficiency – Lighting

- Efficient lighting
- Manual switching with sensor control override
- Automatic Time of use control for office areas with minimum fixed lighting
- Sensor control with time clock override for security lighting

Energy Efficiency – Compressed Air

- Most expensive energy source
- Minimise usage
- Minimise delivery pressure
- Minimise intake air temperature
- Ensure adequate air quality (filtration and drying)
- Minimise leakage
- Optimal plant sizing
- Optimal pipe sizing & storage
- Heat recovery

Energy Efficiency – Hot Water / Steam

- Chose efficient equipment (new or replacement) with efficient part load operation
- Modulating burners with adequate turn-down
- Optimal pipe sizing
- Insulate piping

Energy Efficiency – Steam

- Recover Condensate to the maximum extent
- Recover heat from boiler blow down
- Improve water treatment to reduce blow down

Energy Efficiency

- Links:
  - www.energyefficiencyopportunities.gov.au
  - www.greenhouse.gov.au
  - www.thecarbontrust.co.uk
  - www.eere.energy.gov

Energy Efficiency

- Overview of various opportunities to improve efficiency
- Detailed look at pumping to achieve additional savings