Better Plants
U.S. DEPARTMENT OF ENERGY

WATER VIRTUAL IN-PLANT (VINPLT) TRAINING

Week 3

U.S. DEPARTMENT OF ENERGY

Week 3: Water Treatment, the 5Ls

Thank You!

Sponsor:

Today’s Agenda

	Homework Recap
	Managing Energy Use at Water Treatment Plants
	Break
	The 5 L's: Leaping
	The 5 L's: Looping
	Kahoot!
	Q&A

HOMEWORK RECAP

POLL

MANAGING ENERGY USE AT WATER TREATMENT PLANTS

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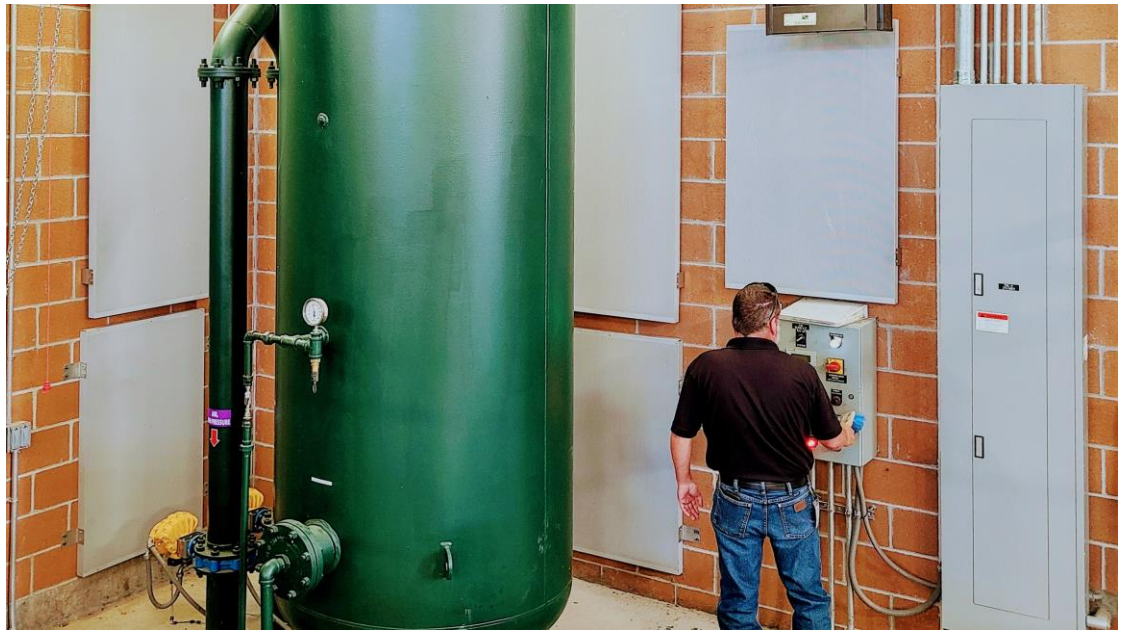
WATER TREATMENT PLANT

Influent (Raw Water) Pumps

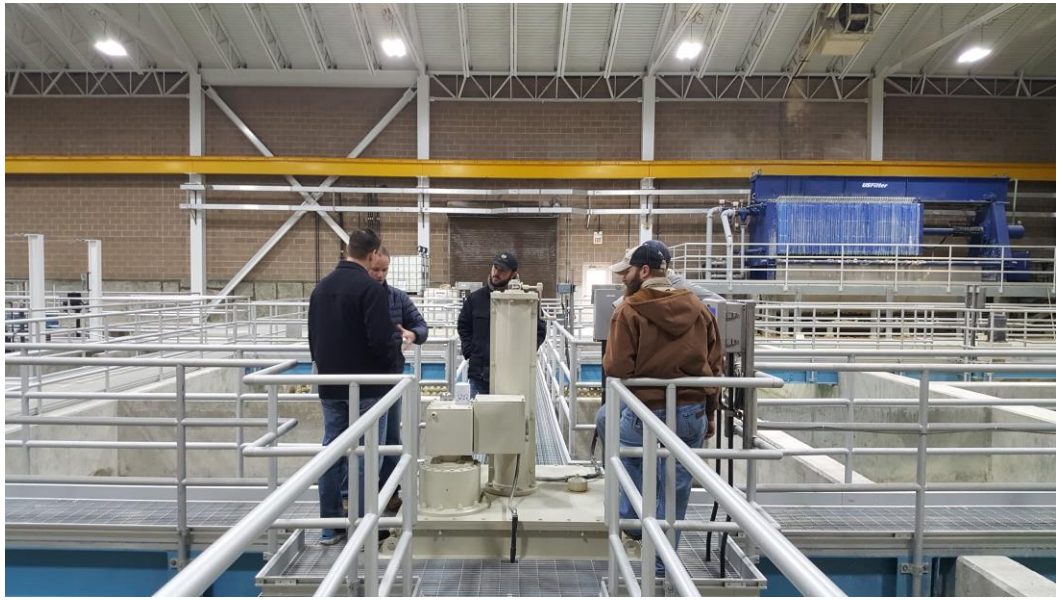
- Find most efficient (energy map!)
- Run constant

Chemicals



- Use only what's needed to meet effluent goals (don't overdose)
- Avoid producing excess sludge
- Coordinate offloading with air compressor use (more later)

Mixers



- Just enough power to get good results
- Use VFD to control speed

Filter Backwash

- Backwash on head loss or turbidity, not time
- Backwash one filter at a time (why?)

Finished Water Pumps

- Find most efficient (energy map!)
- Provide for flexibility (VFDs, multiple pumps and sizes, or downstream storage)

Air Compressors

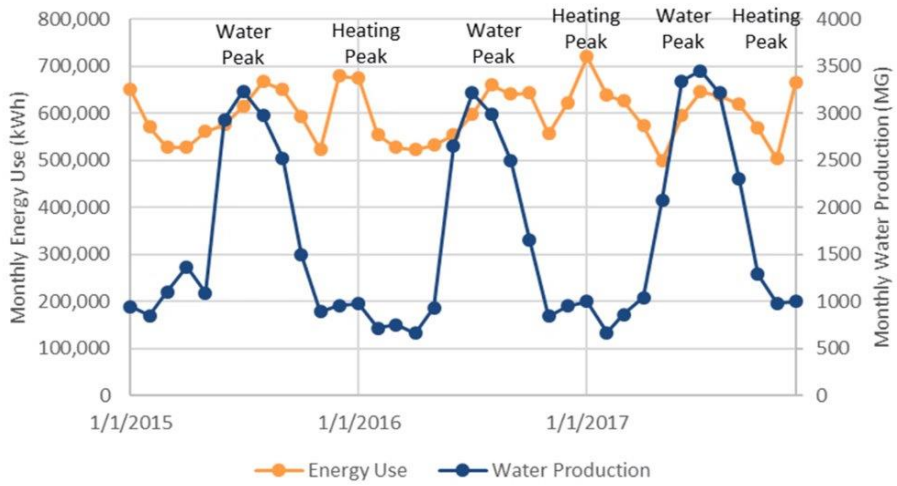
- 3 main types
  - Modulating (least efficient)
  - Load/unload
  - VFD (most efficient)
- Evaluate necessity, frequency, and pressure requirements (valve actuation, tools, backwash, chemical offloading, etc.)
- Reduce pressure
- Turn off on weekends
- Check for leaks!

Solids Handling

- If batch, process during off-peak power hours
- Use equalization tanks to convert batch to constant flow
- Optimize chemical dose to avoid unnecessary sludge production

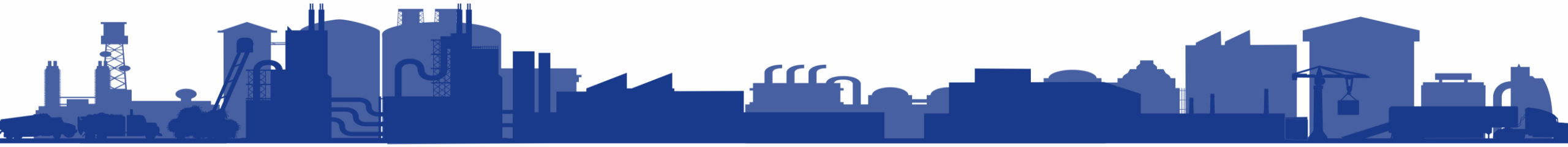
Lighting and HVAC – easy wins!

- Occupancy sensors and timers for lights
- LEDs – check local incentives
- Unoccupied spaces – cool to 80°, heat to 50°
- Programmable thermostats
- Check overnight and weekend settings
- Fans – low speed, high volume for big areas

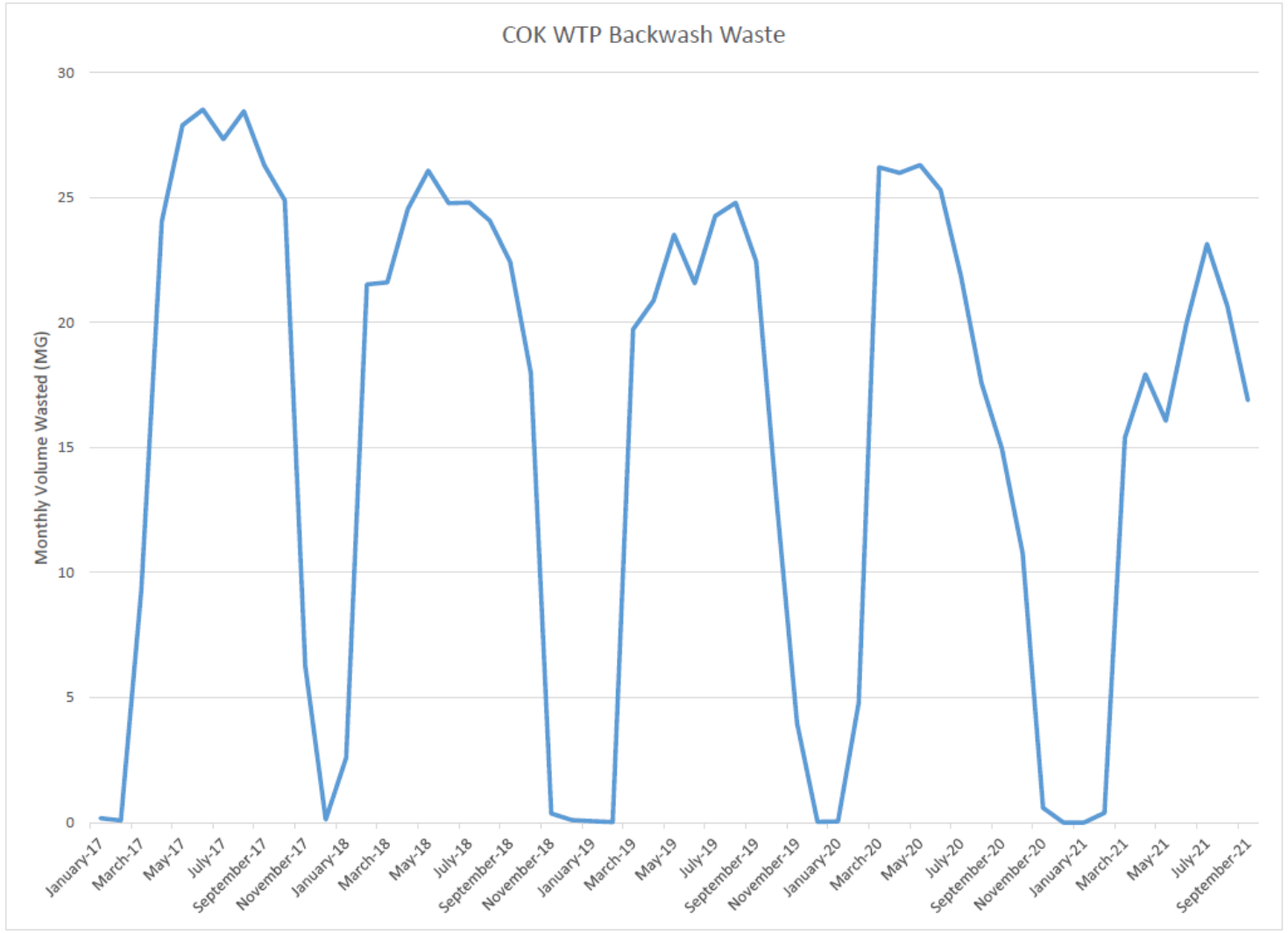


KENNEWICK WTP ADJUSTMENTS

Jeremy Lustig
Bob Bepple




N Hawthorne
615


COK WTP Backwash Waste
Monthly Volume Wasted (MG)
30
25
20
15
10
5
0
January-17
March-17
May-17
July-17
September-17
November-17
January-18
March-18
May-18
July-18
September-18
November-18
January-19
March-19
May-19
July-19
September-19
November-19
January-20
March-20
May-20
July-20
September-20
November-20
January-21
March-21
May-21
July-21
September-21

BREAK

The 5 L's: Common Water System Inefficiencies

- Leaping
- Looping
- Leaking
- Losing
- Loading

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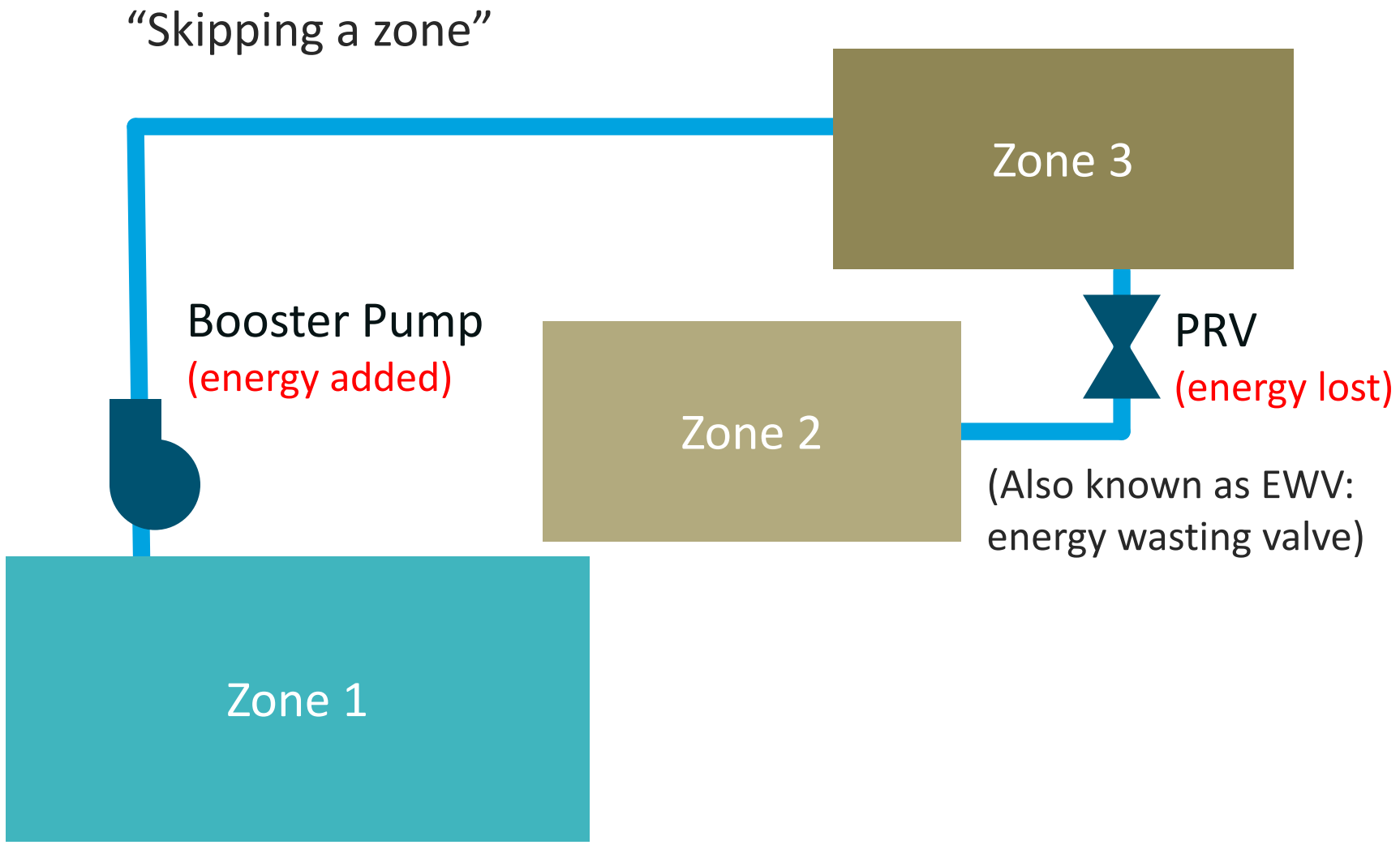
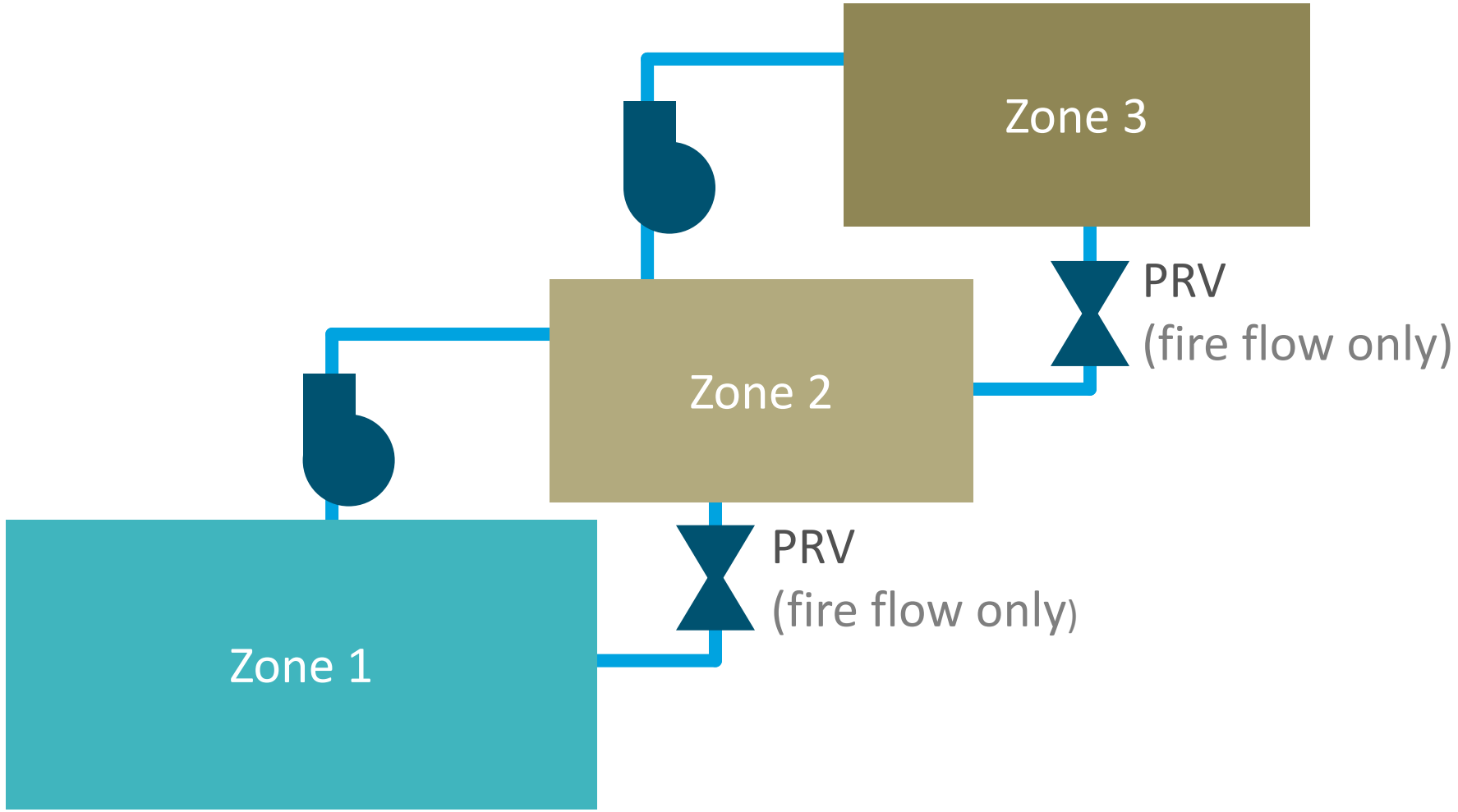
LEAPING

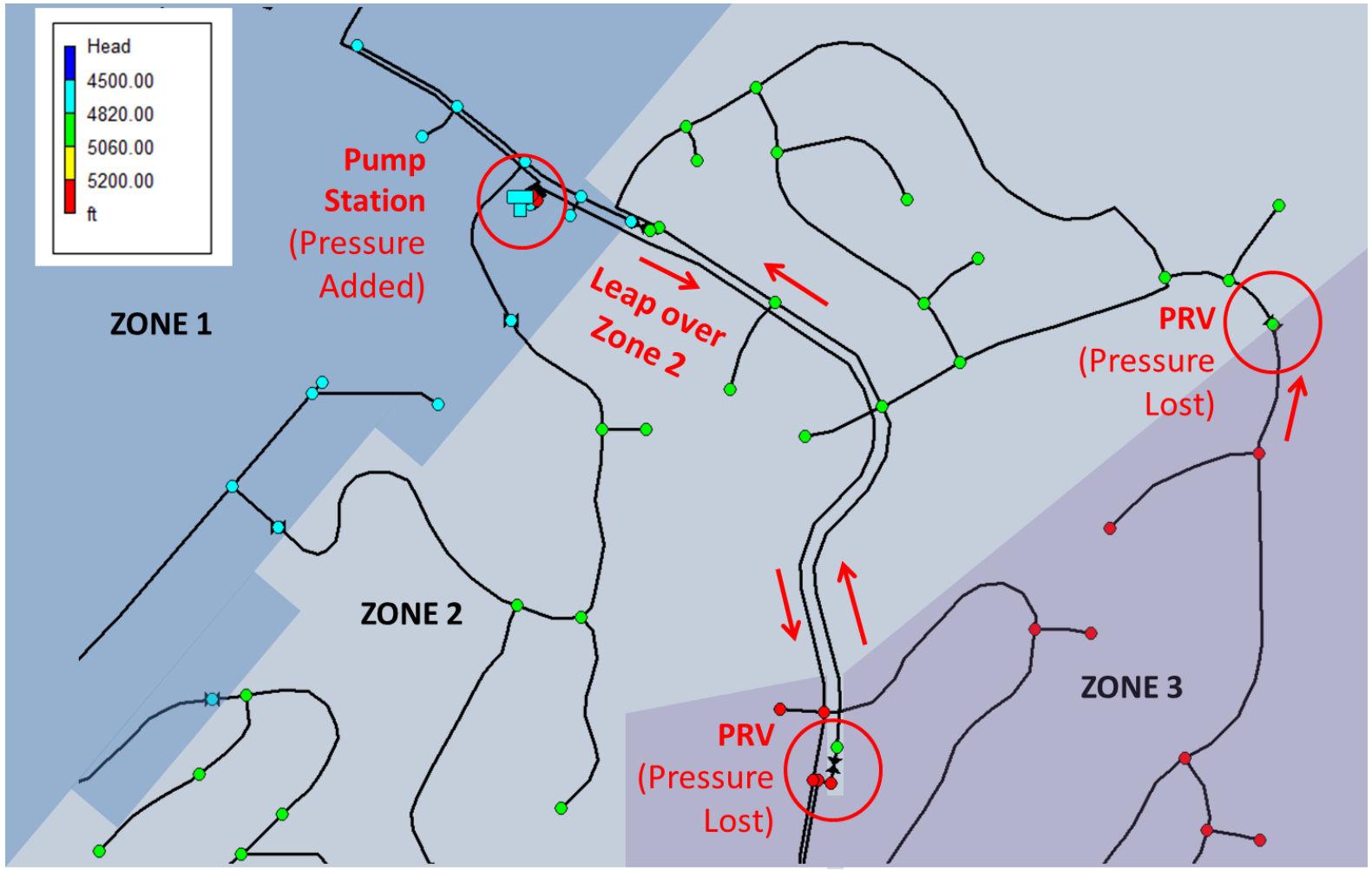
Leaping – Problem



Leaping – Solution



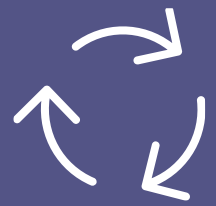
Leaping – Example



Leaping – Diagnosis

How to detect

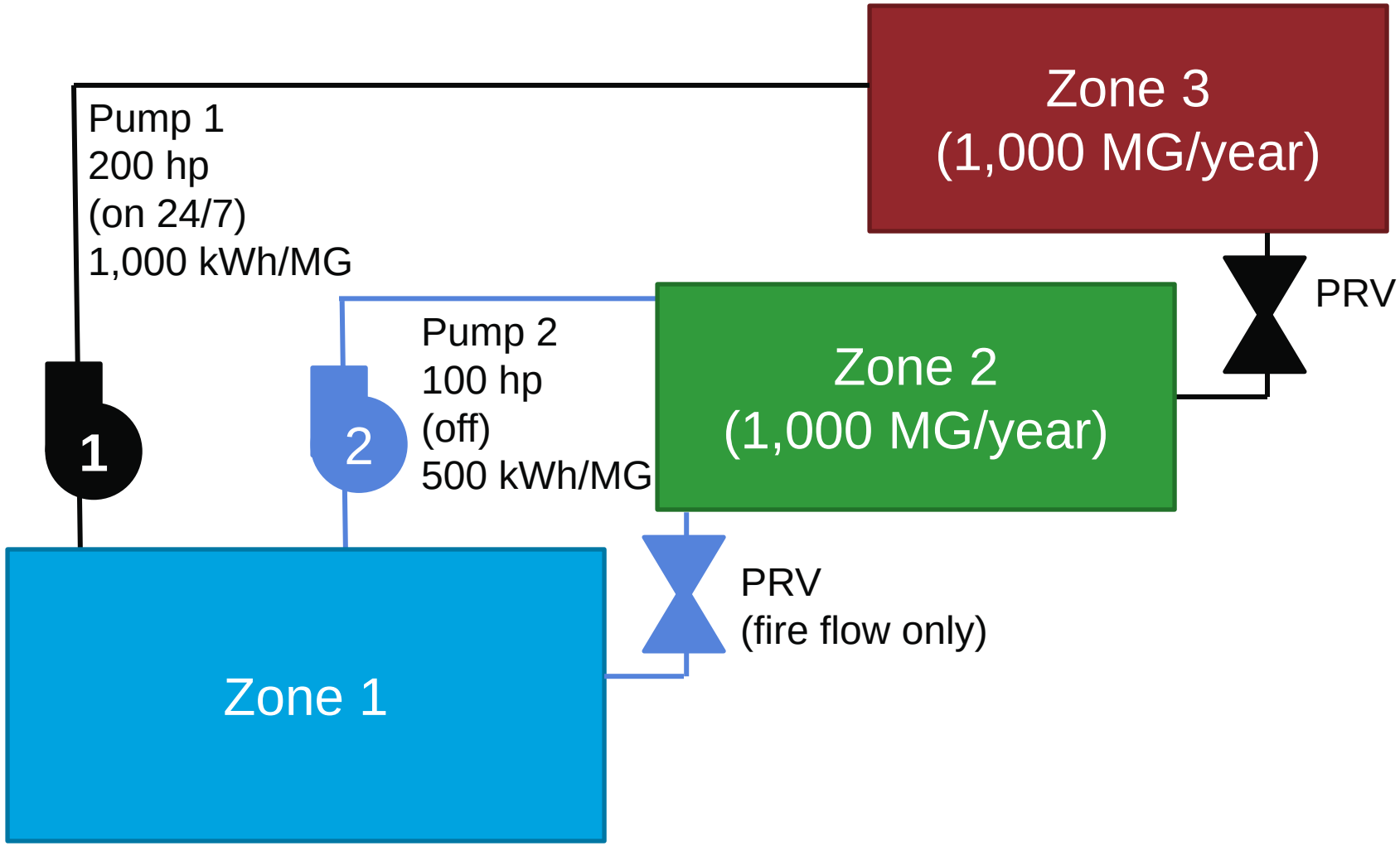
- Pressure zone has no sources
- PRVs usually flowing
- Hydraulic modeling
- Disch. pressure over 200 psi



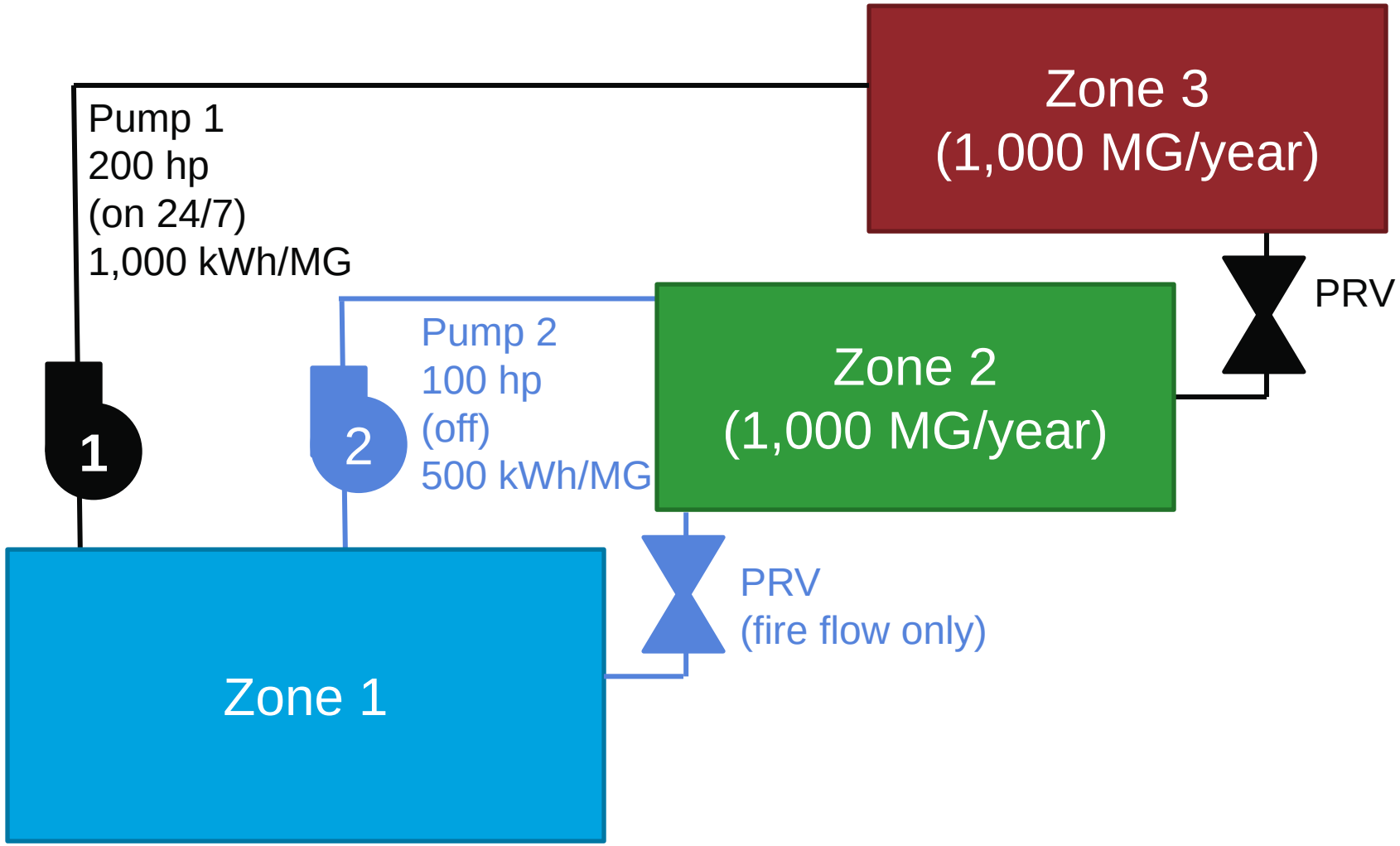
How to resolve

- Reconfigure pumps
- Supply target zone directly

Leaping Activity



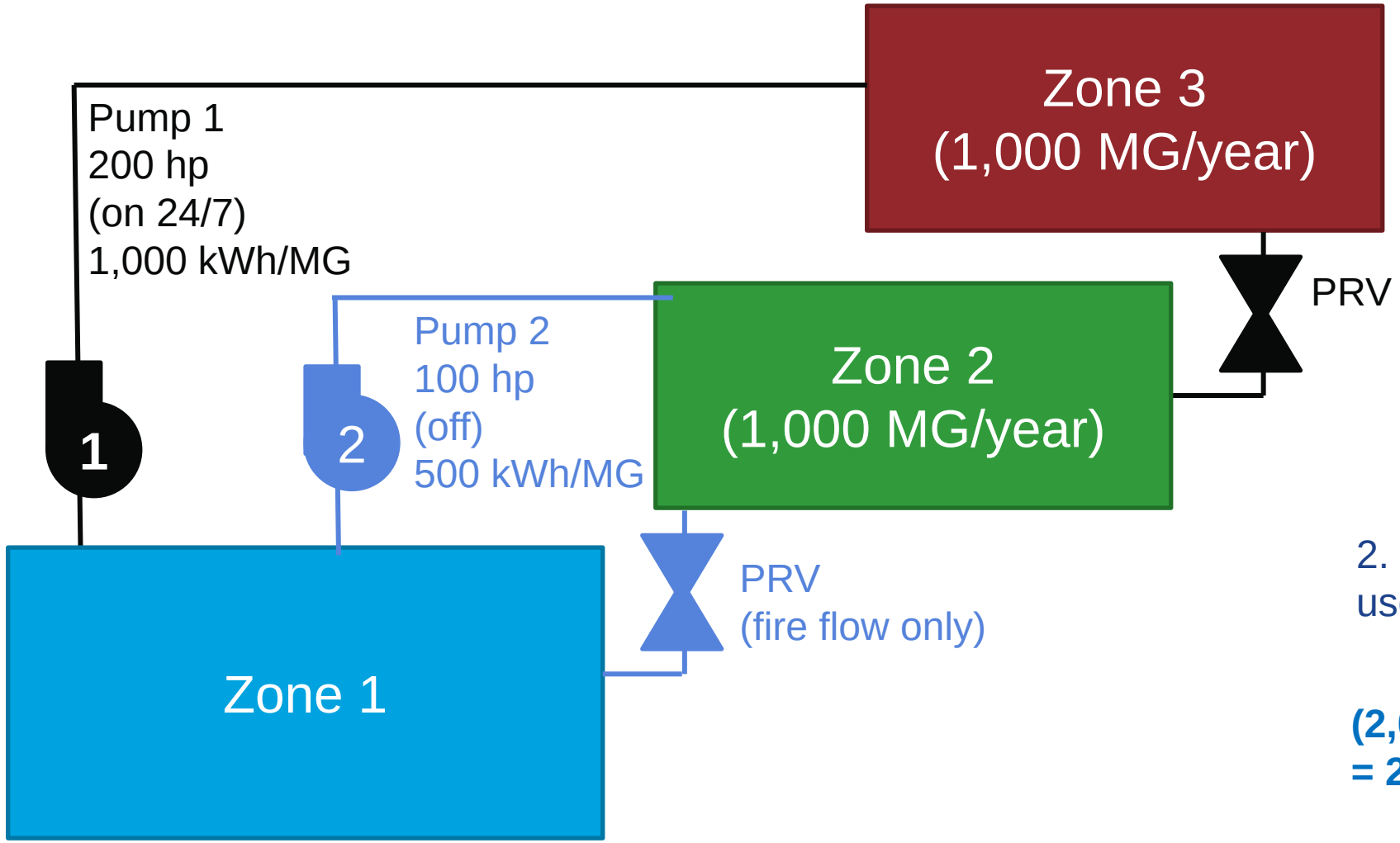
Leaping Activity



1. What is the annual water demand for Zones 2 and 3?

1,000 MG/year + 1,000 MG/year = 2,000 MG/year

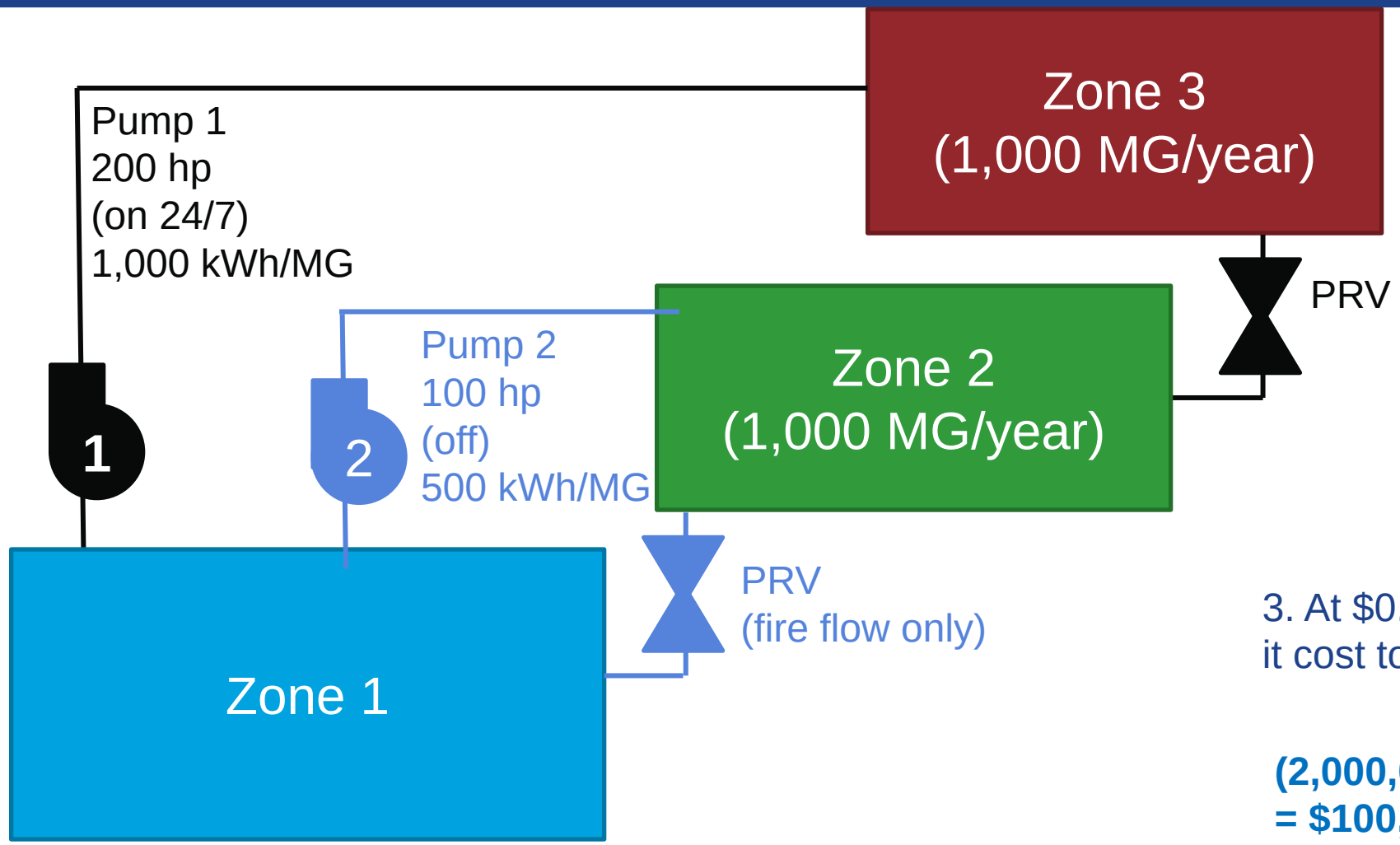
Leaping Activity



2. How much energy (kWh) is currently used to deliver water to Zones 2 and 3?

(2,000 MG/year)(1,000 kWh/MG)
= 2,000,000 kWh/year

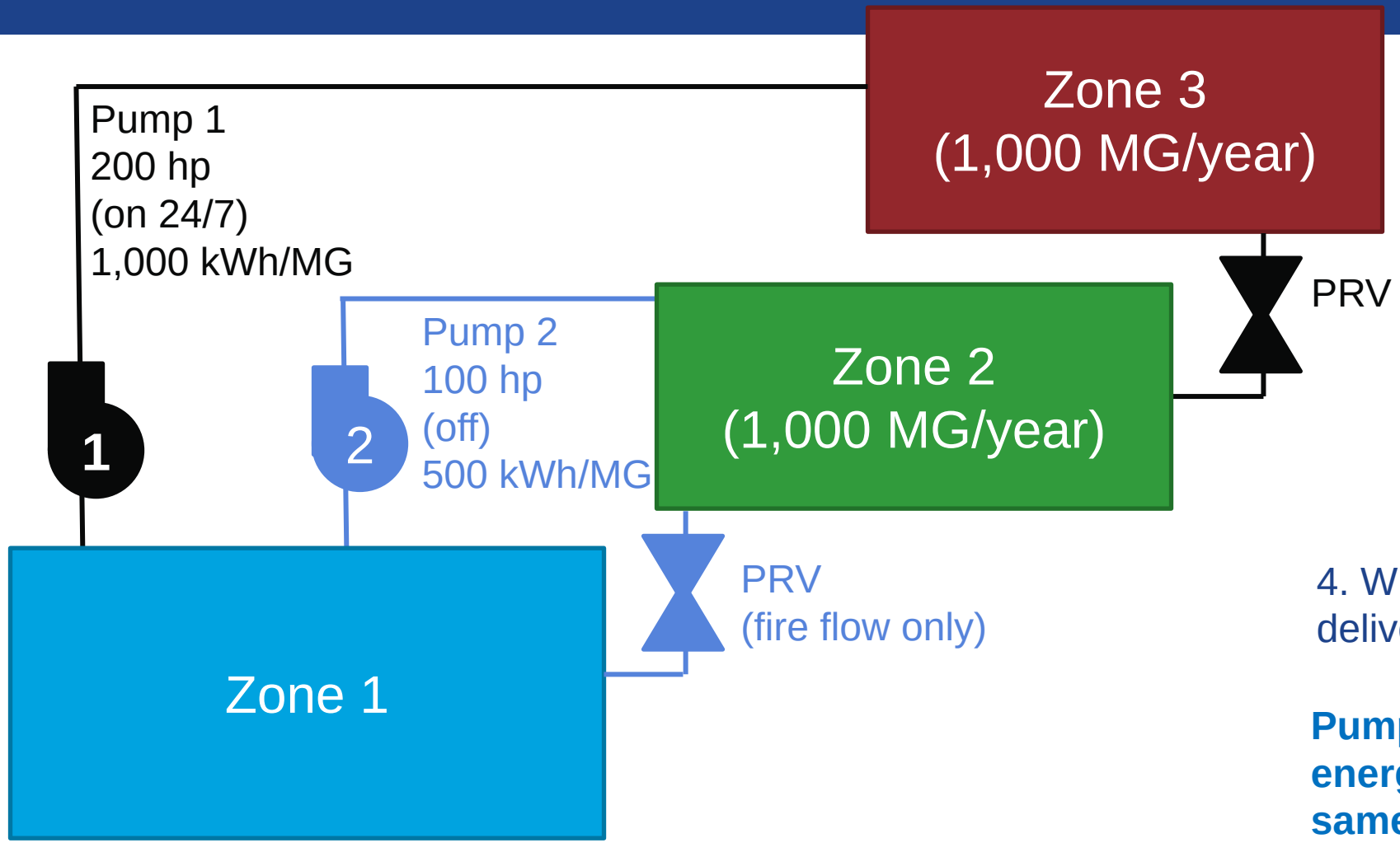
Leaping Activity



3. At $0.05 per kWh, how much money does it cost to deliver water to Zones 2 and 3?

(2,000,000 kWh/year)($0.05/kWh)
= $100,000/year

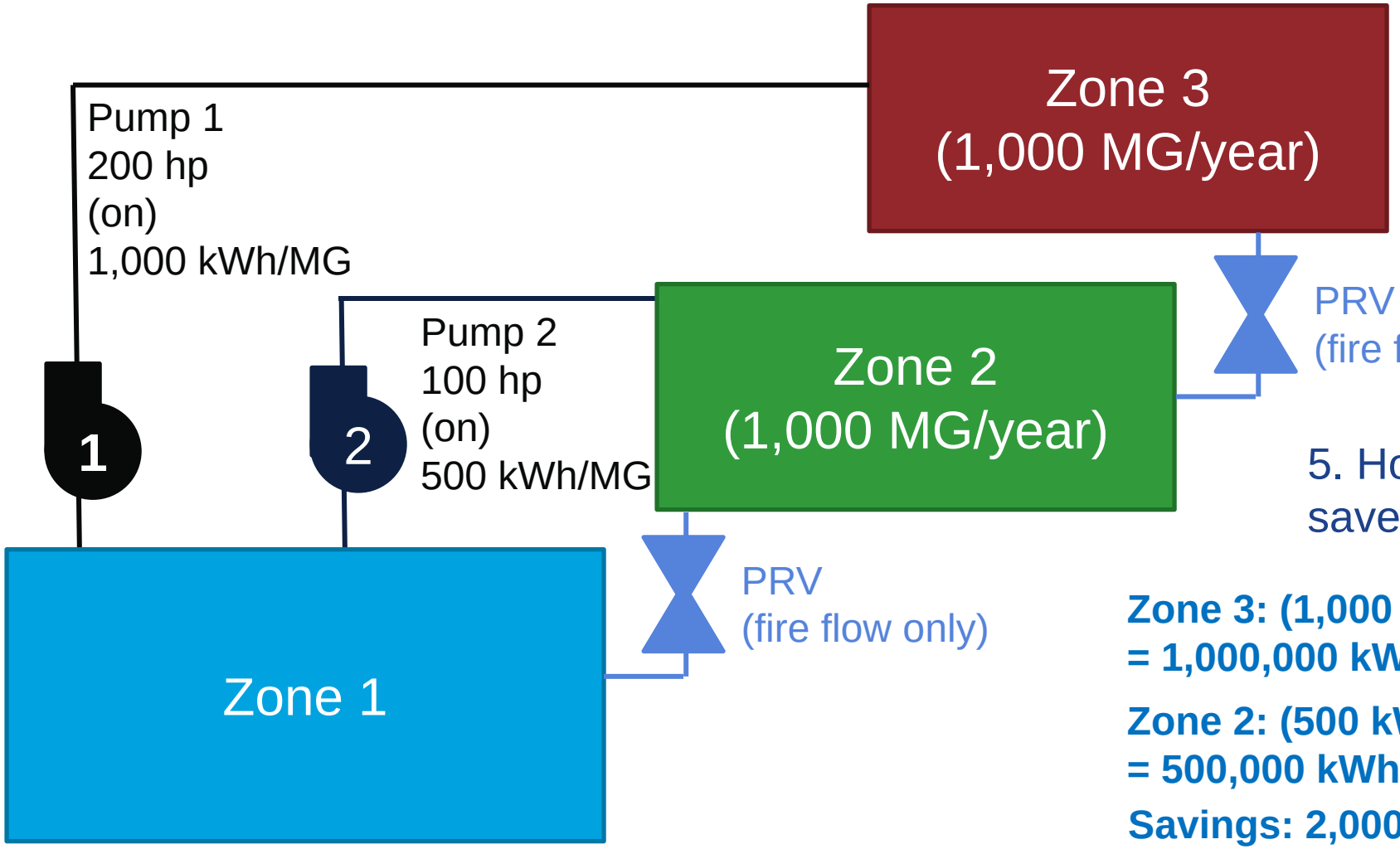
Leaping Activity



4. Which is the best pump to deliver water to Zone 2?

Pump 2 takes half the energy of Pump 1 for the same flow (energy intensity)

Leaping Activity



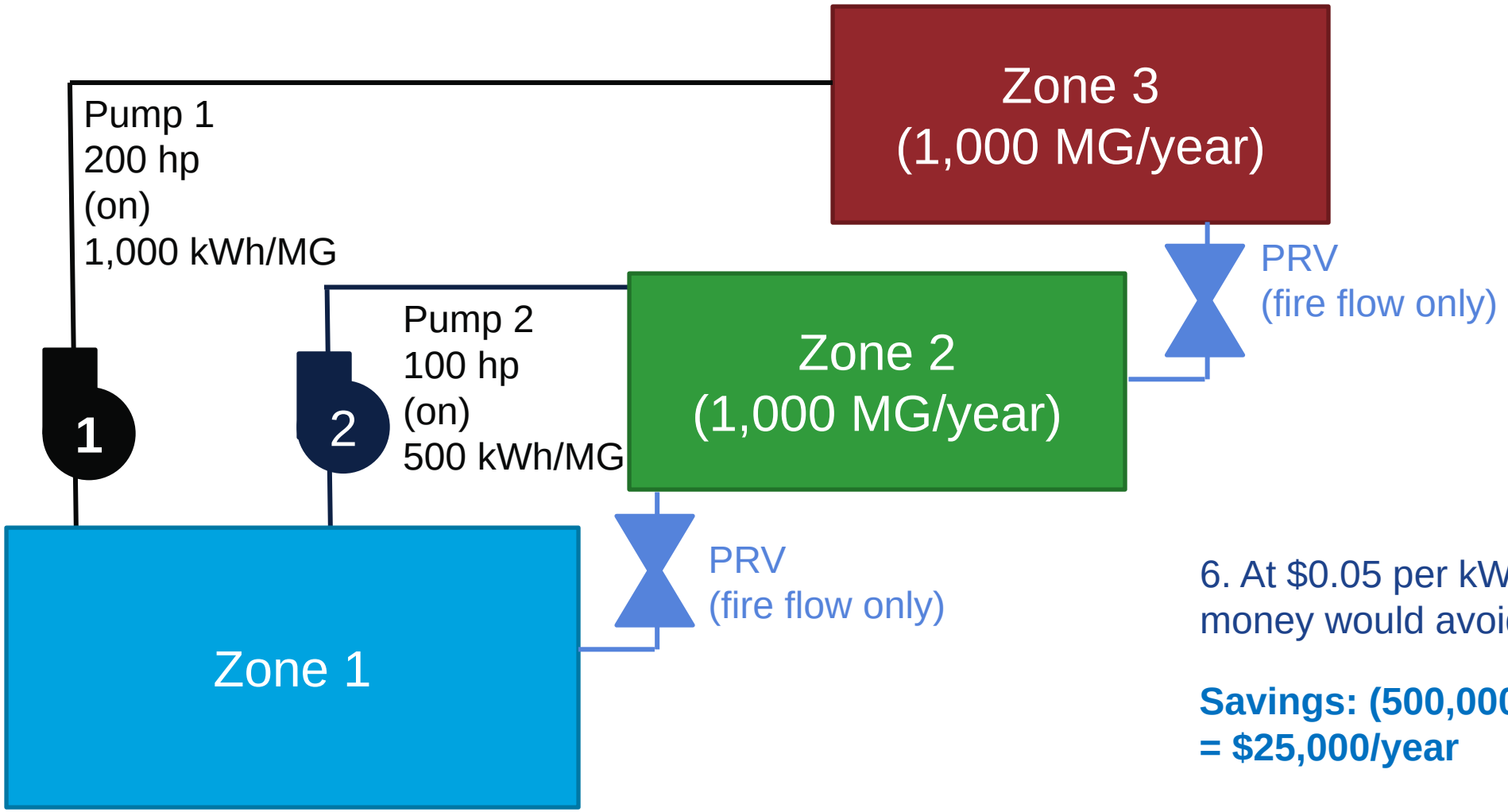
5. How much energy (kWh) can be saved by avoiding Leaping?

Zone 3: (1,000 kWh/MG)(1,000 MG/year) = 1,000,000 kWh/year

Zone 2: (500 kWh/MG)(1,000 MG/year) = 500,000 kWh/year

Savings: 2,000,000 kWh/year – 1,500,000 kWh/year = 500,000 kWh/year

Leaping Activity



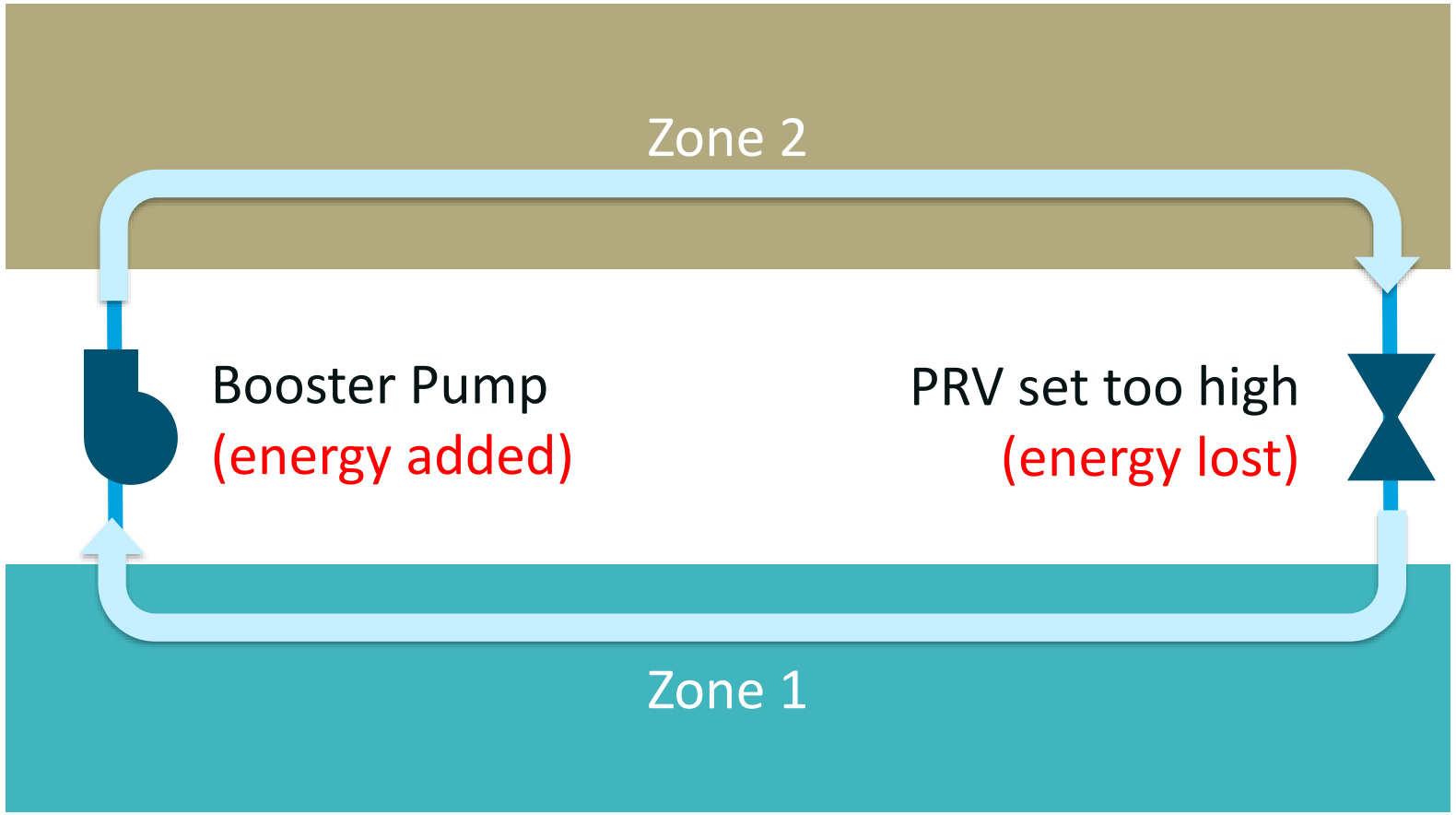
6. At $0.05 per kWh, how much money would avoiding Leaping save?

Savings: (500,000 kWh/year)($0.05/kWh) = $25,000/year

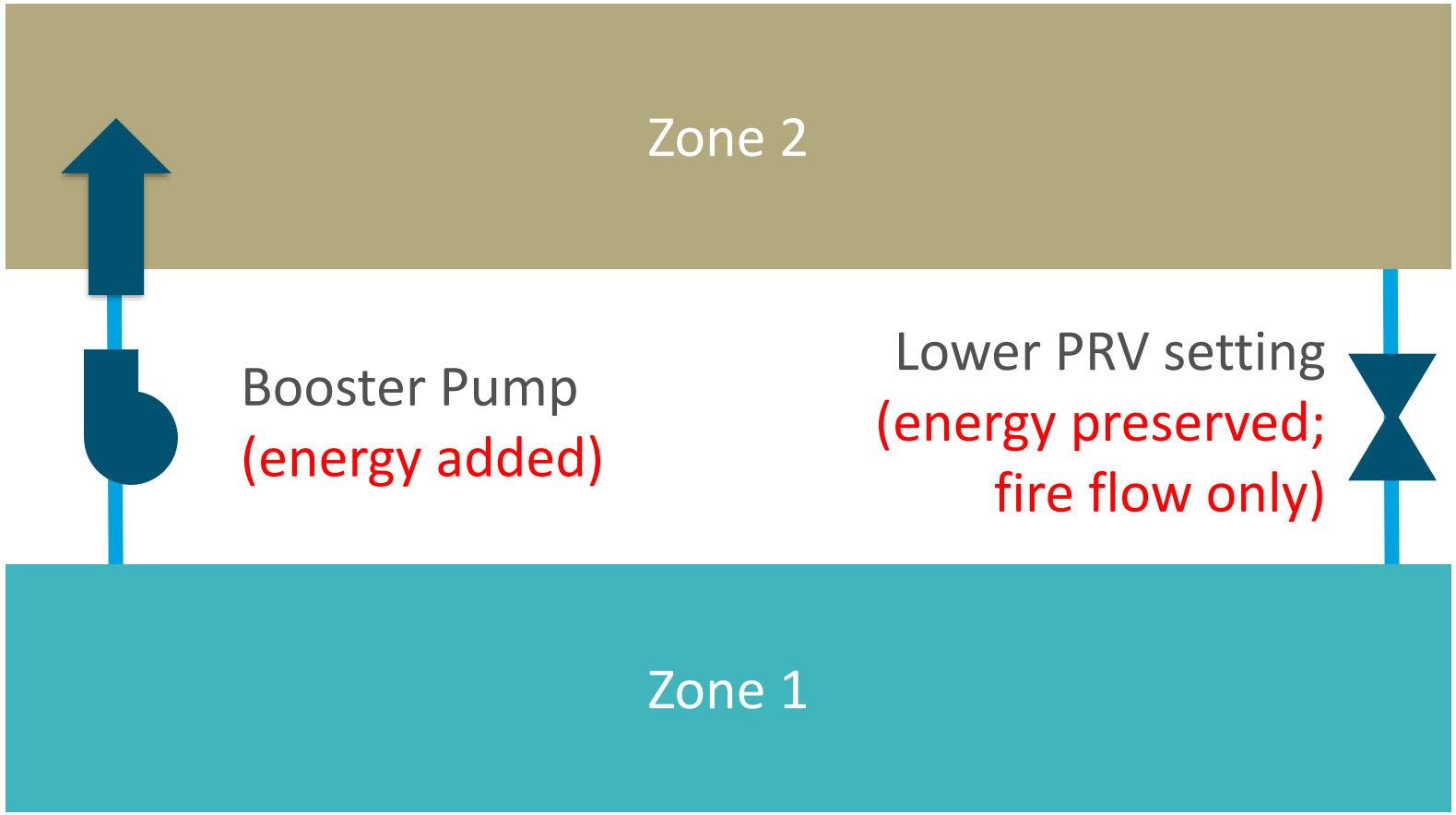
LOOPING

Looping – Problem

"Pumping in Circles"



Looping – Solution



Looping – Diagnosis

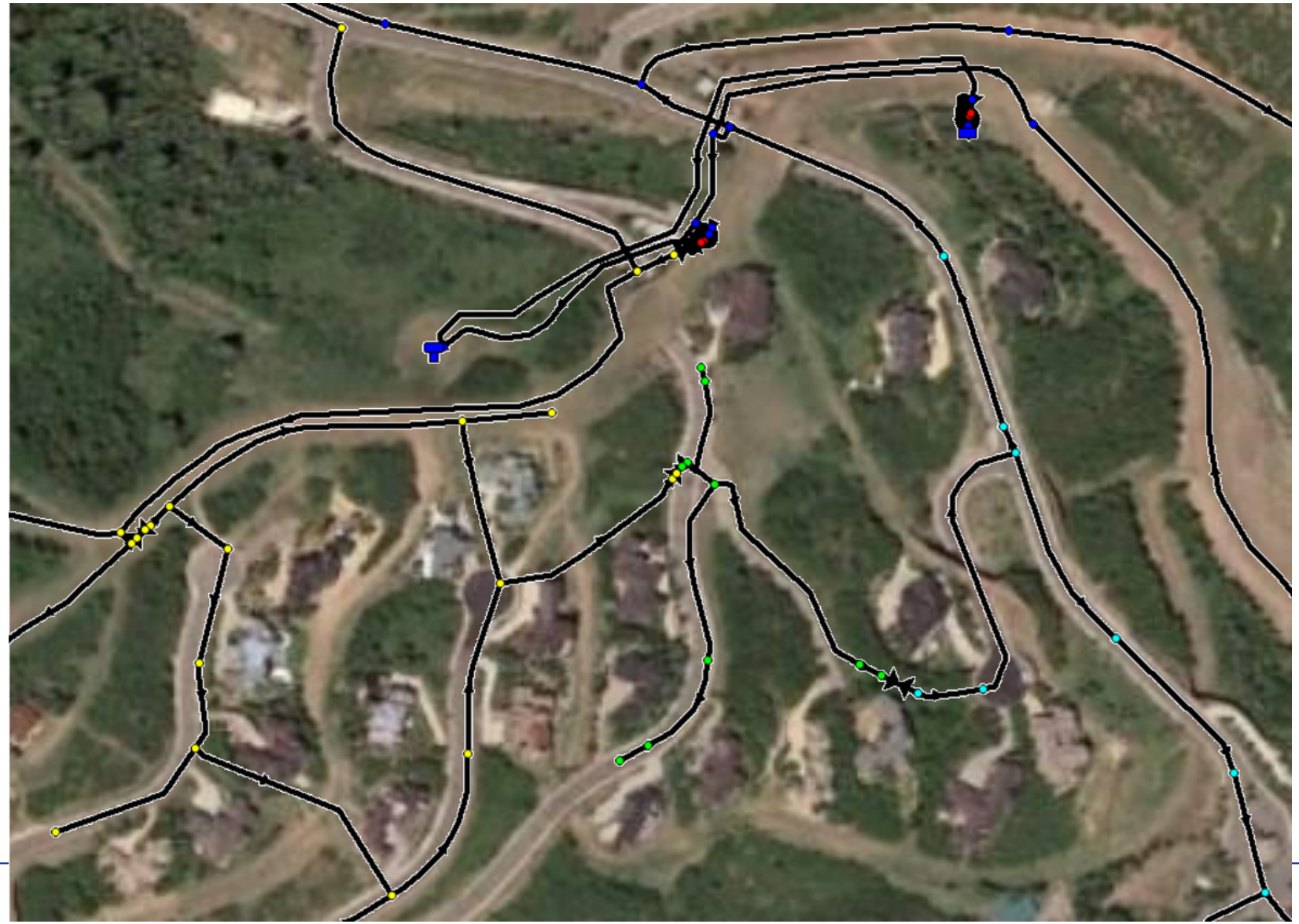
How to detect:

- Pumped flow is greater than consumption
- PRVs flowing
- Hydraulic modeling

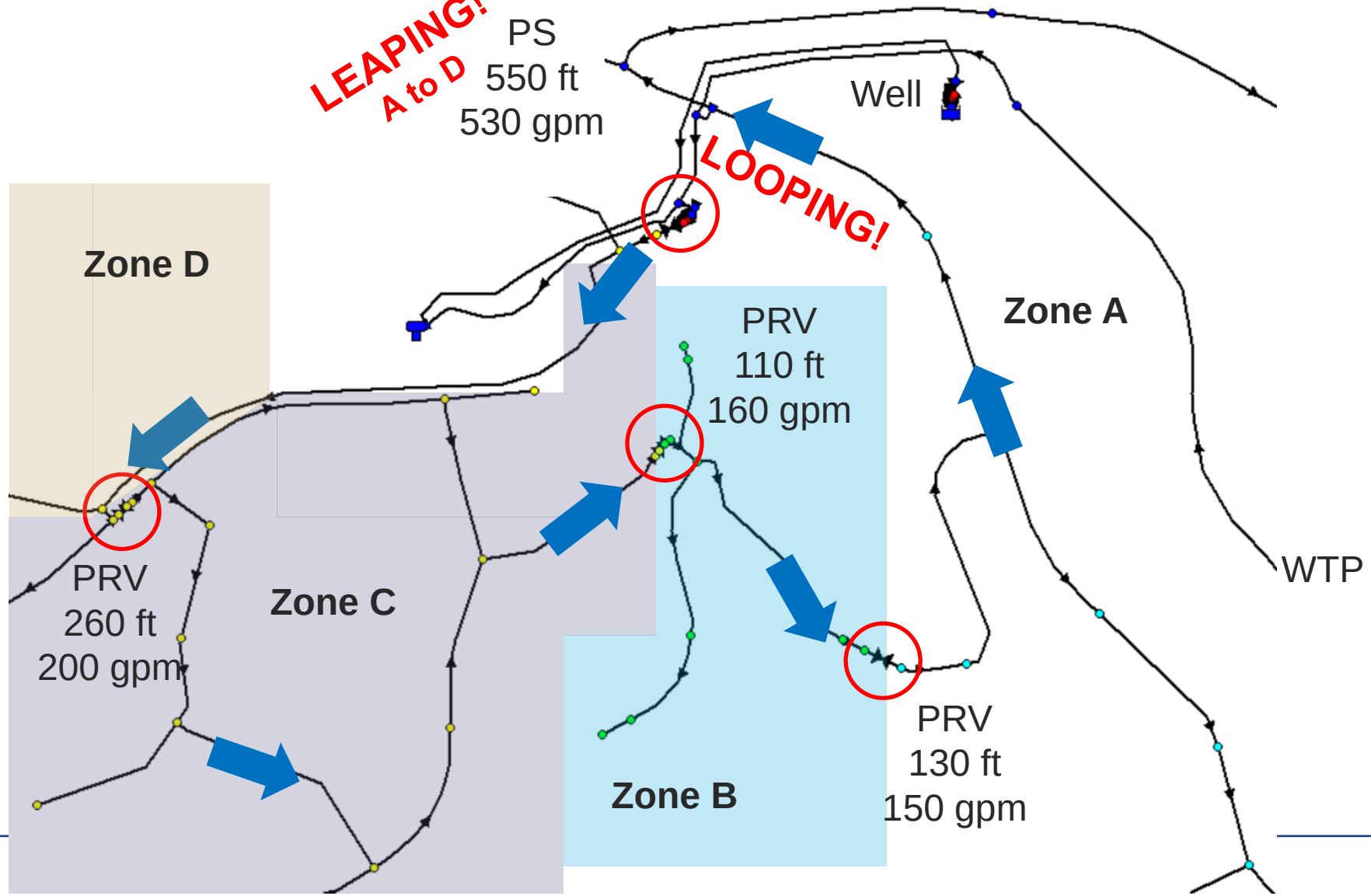
How to resolve:

- Decrease PRV setting
- Downsize pump or add jockey pump
- Add VFD

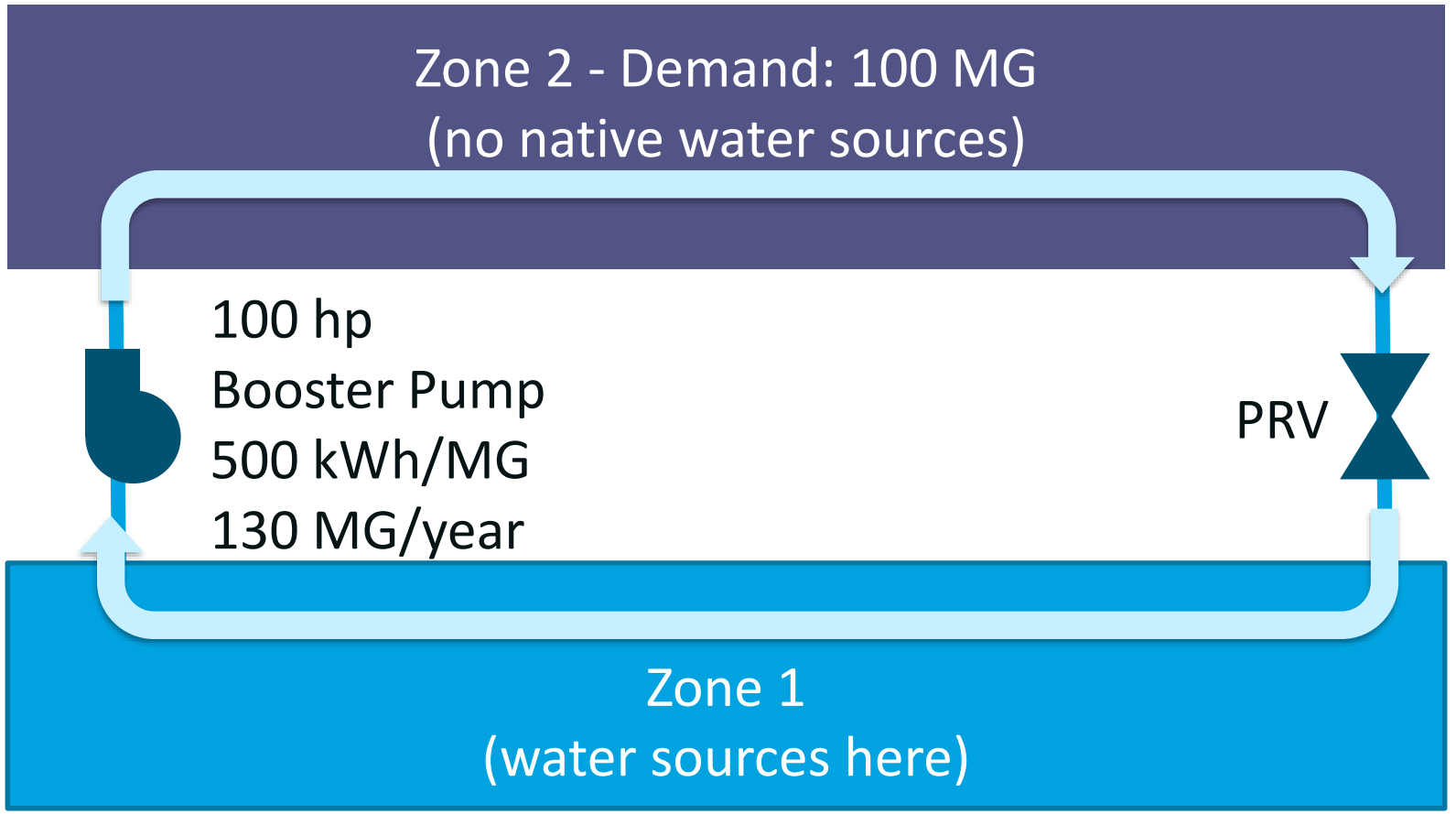
Leaping and Looping – Example



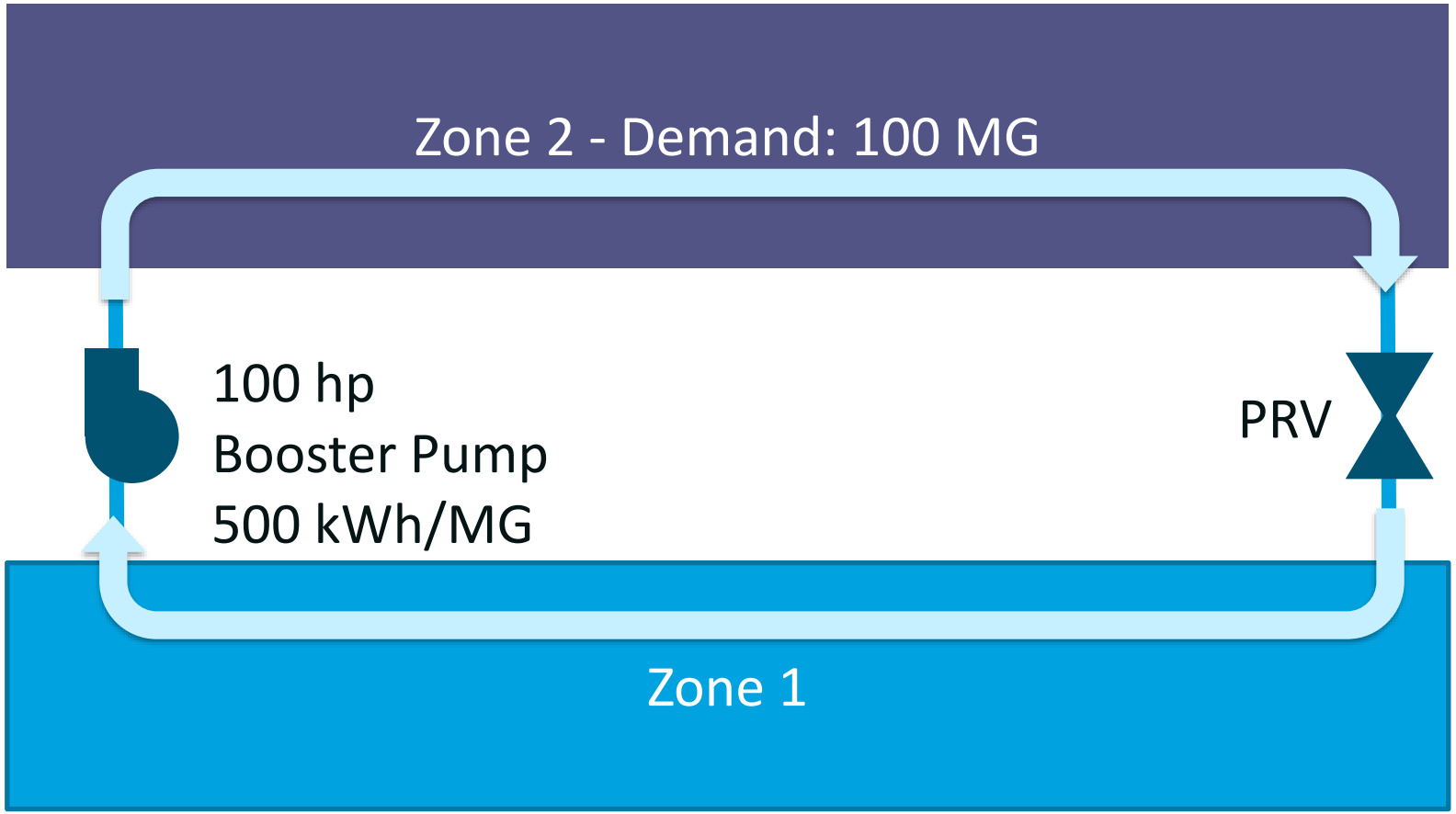
Leaping and Looping – Example



Looping Activity



Looping Workbook Activity

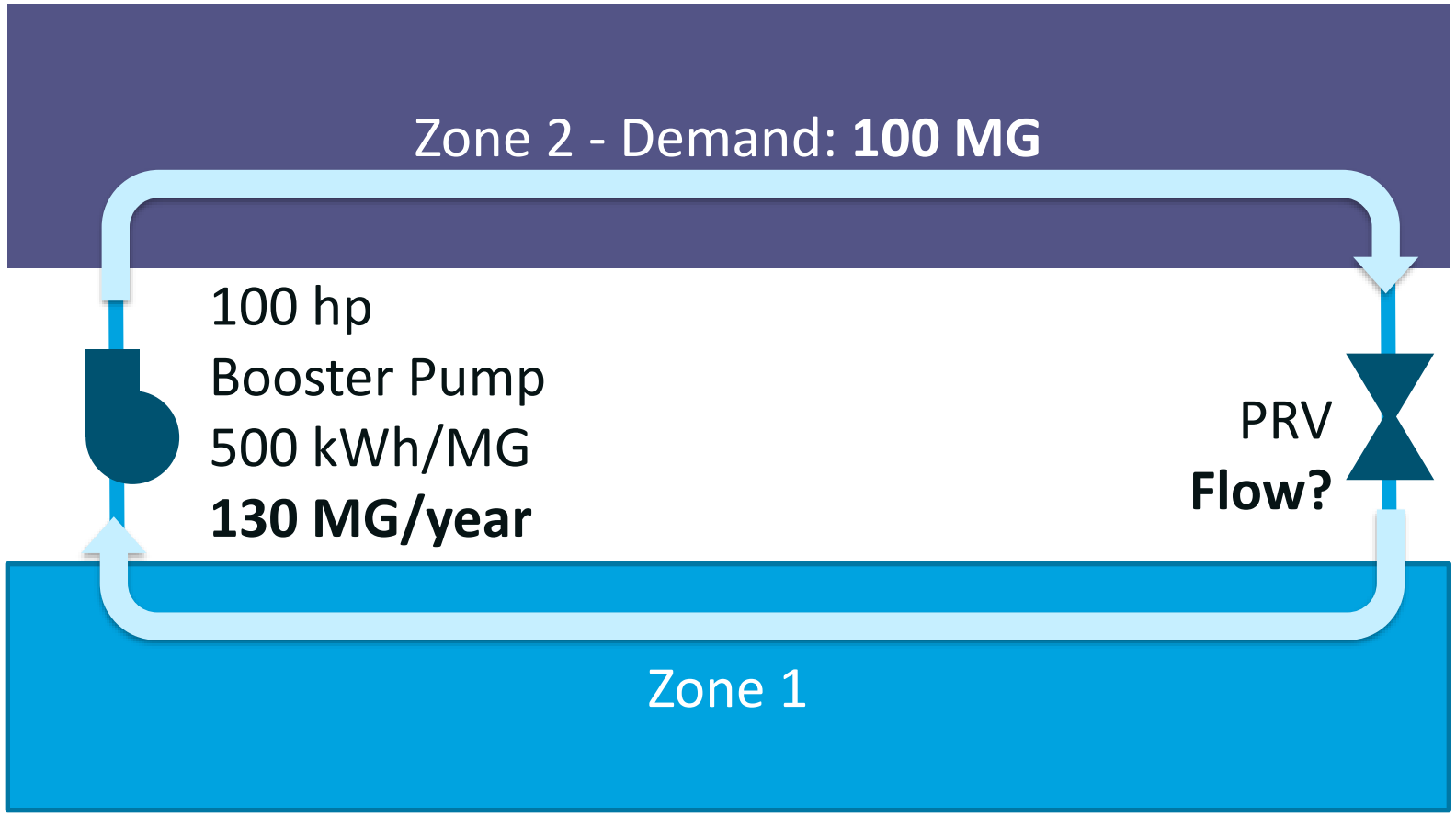


1. How much energy (kWh) is currently used by the booster pump each year?

Energy: (130 MG/year)(500 kWh/MG) = 65,000 kWh/year

Cost: (65,000 kWh/year)($0.05/kWh) = $3,250/year

Looping Activity



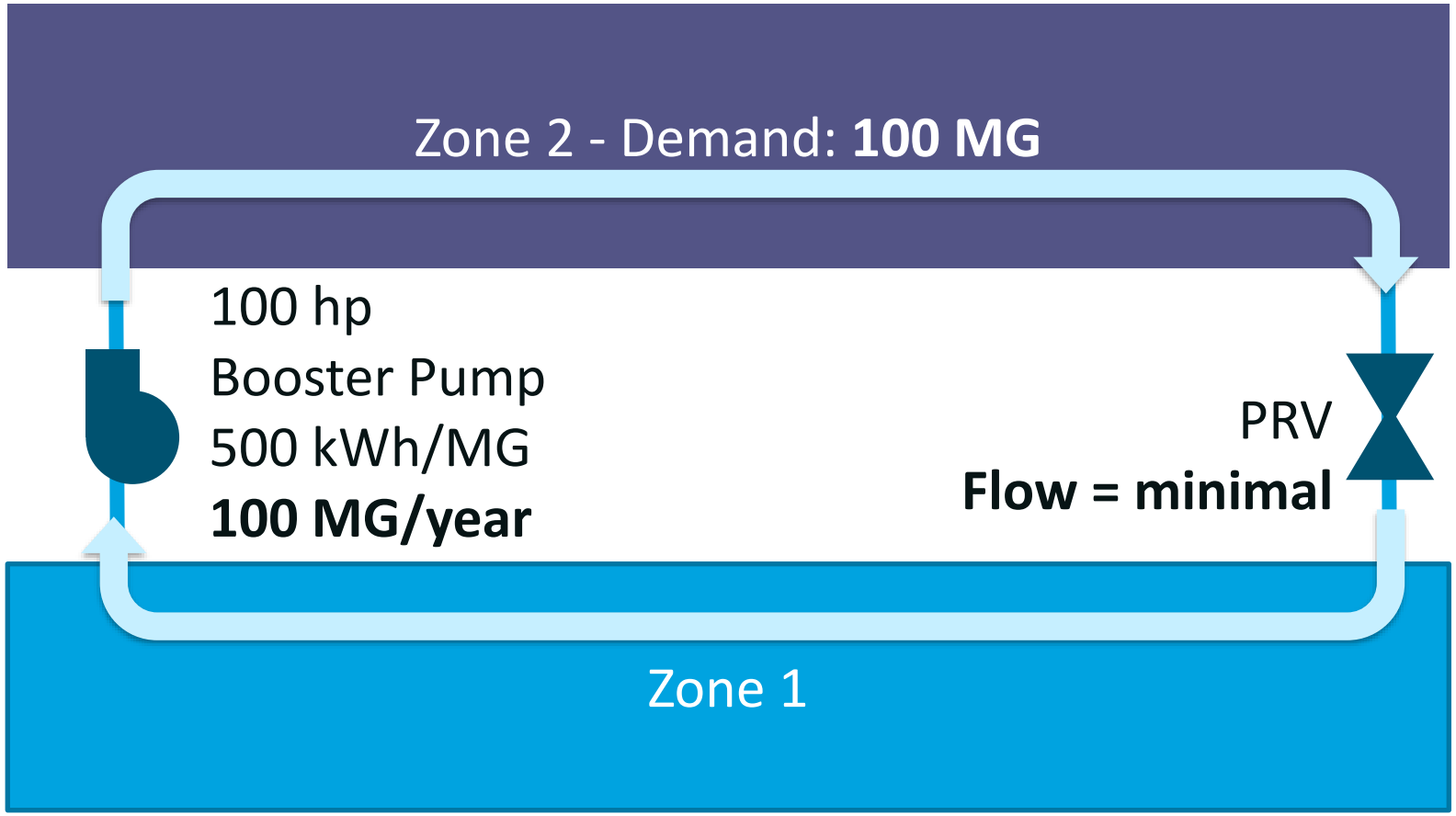
2. How much water is being let through the PRV each year?

PRV Flow:
130 MG/year – 100 MG/year
= 30 MG/year (mass balance)

3. What can we do to avoid wasting energy through the PRV?

Adjust setting downward to keep pumped water in Zone 2

Looping Activity



4. How much energy (kWh) can be saved by avoiding Looping?

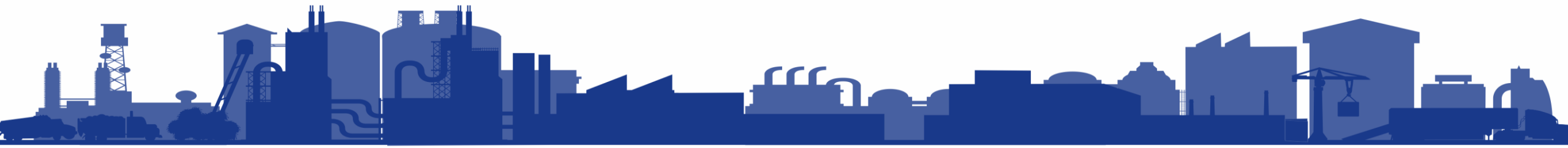
(30 MG/year)(500 kWh/MG)
= 15,000 kWh/year

5. At $0.05 per kWh, how much money would this change save?

(15,000 kWh/year)($0.05/kWh)
= $750/year

On your smart phone
Go to: https://kahoot.it/
Game PIN:

KAHOOT!



Closing

Questions
Comments
Discussion

SEE YOU TUESDAY!

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Saving energy, one gallon at a time