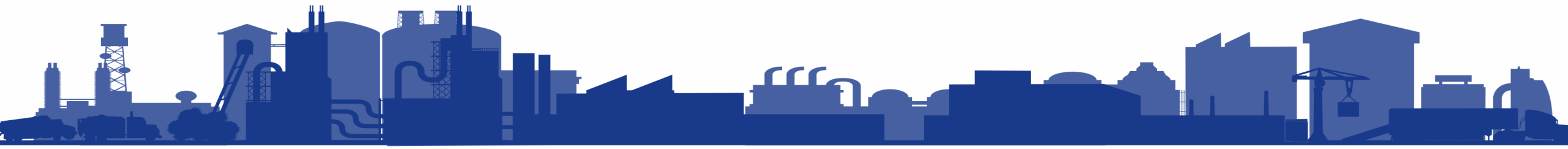
Better Plants
U.S. DEPARTMENT OF ENERGY

WATER VIRTUAL IN-PLANT (VINPLT) TRAINING

Session 7

U.S. DEPARTMENT OF ENERGY

Session 7: Persistence Strategies



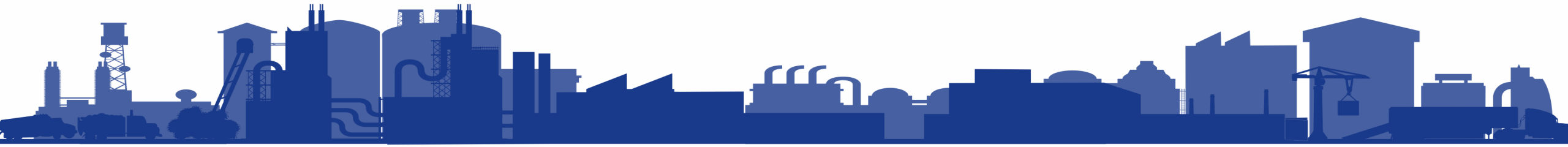
Thank You!

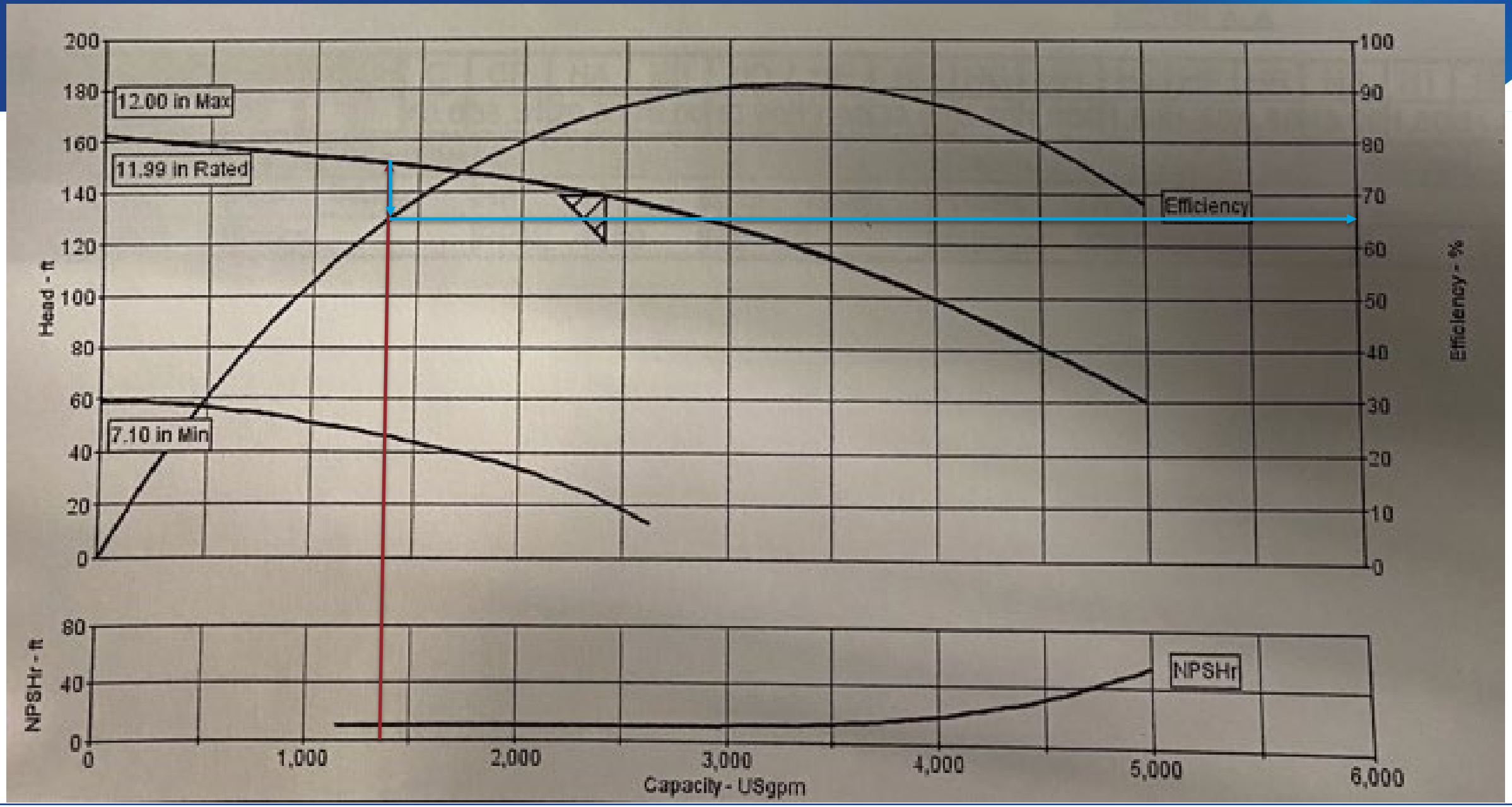
Sponsor:

Today's Agenda

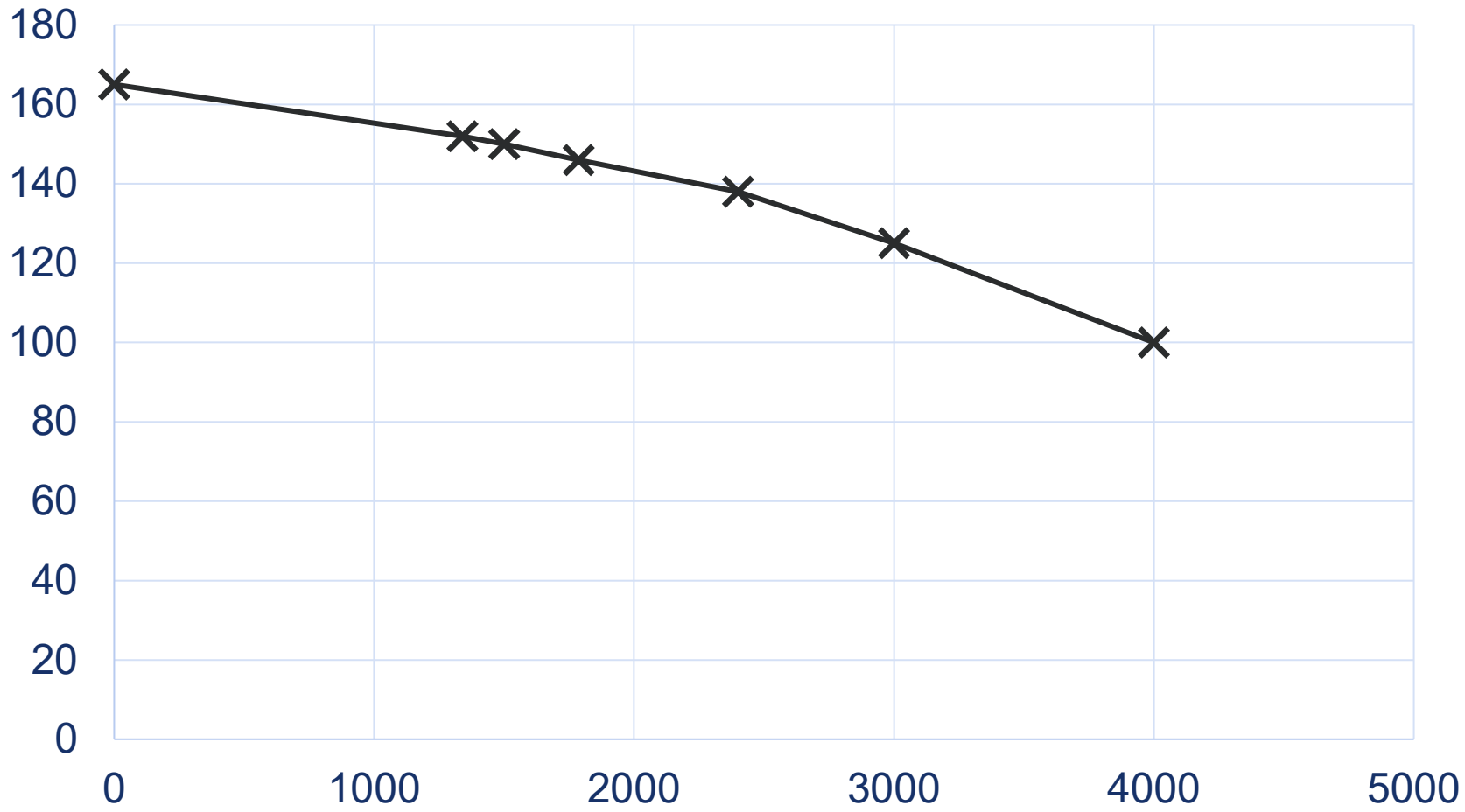
- Homework Recap
- Session 8 Participant Presentations
- Engaging Employees
- Energy Calculations Review
- Break
- Persistence Strategies
- Activity Share-out
- Kahoot!
- Q&A

HOMEWORK RECAP




12.00 in Max
11.99 in Rated
7.10 in Min
Efficiency
Head - ft
Efficiency - %
NPSHr
NPSHr - ft
Capacity - USgpm
200
180
160
140
120
100
80
60
40
20
0
100
90
80
70
60
50
40
30
20
10
0
80
40
0
1,000
2,000
3,000
4,000
5,000
6,000

Pump Curve @100%



Affinity Laws

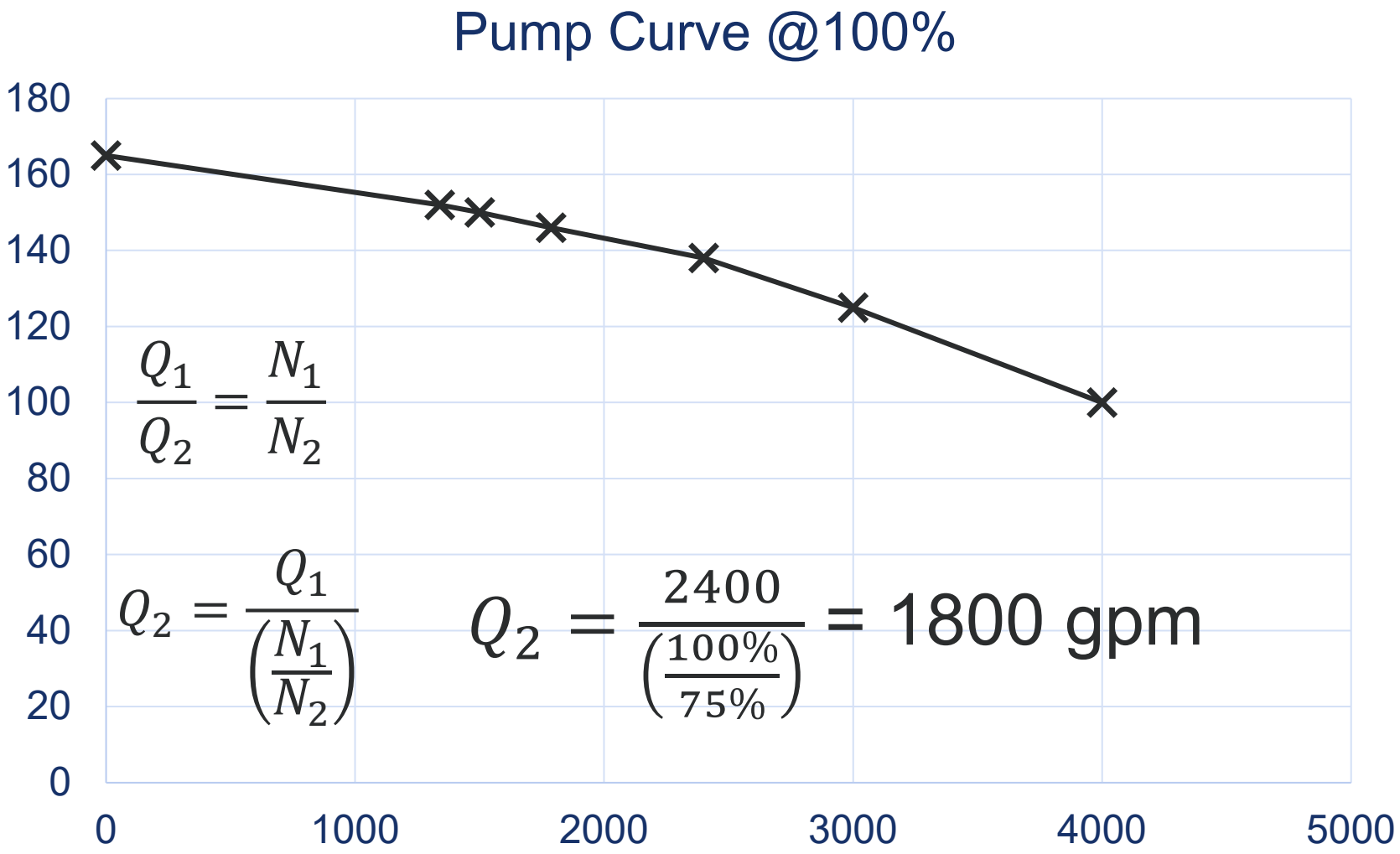
Flow (Q) will change directly	When there is a change in speed (N) or diameter (D)	$\frac{Q_1}{Q_2} = \frac{N_1}{N_2} or \frac{D_1}{D_2}$
Head (H) will change	As the square of change in speed (N) or diameter (D)	$\frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2 \text{or} \left(\frac{D_1}{D_2}\right)^2$
Power will change	As the cube of a change in speed (N) or diameter (D)	$\frac{BHP_1}{BHP_2} = \left(\frac{N_1}{N_2}\right)^3 \text{or} \left(\frac{D_1}{D_2}\right)^3$

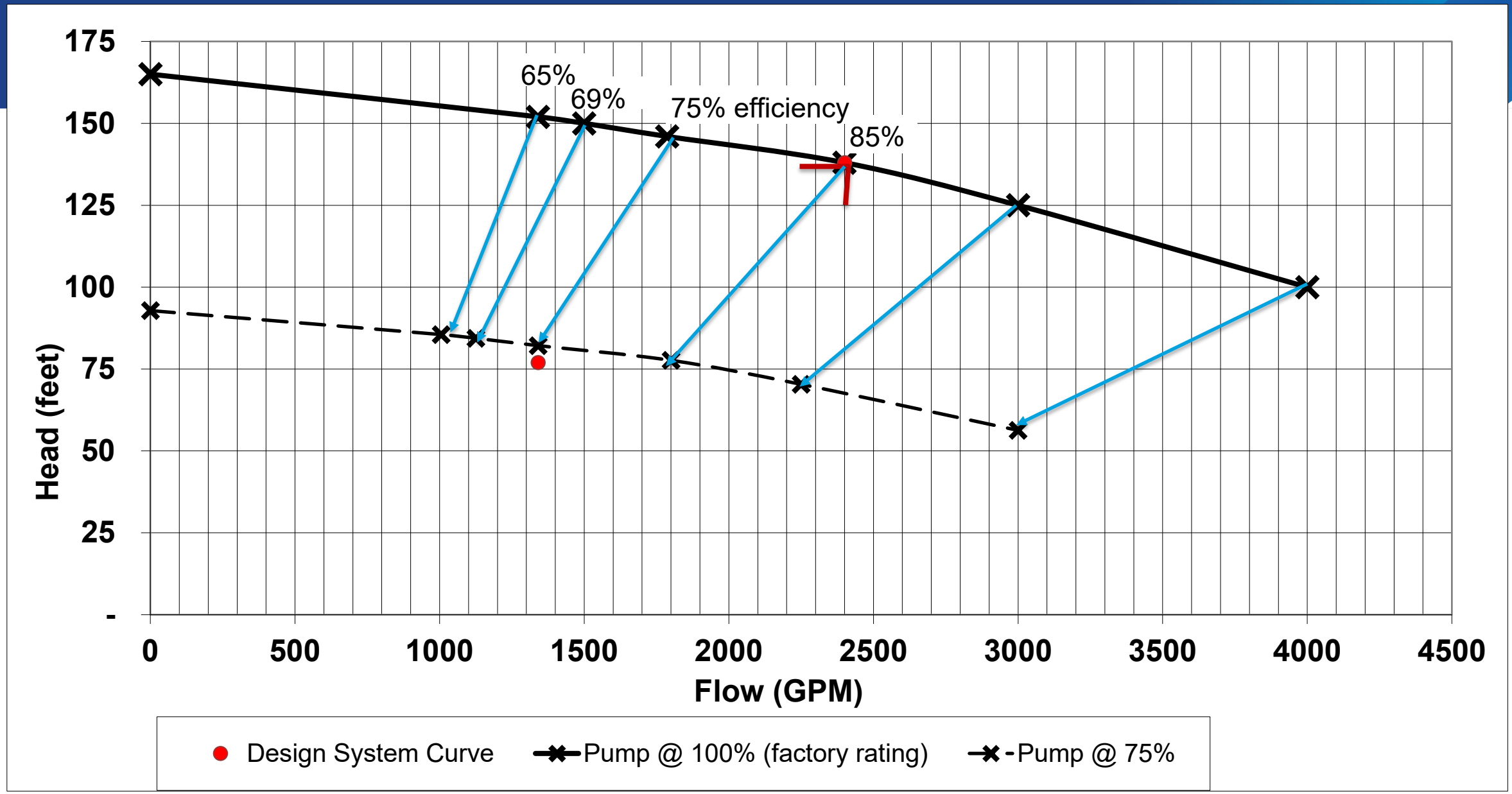
$$\frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2$$

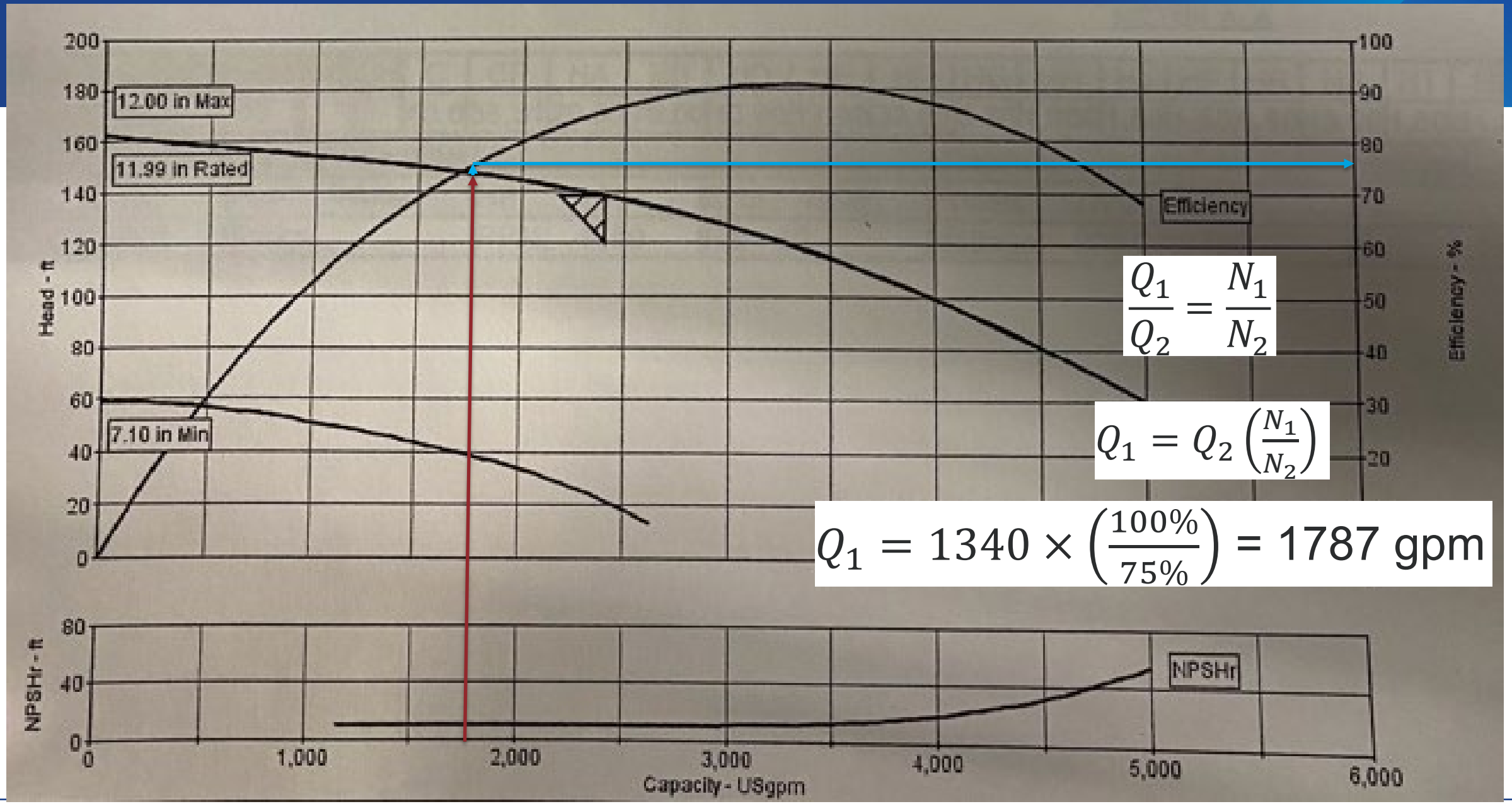
$$H_2 = H_1 / \left(\frac{N_1}{N_2}\right)^2$$

$$H_2 = 138 / \left(\frac{100\%}{75\%}\right)^2$$

H_2= 78 feet




175
150
125
100
75
50
25
-
Head (feet)
65%
69%
75% efficiency
85%
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Flow (GPM)
Design System Curve
Pump @ 100% (factory rating)
Pump @ 75%



$$\frac{Q_1}{Q_2} = \frac{N_1}{N_2}$$

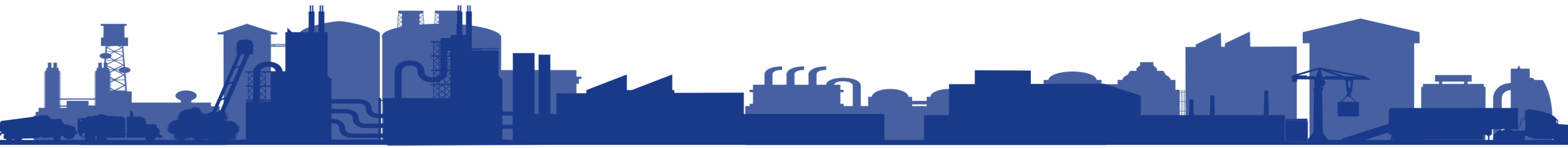
$$Q_1 = Q_2 \left(\frac{N_1}{N_2}\right)$$

$$Q_1 = 1340 \times \left(\frac{100\%}{75\%}\right) = 1787 \text{ gpm}$$

Homework Recap

- POLL

SESSION 8: CLOSEOUT



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Drinking Water Systems VINPLT: Close-out Presentation

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Company Name:
Facility Name:
Participant Name(s):

Savings Opportunities in Water Treatment

Savings Opportunities in Source Selection

Savings Opportunities in “Leaping”

Savings Opportunities in “Looping”

Savings Opportunities in “Leaking”

Savings Opportunities in “Losing”

Savings Opportunities in “Loading”

Savings Opportunities in Pumps

Savings Opportunities from Hydraulic Model

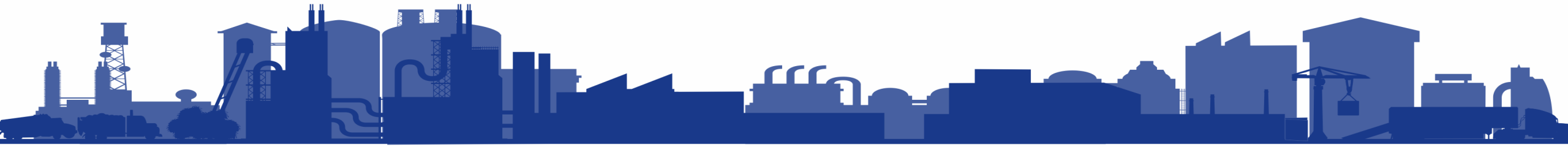
Tips Learned from this Training

Next Steps or Action Items after the VINPLT

- What are your next steps to implement opportunities?
- What are you planning to do after the VINPLT?
- Lessons learned?

Questions and Answers

ENGAGING EMPLOYEES



When people are financially invested, they want a return.

When people are emotionally invested, they want to contribute.

Simon Sinek,
leadership guru and
promoter of "The Golden Circle"

An Engaged Workforce…

UNDERSTANDS the goals and objectives for energy management.

KNOWS their jobs impact energy performance.

Feels **EMPOWERED** to take steps.

Is **AWARE** of the process for collecting and vetting their energy ideas.

Is **RECOGNIZED** for their contributions.

SEM Alumni Employee Engagement Strategies

Key takeaways: Culture change within the water department played a critical role in helping the public works staff embrace energy management. Recommended operational changes also improved operating pressures, which resulted in fewer customer complaints.

SEM Alumni Employee Engagement Strategies

CITY OF Vernon

LESSONS LEARNED

- Staff bought in completely and quickly
- Questioning assumptions was crucial
- Surprised by how many energy saving ideas were generated
- Even with a small team, many projects were completed
- It didn't take a lot of time or money to get most projects implemented
- Energy saving projects were interesting and fun to work on

SEM Alumni Employee Engagement Strategies

Keep your team informed about successes (and failures)

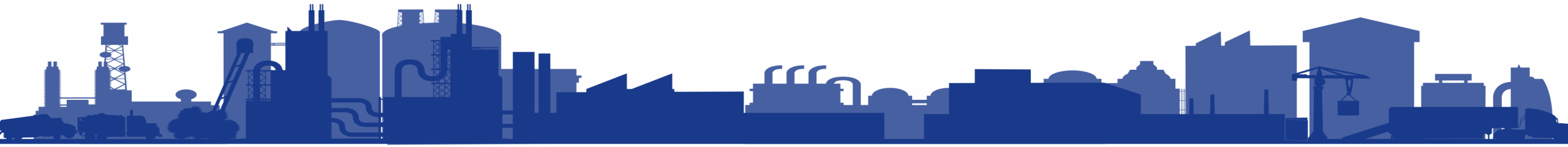
Communication is critical to maintaining momentum. Failures are okay and expected. Take small steps with a new measure so you can back out before an issue grows.

Team effort with operations, engineering, and management

All team members, including upper management, need to be involved and supportive. Ask for ideas from the entire staff.

Past Experience with Employee Engagement

ENERGY CALCULATIONS REVIEW



Pressure Reduction

Booster station pumped 30 MG in June to maintain 85 PSIG line pressure.

Energy Calc:

$$\frac{3.14\ kWh}{MG*Feet} \times MG \times Feet = \text{energy consumption in a perfect world}$$

$$\frac{3.14\ kWh}{MG*Feet} * 30\ MG * 85\ psi * \frac{2.31\ Feet}{psi} = 18{,}500\ kWh \text{ in a perfect June}$$

Pressure Reduction

Booster station pumped 30 MG in June to maintain 85 PSIG line pressure.

18,500 kWh in a perfect June

Wire-to-Water efficiency is the total efficiency stack, from the grid through the pump system to the material moved.

97% VFD x 94% motor x 85% pump = 77.5%

$$\frac{\textbf{18,500 kWh}}{\textbf{0.775}} = \textbf{24,000 kWh in June}$$

What is the energy intensity?

24,000 kWh/30 MG = 800 kWh/MG

Pressure Reduction

Booster station pumped 30 MG in June to maintain **80** PSIG line pressure.

$\frac{\text{5 psi reduction}}{\text{85 psi}}$ * 24,000 kWh in June = 1400 kWh savings

Leak repair

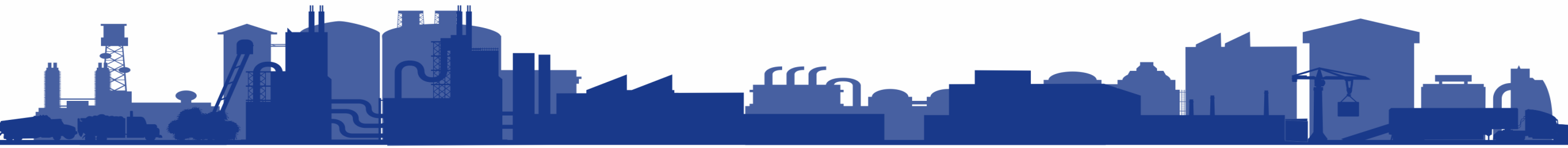
Energy intensity is 2,700 kWh/MG

Leak repair saves 60 MG/year

$$\frac{2{,}700\ \text{kWh}}{\cancel{\text{MG}}} * \frac{60\ \cancel{\text{MG}}}{\text{year}} = \frac{162{,}000\ \text{kWh}}{\text{year}}$$

BREAK

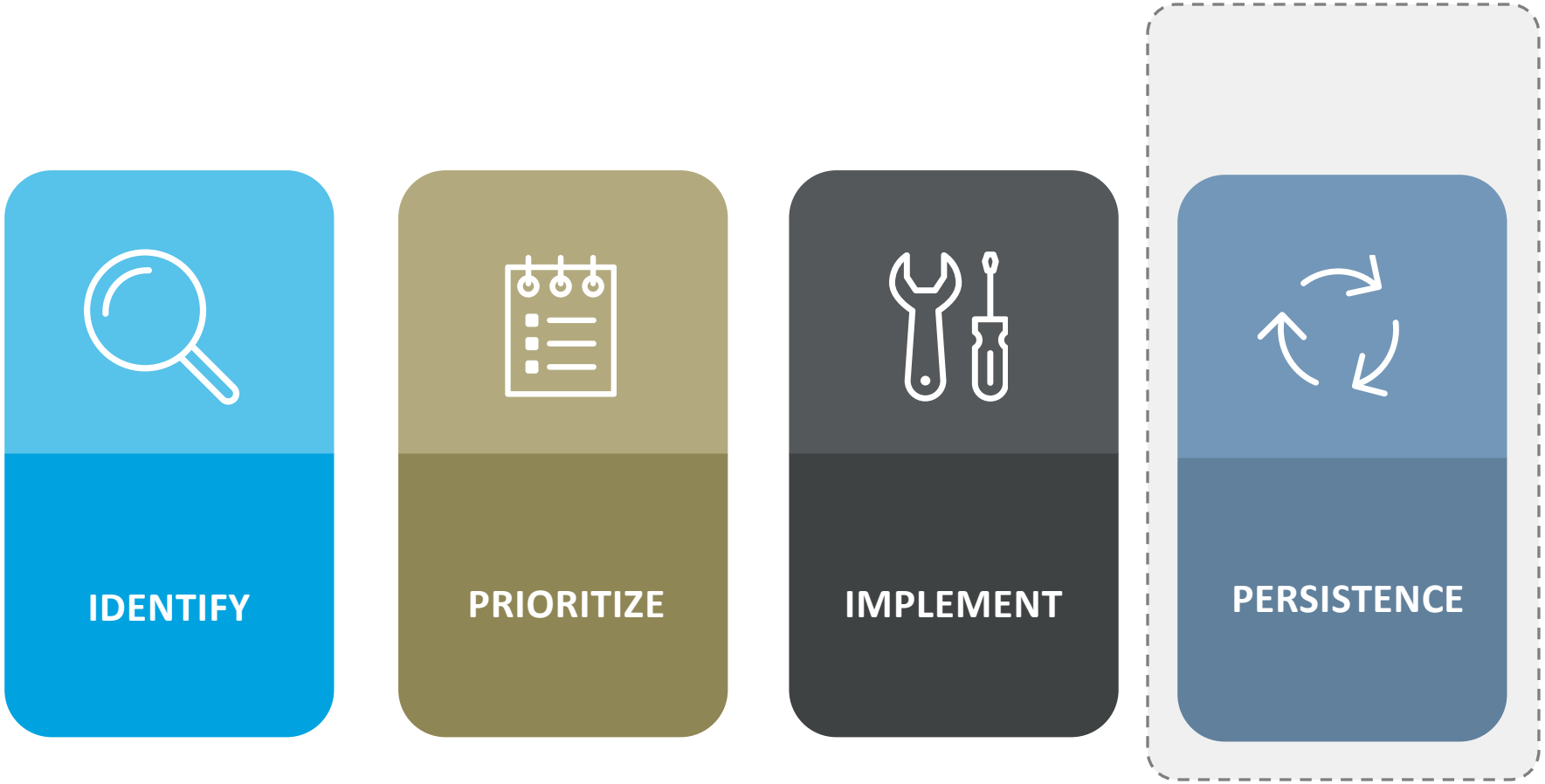
PERSISTENCE STRATEGIES



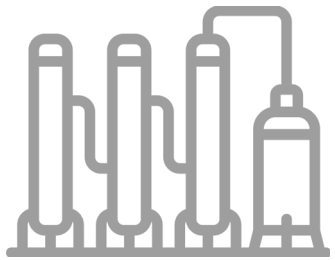
It's not just what you know, but how you practice what you know that determines how well the learning serves you later.

Peter C. Brown
Make It Stick

Energy Project Lifecycle

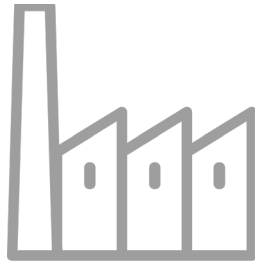


What could happen? Or has already happened?



New Equipment

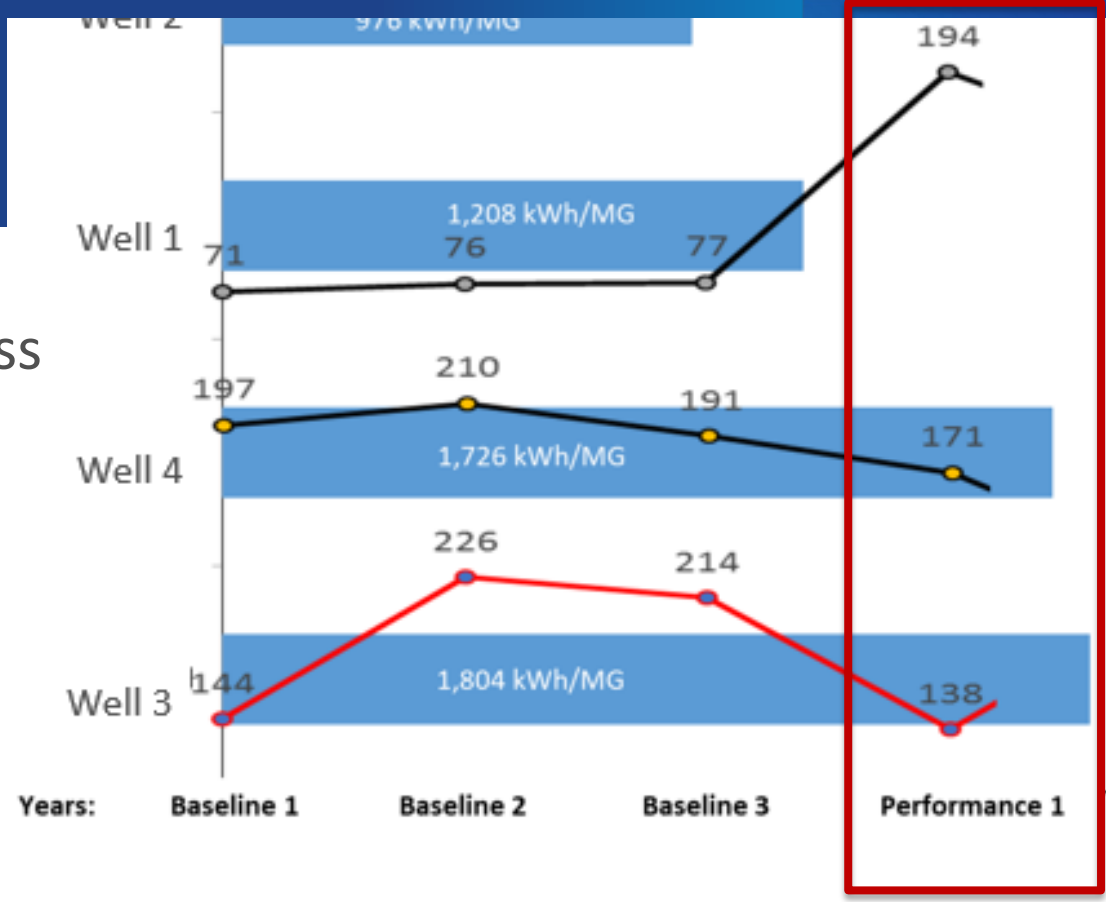
New Operator



Change in Requirements

Persistence Strategies

Source Selection



Energy savings from using Well 1 more and Well 3 less

- Reduced Well 3 by 76 MG
- Assume Well 1 produced extra 76 MG

$$\frac{1800\ \text{kWh}}{\text{MG}} - \frac{1200\ \text{kWh}}{\text{MG}} = \frac{600\ \text{kWh savings}}{\text{MG}}$$

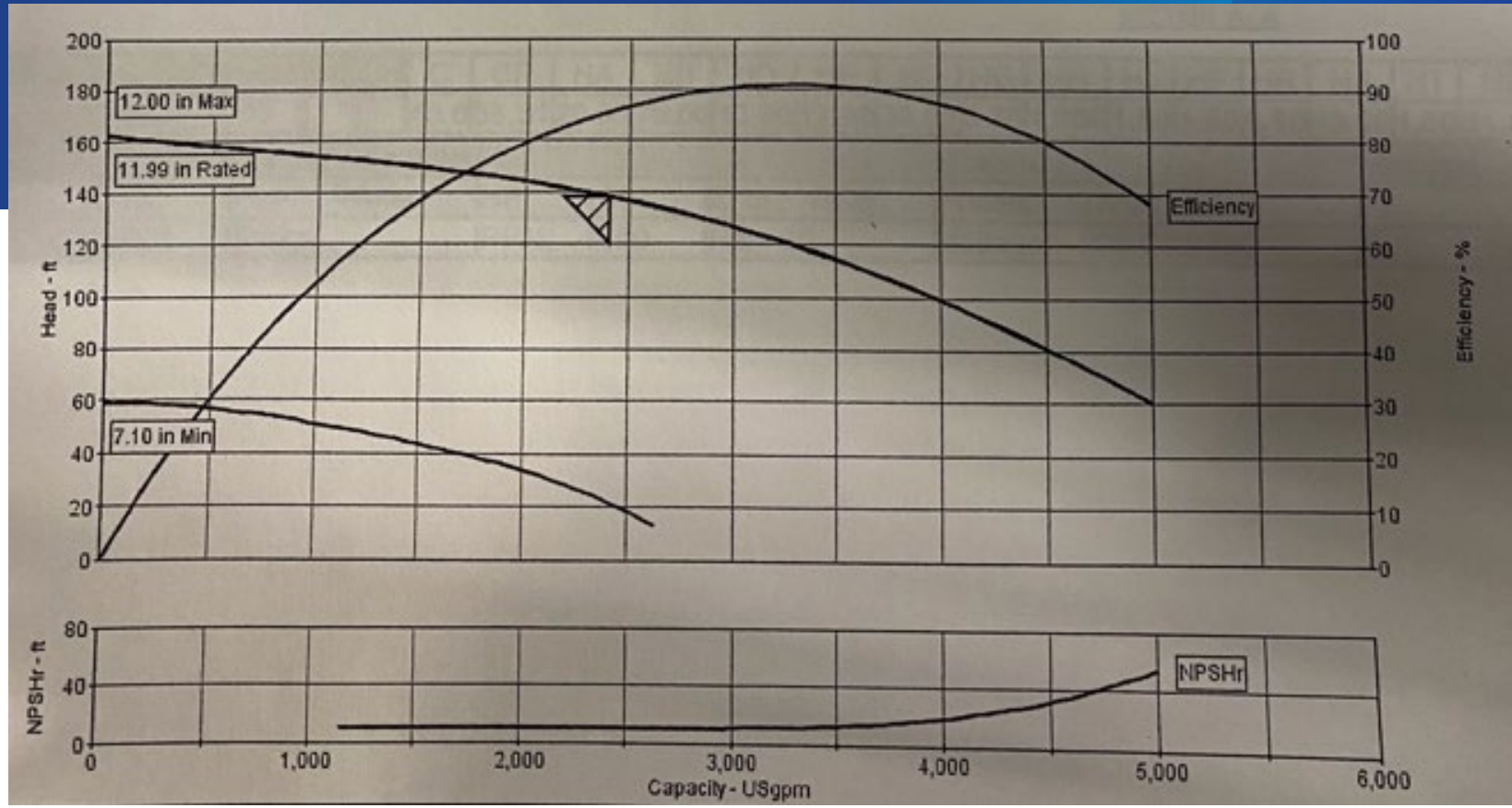
$$\frac{600\ \text{kWh savings}}{\cancel{\text{MG}}} * \frac{76\ \cancel{\text{MG}}}{} = 45{,}600\ \text{kWh savings}$$

$$\frac{45{,}600\ \cancel{\text{kWh}}}{\text{year}} * \frac{\$0.05}{\cancel{\text{kWh}}} = \$2{,}280 \text{ in energy (kWh) savings}$$

Increase efficiency

$$BHP = \frac{Q * H}{3960 * \eta}$$

$$BHP = \frac{1340*77}{3960*0.75} = 35 \text{ hp}$$

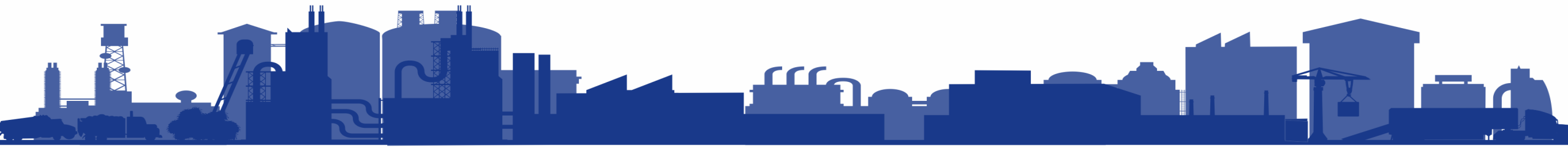


35 hp * 0.75 kW/hp / 0.93 / 0.97 * 5,000 hrs/year = 145,000 kWh/yr

145,000 kWh/yr * 5% = 7,250 kWh/year

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

KAHOOT!



Takeaways

- Engage employees around energy savings
- Implement persistence strategies whenever you implement energy saving projects
- Use rough energy calculations to estimate savings
- Prepare to share next week

Closing

Questions
Comments
Discussion

SEE YOU TUESDAY!

aquafficiency®

Saving energy, one gallon at a time