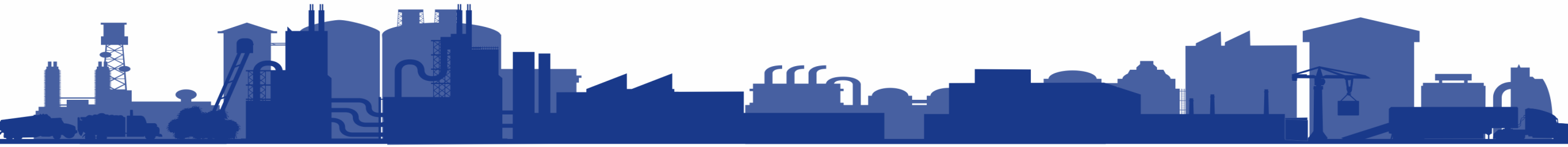
Better Plants
U.S. DEPARTMENT OF ENERGY

WATER VIRTUAL IN-PLANT (VINPLT) TRAINING

Week 2

U.S. DEPARTMENT OF ENERGY

Week 2: Water Source Selection, KPIs, and Energy Teams



Thank You!

Sponsor:

Today's Agenda

	Homework Recap
	KPIs
	Source Selection part 1
	Break
	Source Selection part 2
	Energy Teams
	Kahoot!
	Q&A

POLL

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Opportunity Register

Energy Projects

Energy Project		VALUE MATRIX		Step	Identify					
		GO TO VALUE MATRIX		1						
Opportunity #	Opportunity Name	Savings (1-10)	Cost/Effort (1-10)		Opportunity Description	Location	System*	Date Submitted	Capital or O&M	Submitted By
1										
2										
3										
4										
5										
6										
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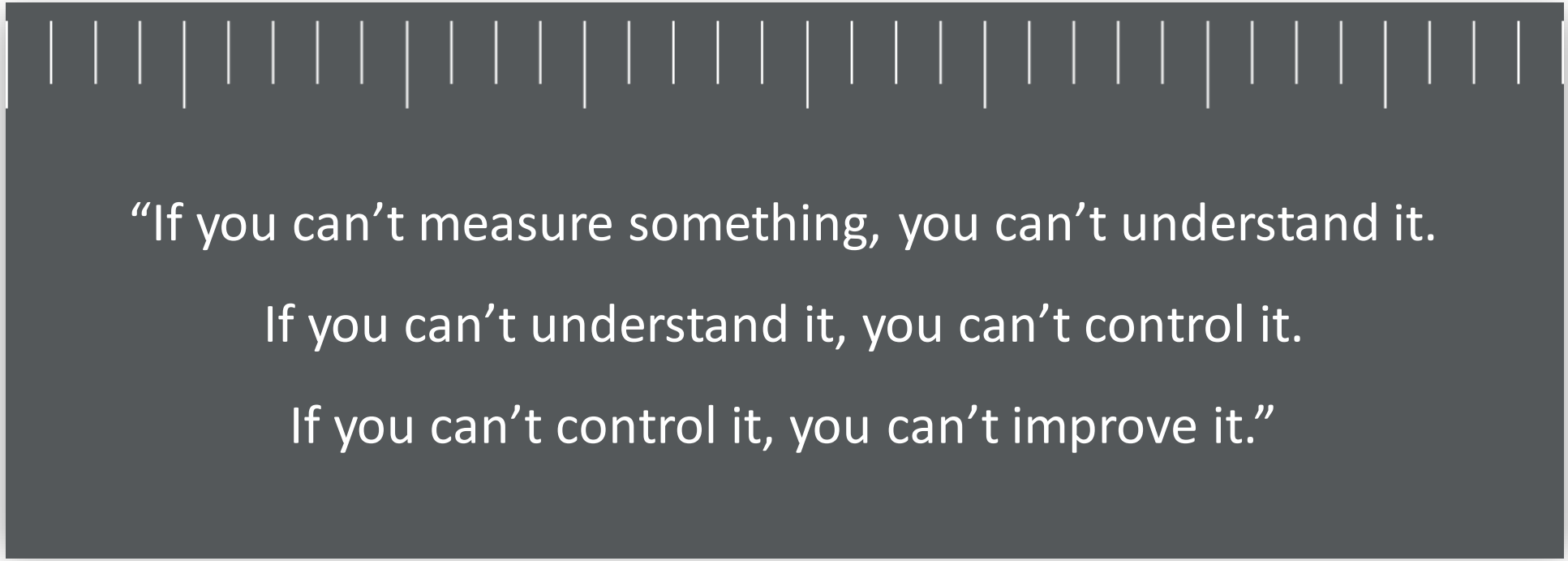
14										

KEY PERFORMANCE INDICATORS

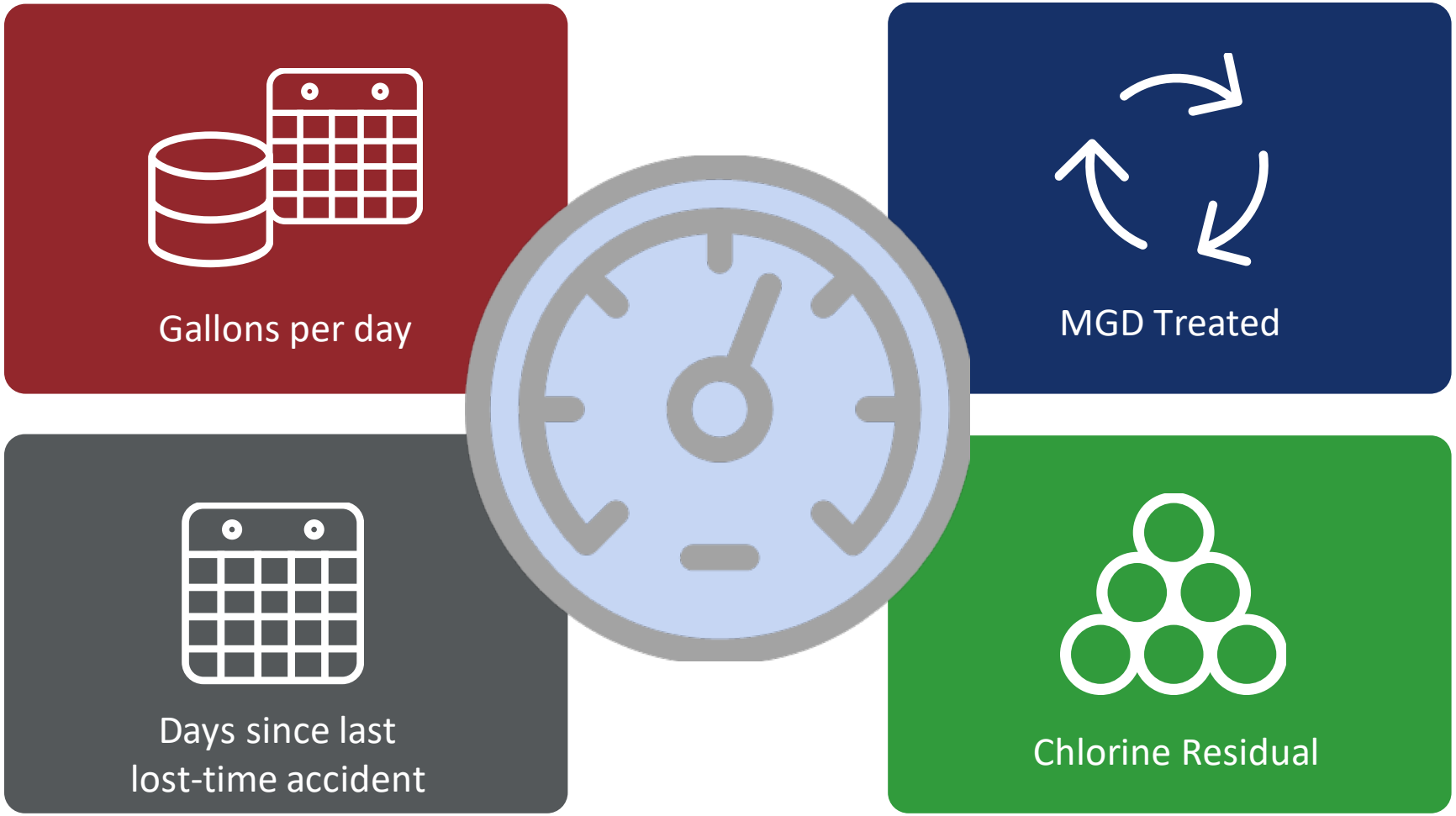


—H. James Harrington

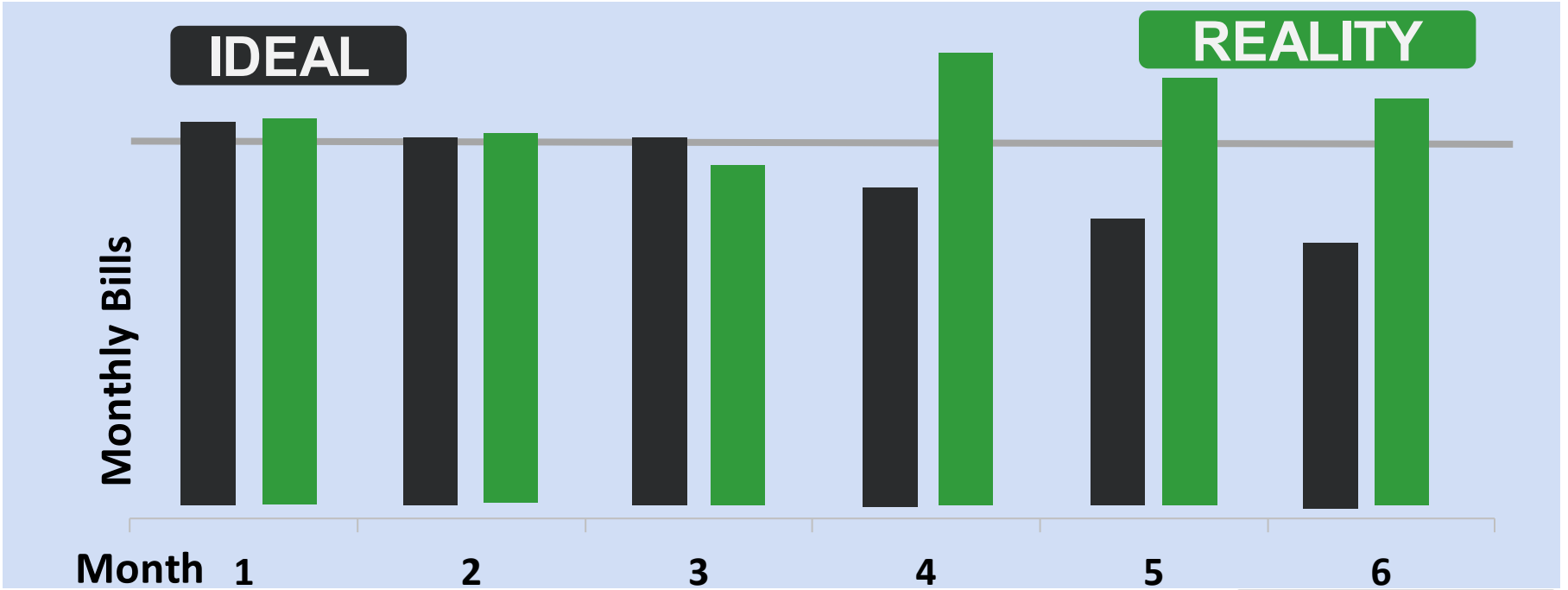
Why Track Energy Performance?

Track Progress → **Improve Operations** → **Communicate Success**

What Metrics Do You Use?



Why Tracking Monthly Bills is not Sufficient



Project 6

Project 5

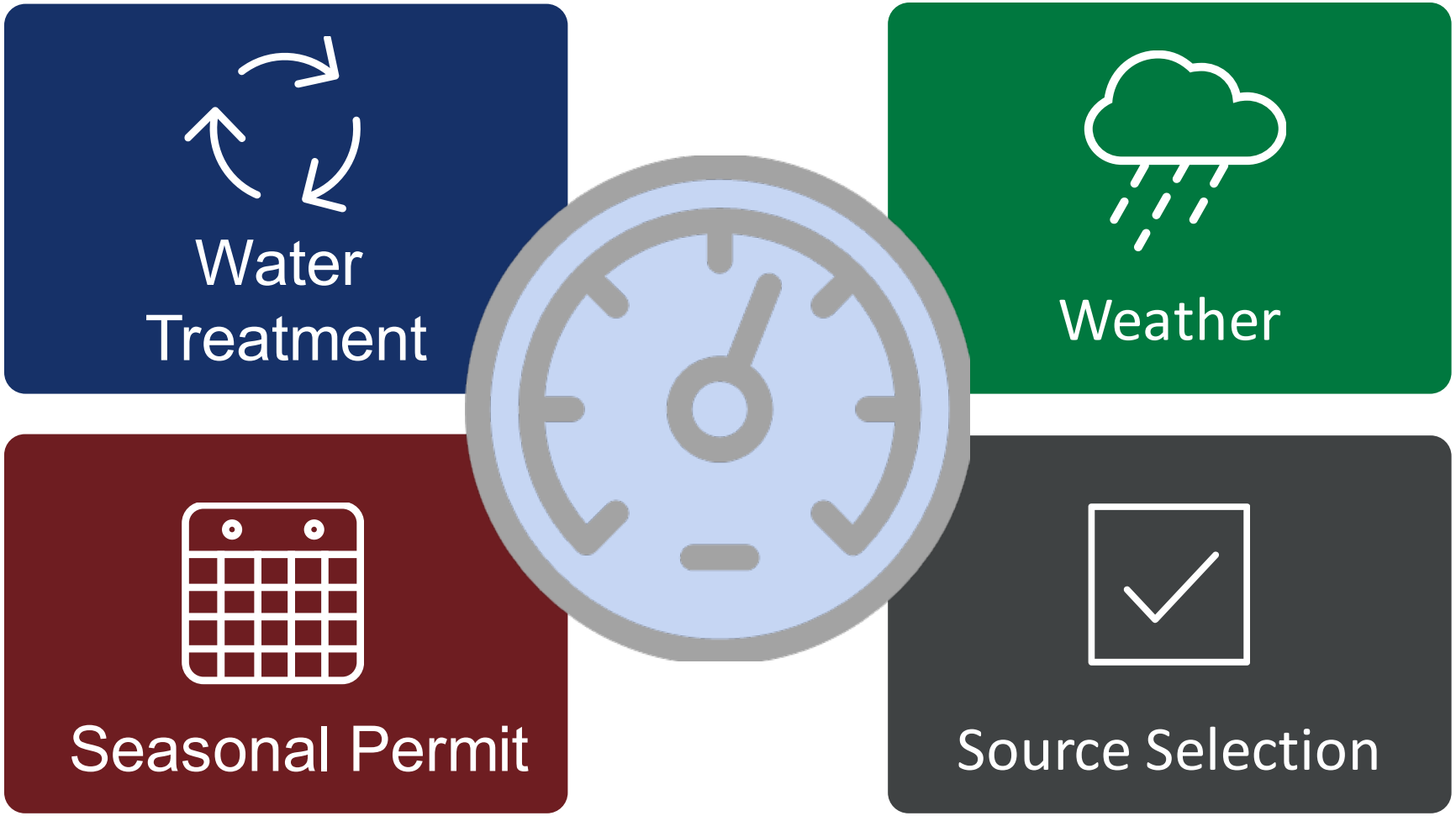
Repaired Leaks

Tuned VFD Settings

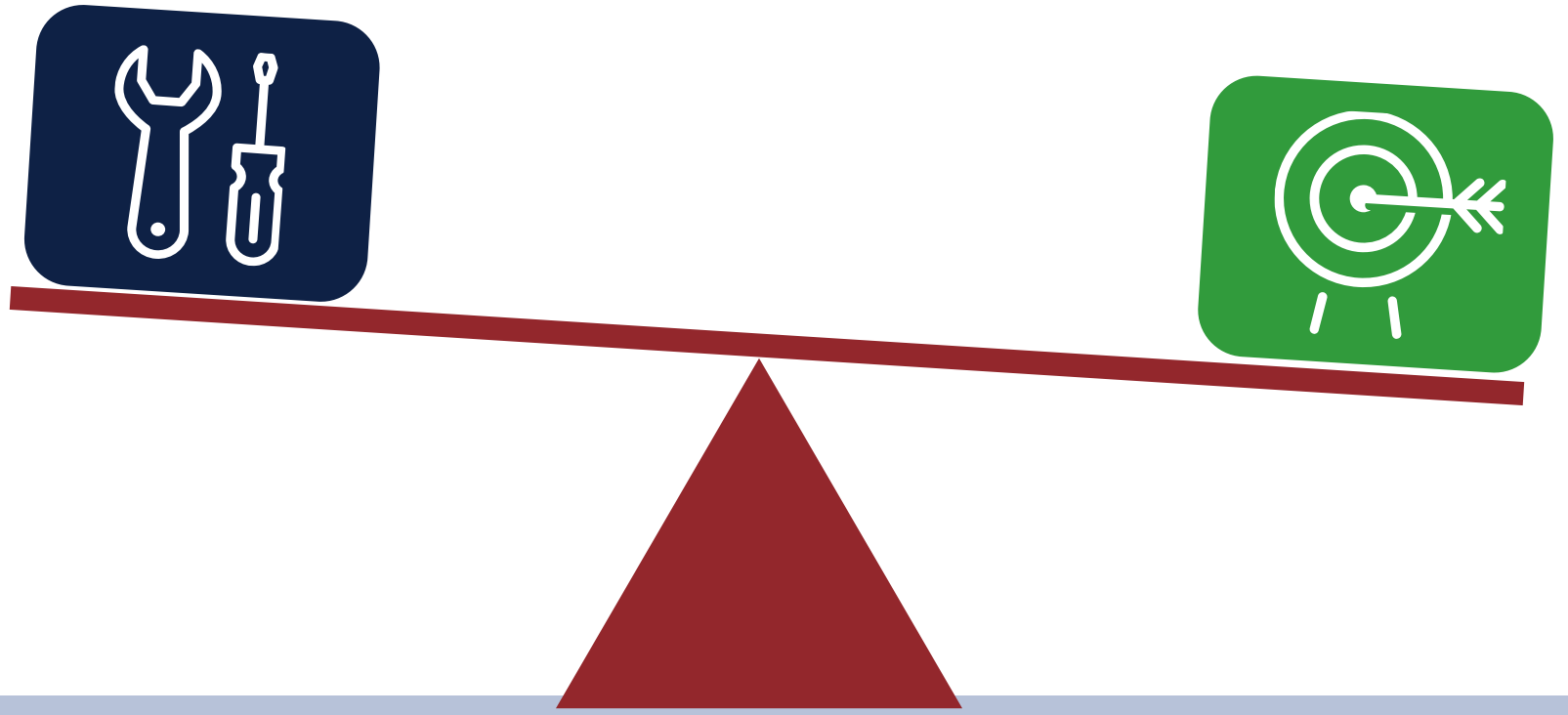
Improved Start-Up Procedure

Reduced Pressure

Know Your Energy Drivers

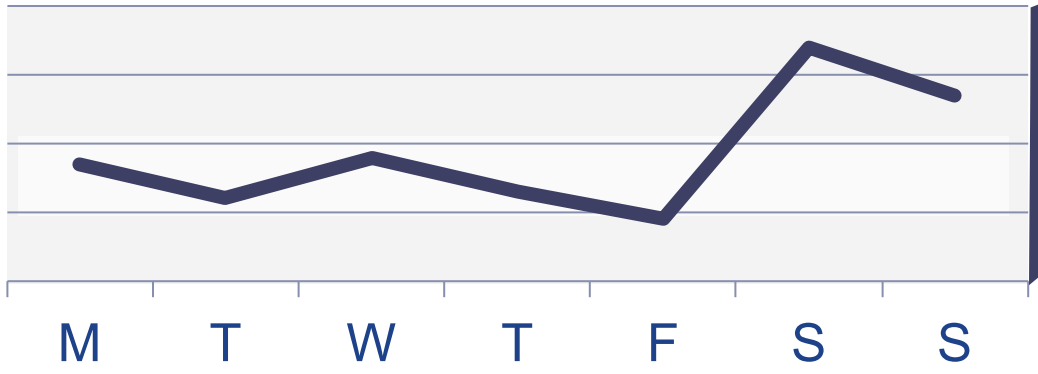


A Delicate Balance



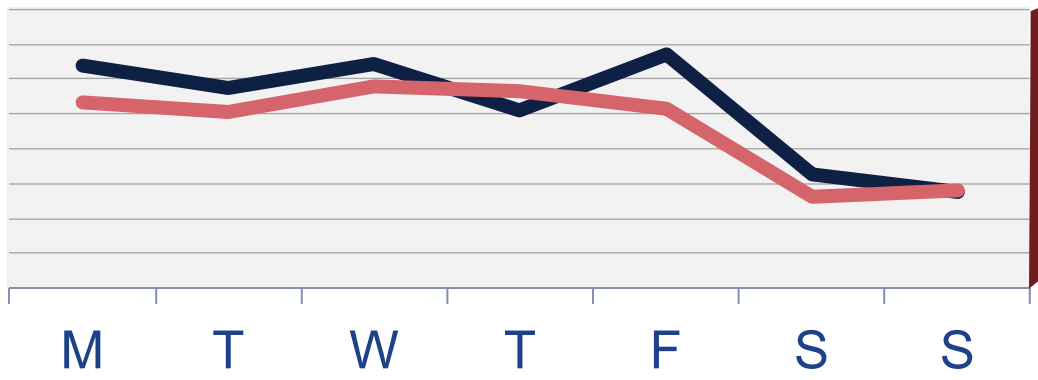
Energy KPIs vs. Energy Intensity Model

Energy Key Performance Indicators (KPIs)



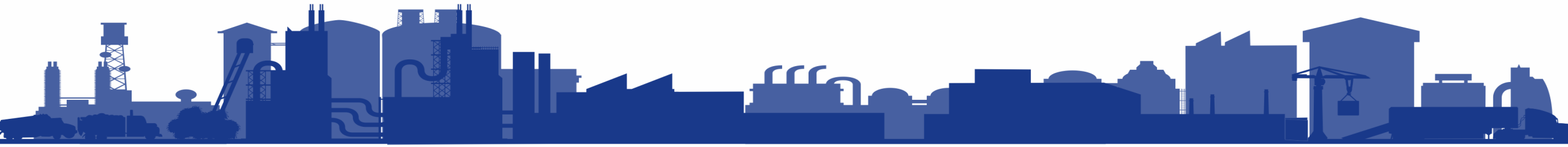
Simple,
but less actionable

Energy Intensity Model

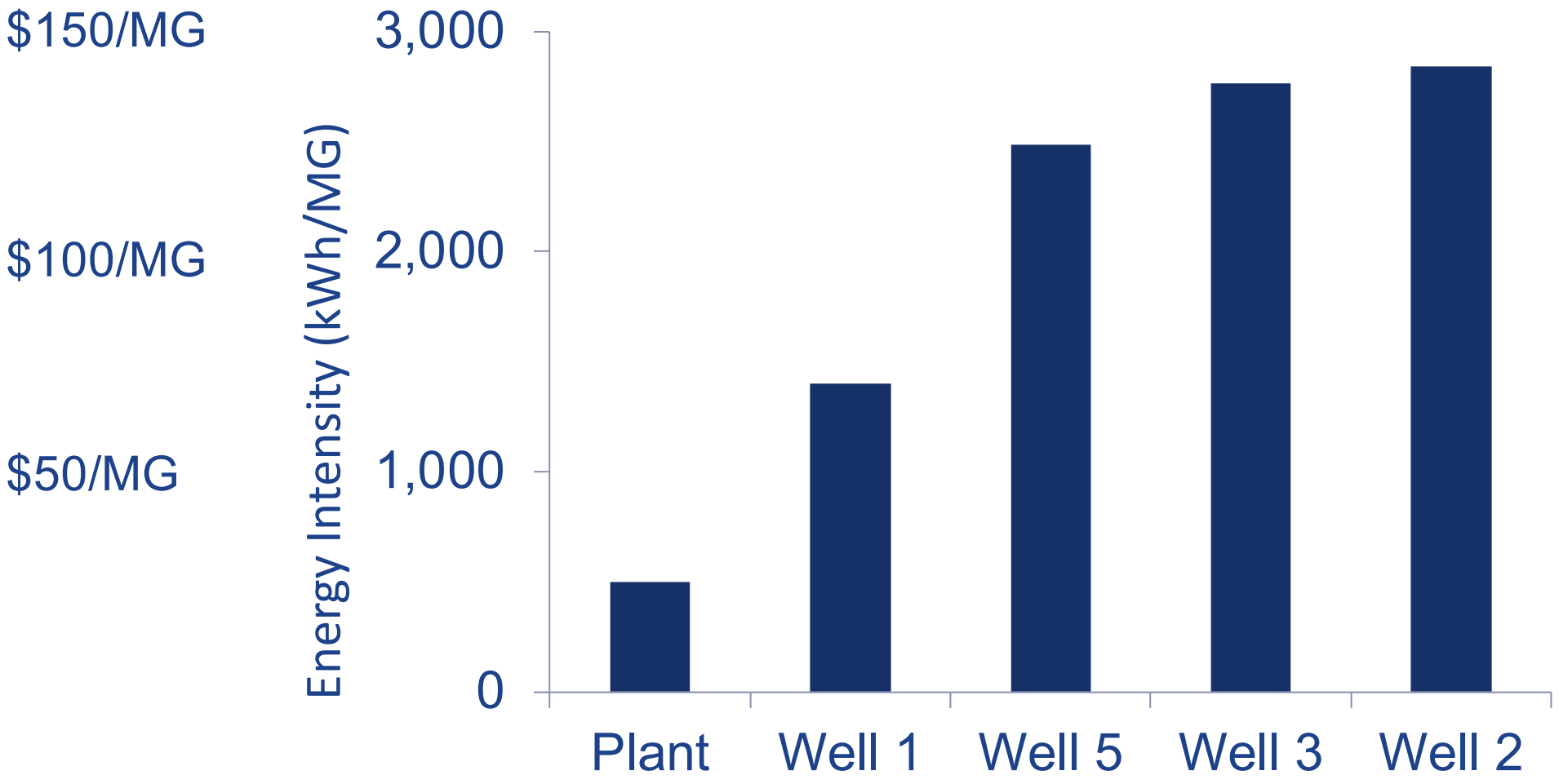


More complicated,
more actionable

SOURCE SELECTION

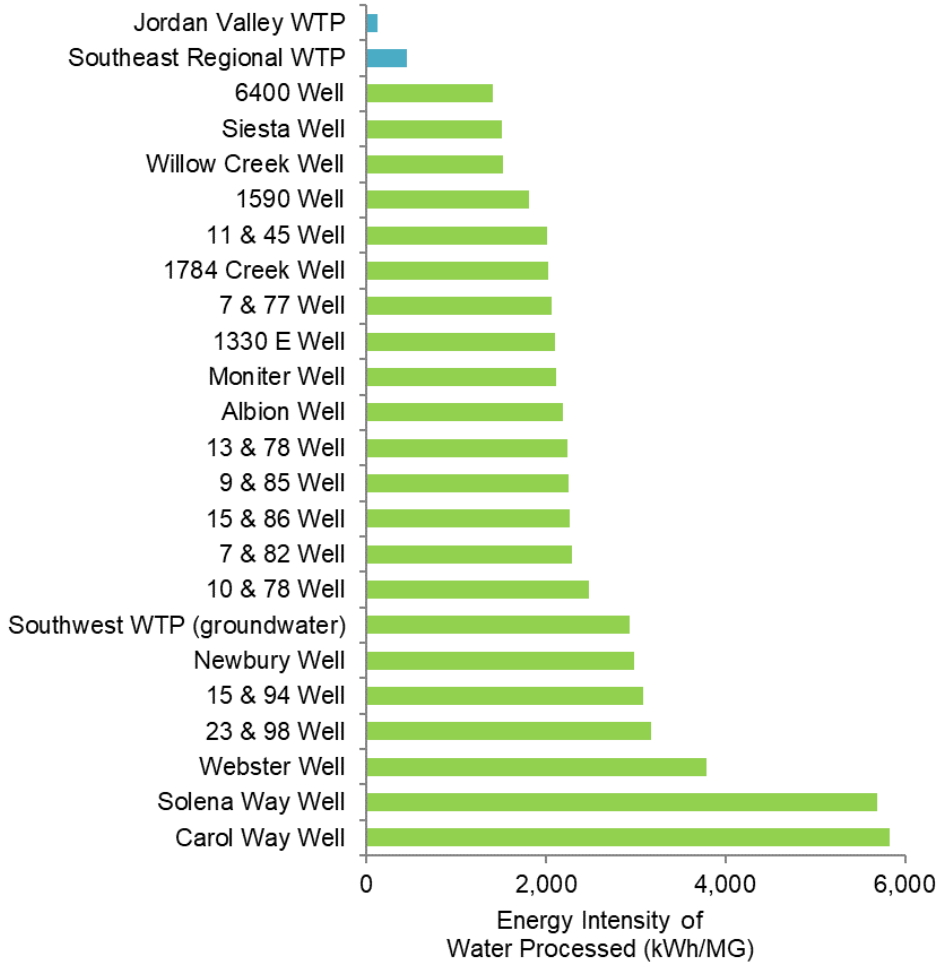


Source Selection



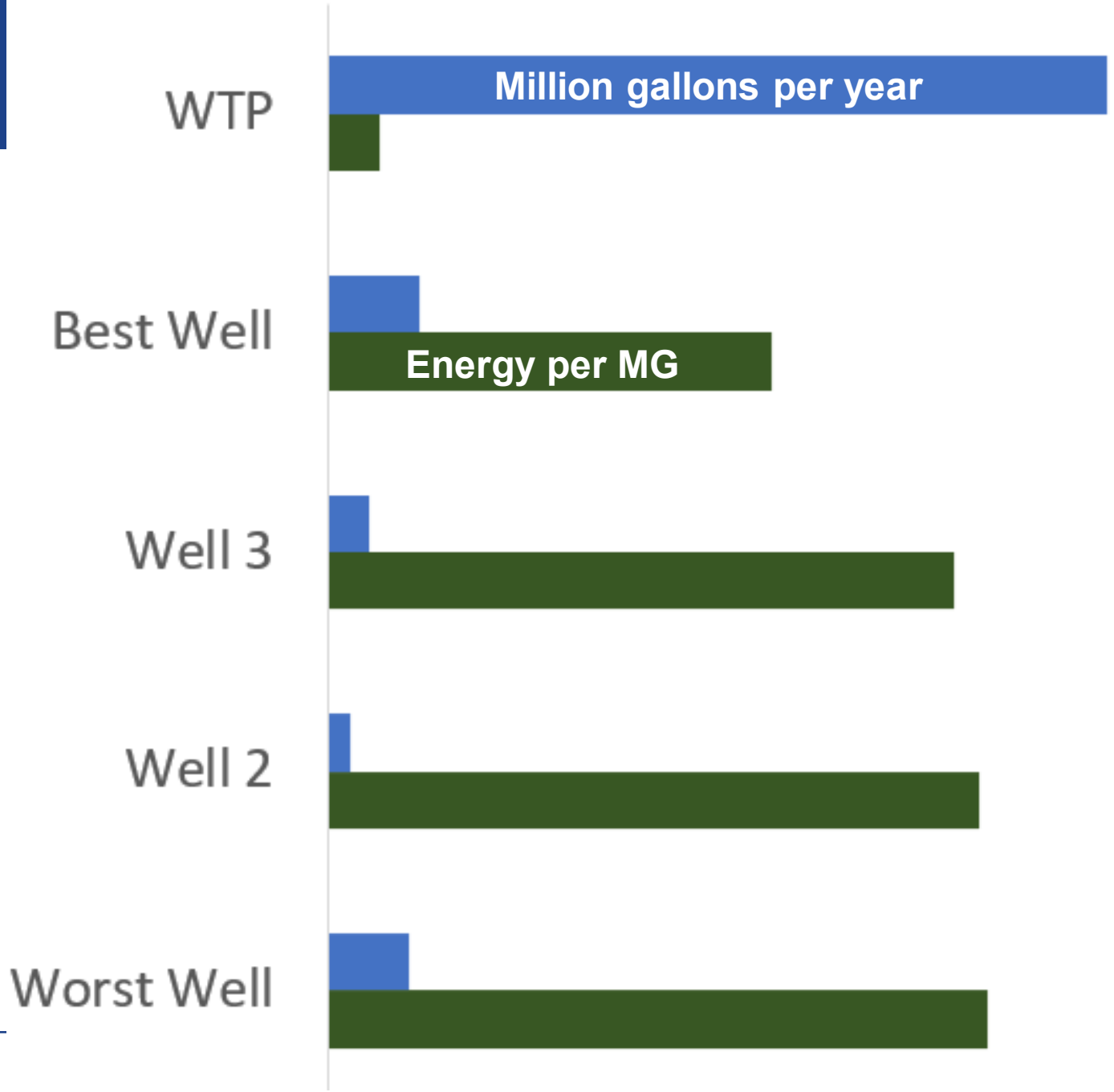
Concept: All else being equal, choose the cheapest water source.

Jordan Valley Water Conservancy District, UT



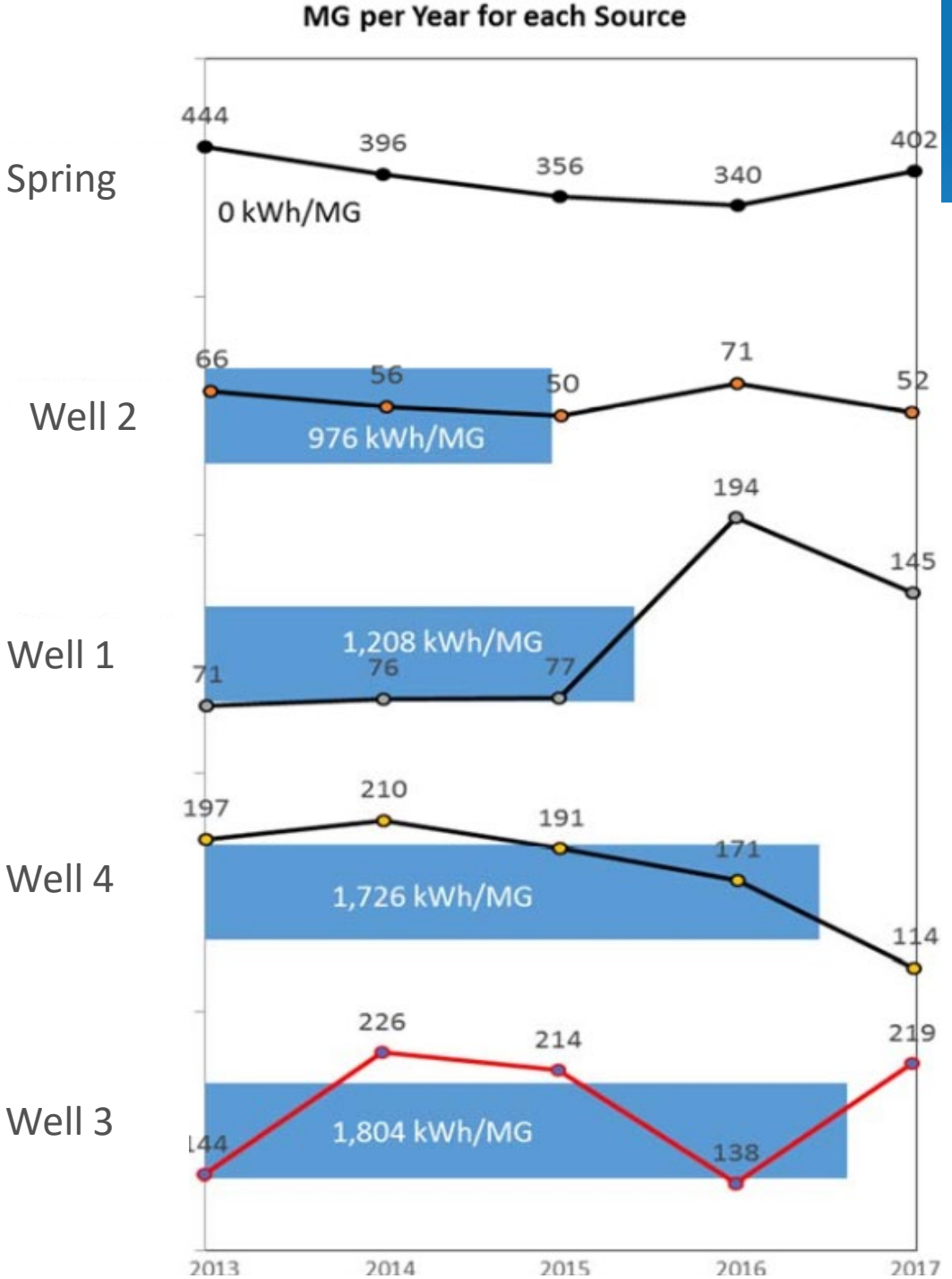
"Until the team examined the data, they had assumed that the newest or most conveniently located wells were the most efficient."

City of Yakima



Source Selection Example

- Baseline energy intensity (kWh/MG) is based on 2013, 2014, and 2015
- Spring flow is maximized
- What differences in 2016 were good
- What difference in 2017 used more energy



How to make an energy map

1. **Select** a water facility that:
- Has been used consistently
- Has been used for at least several months
- Has water production records
- Has energy use records

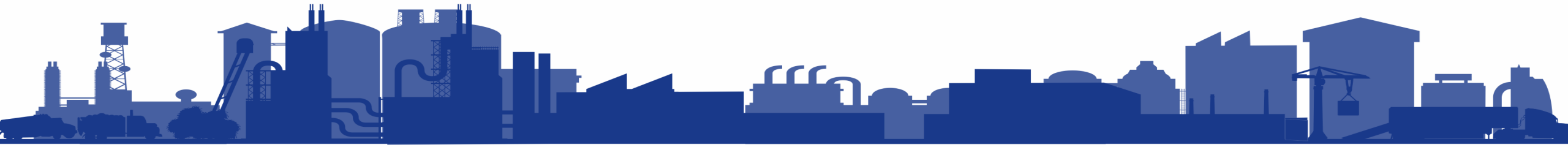
2. **Gather** water production and energy use data

3. **Compute**: Total Energy (kWh) divided by Total Water (MG or ac-ft)

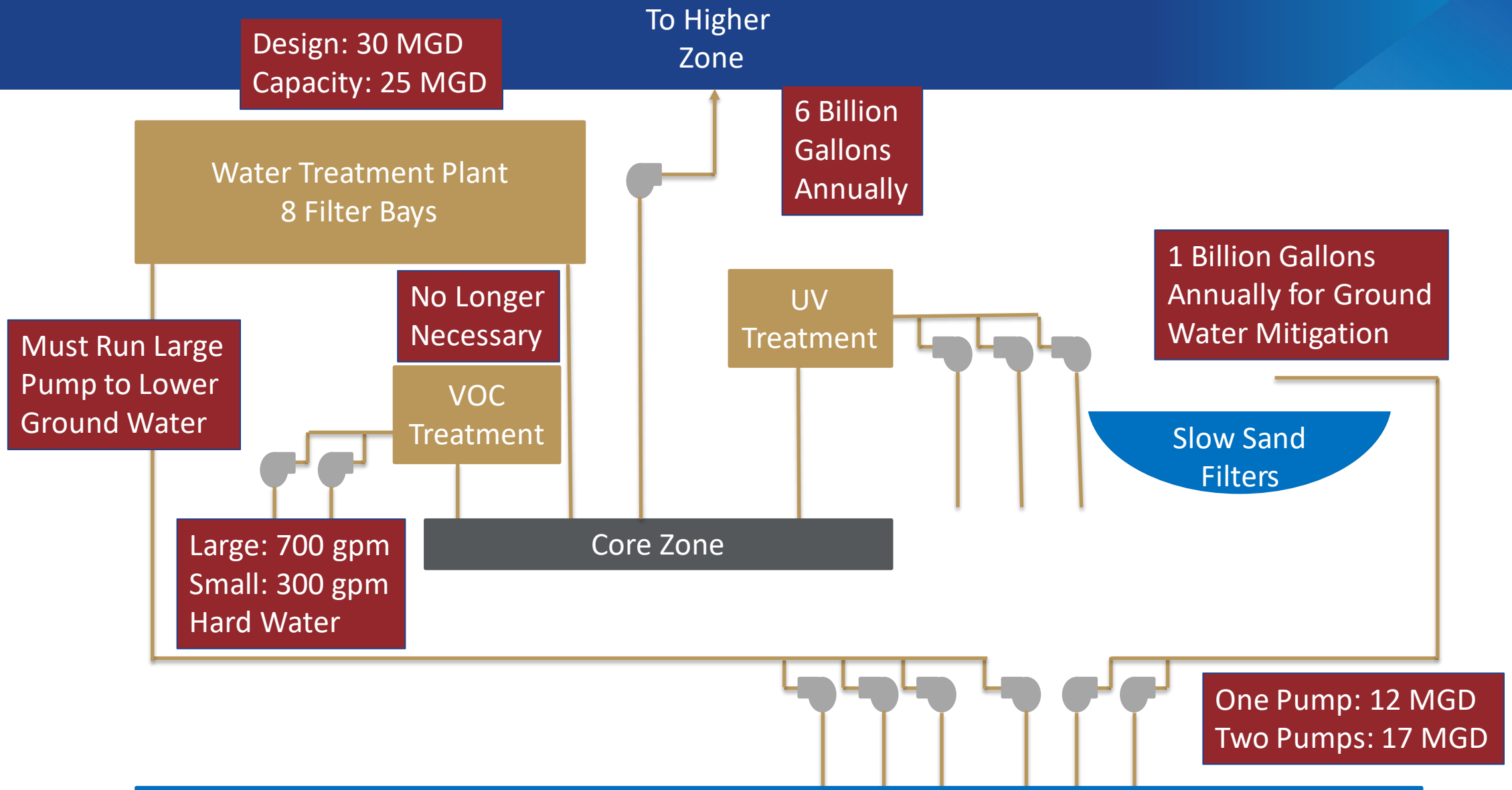
4. **Repeat** for each water source, **discuss** the results, and **update** as needed

BREAK

SOURCE SELECTION ACTIVITY




Columbia Heights
Water System


Design: 30 MGD
Capacity: 25 MGD
To Higher Zone
6 Billion Gallons Annually
Water Treatment Plant
8 Filter Bays
1 Billion Gallons Annually for Ground Water Mitigation
No Longer Necessary
UV Treatment
Must Run Large Pump to Lower Ground Water
VOC Treatment
Slow Sand Filters
Large: 700 gpm
Small: 300 gpm
Hard Water
Core Zone
One Pump: 12 MGD
Two Pumps: 17 MGD
Columbia River

Calculating Energy Efficiency/Intensity

- Treatment Plant Production (kWh/MG)
  - Energy (Numerator)
    - WTP Intake Pumps (kWh)
    - Water Treatment Plant (kWh)
  - Water Production (Denominator)
    - Finished Water (MG)

Calculating Energy Efficiency/Intensity

- Deep Well Production (kWh/MG)
  - Energy (Numerator)
    - Large Pump (kWh)
    - Small Pump (kWh)
    - VOC Treatment (kWh)
  - Water Production (Denominator)
    - Large Pump (MG)
    - Small Pump (MG)

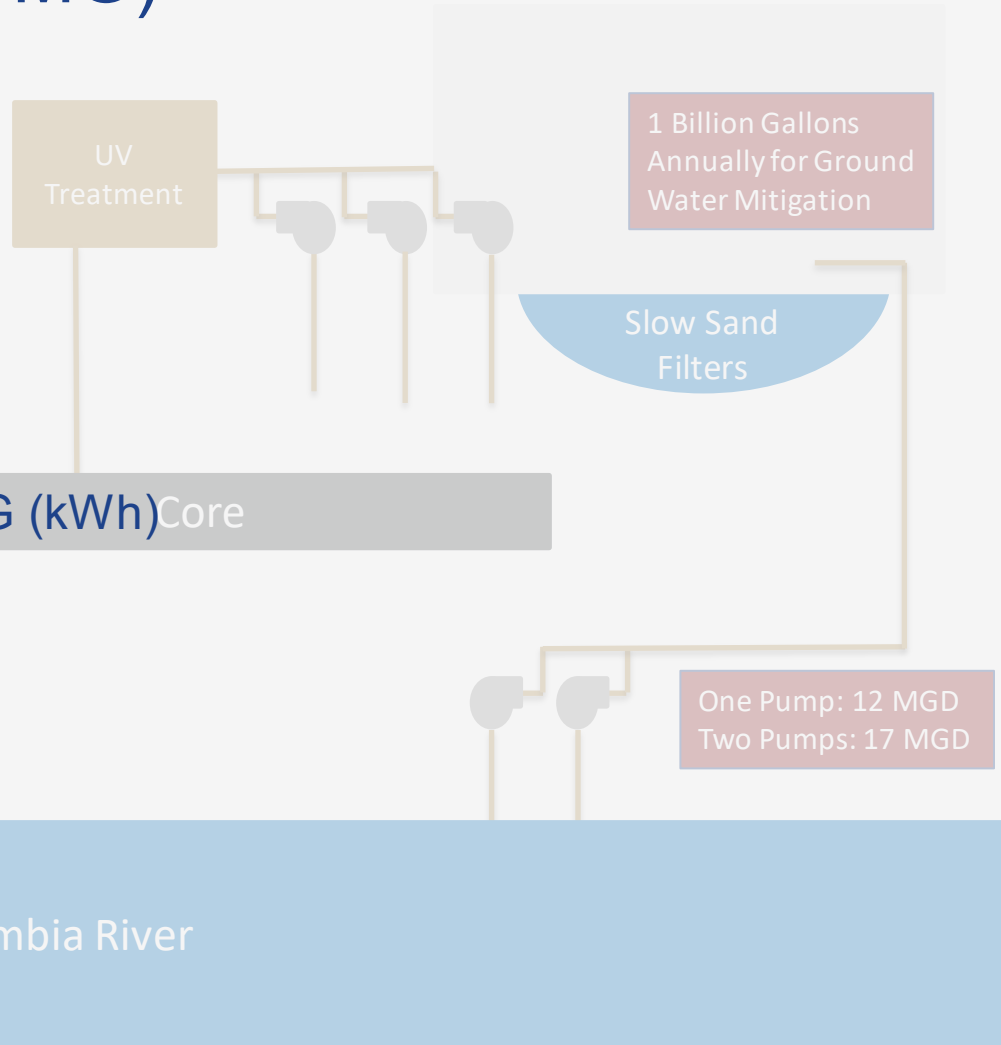
Calculating Energy Efficiency

- Slow Sand Filter Production (kWh/MG)
  - Energy (Numerator)
    - SSF Intake Pumps (kWh)
    - Shallow Pumps (kWh)
    - UV Treatment (kWh)
  - Water Production (Denominator)
    - Shallow Pumps (MG)

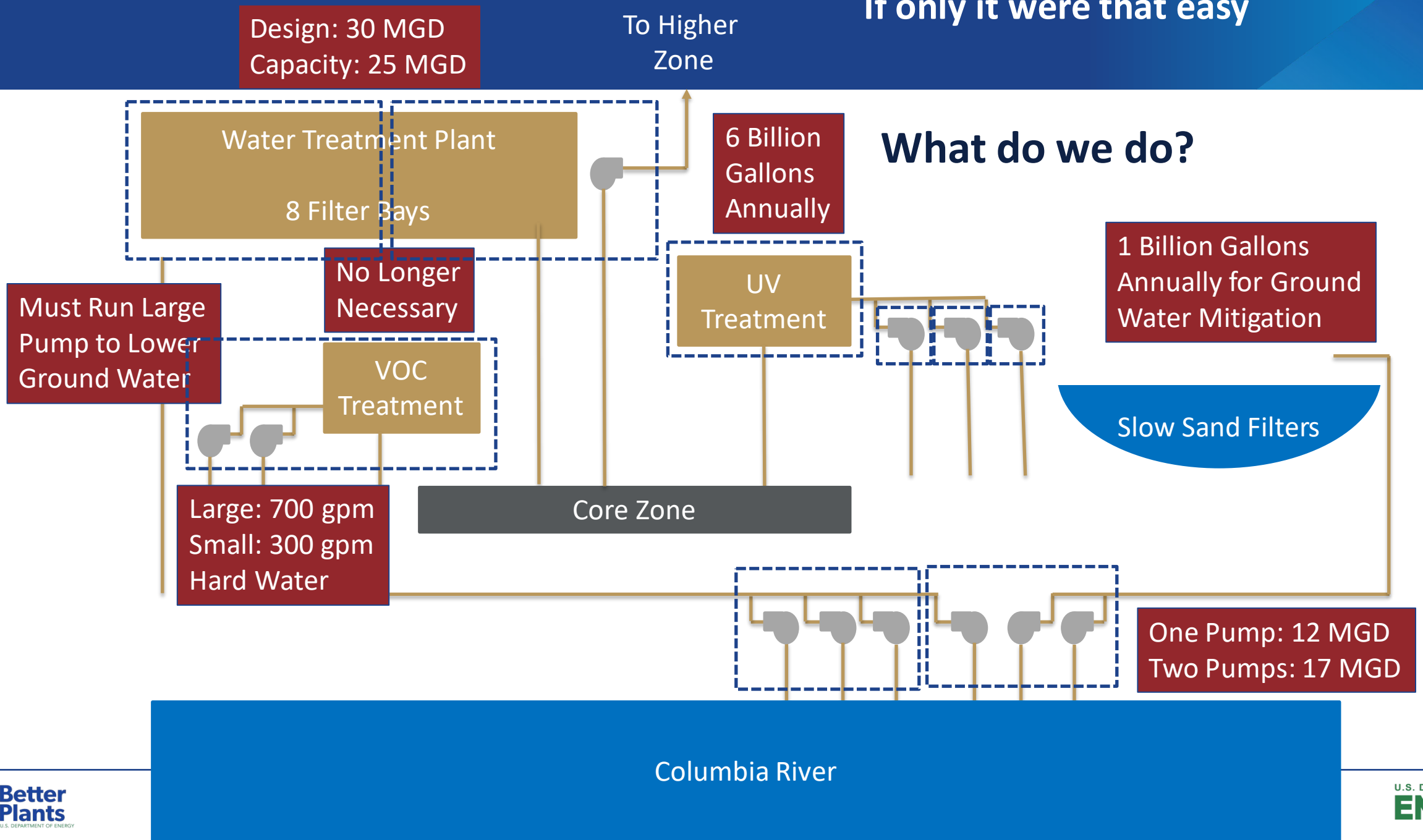
Wait, is that the right way to do it?

Calculating Energy Efficiency

- Ground Water Mitigation (kWh/MG)
  - Energy (Numerator)
    - SSF Intake Pumps – 1,000 MG (kWh)
  - Water Production (Denominator)
    - SSF Intake Pumps – 1,000 MG (MG)
- Slow Sand Filter Production
  - Energy (Numerator)
    - SSF Intake Pumps – MG over 1,000 MG (kWh)
    - Shallow Pumps (kWh)
    - UV Treatment (kWh)
  - Water Production (Denominator)
    - Shallow Pumps (MG)



If only it were that easy



Calculating Energy Efficiency

- Treatment Plant Production (kWh/MG)
  - Energy (Numerator) **511,436 kWh**
    - WTP Intake Pumps: 96,151 kWh
    - Water Treatment Plant: 415,285 kWh
  - Water Production (Denominator) **332.2 MG**
    - Finished Water: 332.2 MG
  - Energy Intensity: **1,540 kWh/MG**

Calculating Energy Efficiency

- Ground Water Mitigation (kWh/MG)
  - Energy (Numerator) **134,336 kWh**
    - SSF Intake Pumps: 134,336 kWh
  - Water Production (Denominator) **362 MG**
    - SSF Intake Pumps: 362 MG
  - Energy Intensity: **371 kWh/MG**

Calculating Energy Efficiency

- Slow Sand Filter Production (kWh/MG)
  - Energy (Numerator) **537,160 kWh**
    - Shallow Pumps: 166,236 kWh
    - UV Treatment: 246,500 kWh
    - WTP Finished Water Pumps: 57,644 kWh
    - SSF Intake Pumps: 66,780 kWh
  - Water Production (Denominator) **180 MG**
    - Shallow Pumps: 180 MG
  - Energy Intensity: **2,977 kWh/MG**

Calculating Energy Efficiency

- Deep Well Production (kWh/MG)
  - Energy (Numerator) **72,924 kWh**
    - Deep Well Meter: 55,464 kWh
    - WTP Finished Water Pumps: 17,460 kWh
  - Water Production (Denominator) **54.5 MG**
    - Finished Water: 54.5 MG
  - Energy Intensity: **1,338 kWh/MG**

Energy Intensity Summary

- Treatment Plant: 1,540 kWh/MG
- Slow Sand Filters: 2,977 kWh/MG
- Deep Wells: 1,338 kWh/MG
- Ground Water Mitigation: 371 kWh/MG

Columbia Heights Water System

- Annual Energy Use: 11,345,205 kWh
- Annual Production: 6,038 MG
- Annual Ground Water Mitigation: 1,000 MG
- Annual Energy Intensity: 1,879 kWh/MG

- Production Capacity
  - WTP: 750 MGM
  - SSF Intake Pump: 360 MGM
  - Deep Wells: 1 MGM

New Columbia Heights Strategy

		Deep Wells	WTP	SSF	GWM
Capacity		1	750	360	
Energy Intensity (kWh/MG)		1,338	1,540	2,977	371
	Monthly Demand (MGM)	Proposed Monthly Production MGM			
Jan	221				
Feb	205				
Mar	247				
Apr	403				
May	677				
Jun	799				
Jul	999				
Aug	928				
Sep	680				
Oct	409				
Nov	238				
Dec	232				

New Columbia Heights Strategy

		Deep Wells	WTP	SSF	GWM
Capacity		1	750	360	
Energy Intensity (kWh/MG)		1,338	1,540	2,977	371
	Monthly Demand (MGM)	Proposed Monthly Production MGM			
Jan	221	1			
Feb	205	1			
Mar	247	1			
Apr	403	1			
May	677	1			
Jun	799	1			
Jul	999	1			
Aug	928	1			
Sep	680	1			
Oct	409	1			
Nov	238	1			
Dec	232	1			

New Columbia Heights Strategy

		Deep Wells	WTP	SSF	GWM
Capacity		1	750	360	
Energy Intensity (kWh/MG)		1,338	1,540	2,977	371
	Monthly Demand (MGM)	Proposed Monthly Production MGM			
Jan	221	1			100
Feb	205	1			100
Mar	247	1			100
Apr	403	1			100
May	677	1			100
Jun	799	1			100
Jul	999	1			
Aug	928	1			
Sep	680	1			100
Oct	409	1			100
Nov	238	1			100
Dec	232	1			100

New Columbia Heights Strategy

		Deep Wells	WTP	SSF	GWM
Capacity		1	750	360	
Energy Intensity (kWh/MG)		1,338	1,540	2,977	371
	Monthly Demand (MGM)	Proposed Monthly Production MGM			
Jan	221	1	220		100
Feb	205	1	204		100
Mar	247	1	246		100
Apr	403	1	402		100
May	677	1	676		100
Jun	799	1	750		100
Jul	999	1	750		
Aug	928	1	750		
Sep	680	1	679		100
Oct	409	1	408		100
Nov	238	1	237		100
Dec	232	1	231		100

New Columbia Heights Strategy

		Deep Wells	WTP	SSF	GWM
Capacity		1	750	360	
Energy Intensity (kWh/MG)		1,338	1,540	2,977	371
	Monthly Demand (MGM)	Proposed Monthly Production MGM			
Jan	221	1	220		100
Feb	205	1	204		100
Mar	247	1	246		100
Apr	403	1	402		100
May	677	1	676		100
Jun	799	1	750	48	100
Jul	999	1	750	248	
Aug	928	1	750	177	
Sep	680	1	679		100
Oct	409	1	408		100
Nov	238	1	237		100
Dec	232	1	231		100

New Columbia Heights Strategy

Total
10,346,797

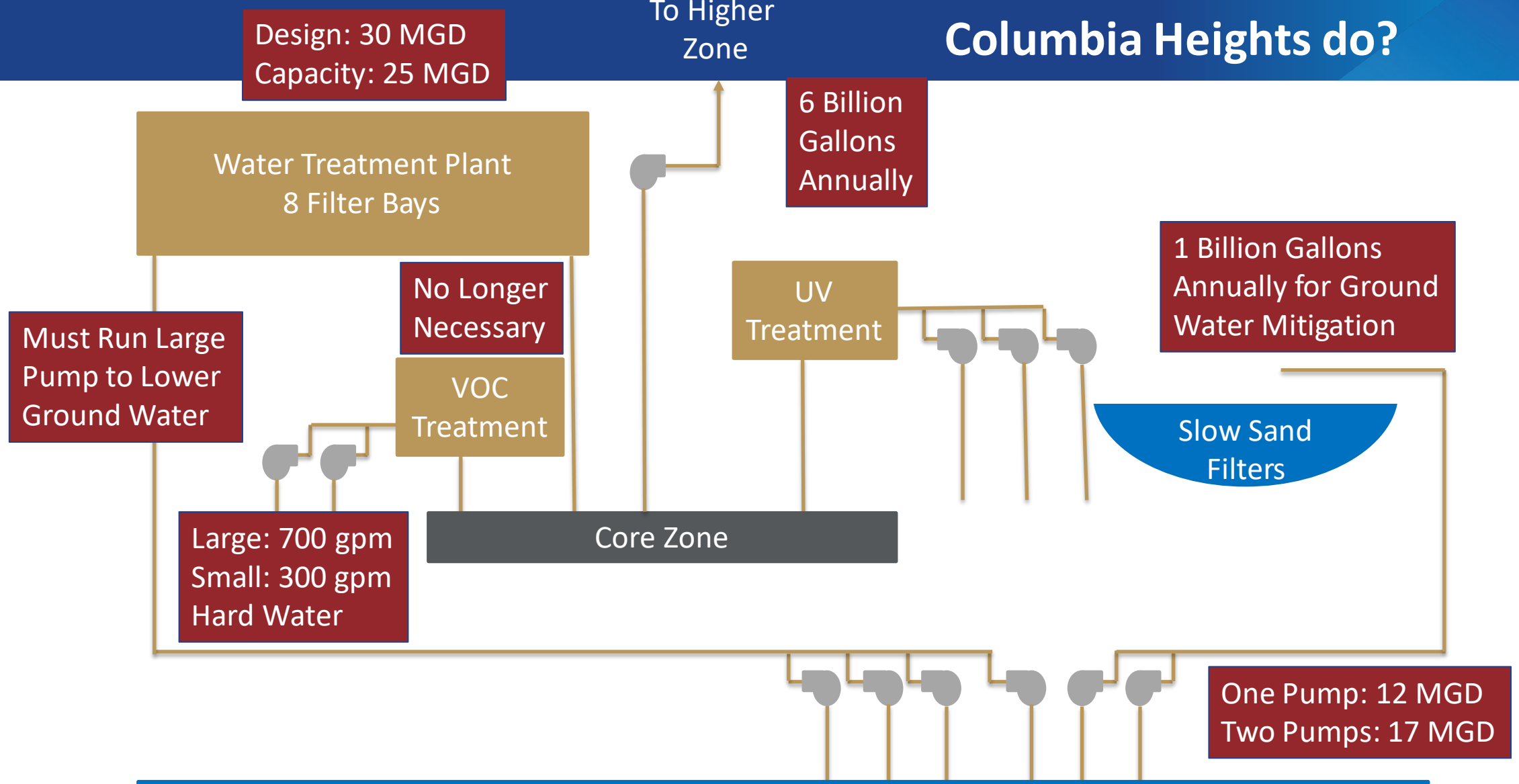
		Deep Wells	WTP	SSF	GWM
Capacity		1	750	360	
Energy Intensity (kWh/MG)		1,338	1,540	2,977	371
	Monthly Demand (MGM)	Proposed Monthly Production MGM			
Jan	221	1	220		100
Feb	205	1	204		100
Mar	247	1	246		100
Apr	403	1	402		100
May	677	1	676		100
Jun	799	1	750	48	100
Jul	999	1	750	248	
Aug	928	1	750	177	
Sep	680	1	679		100
Oct	409	1	408		100
Nov	238	1	237		100
Dec	232	1	231		100
		16,056	8,551,620	1,408,121	371,000

Columbia Heights Operational Savings

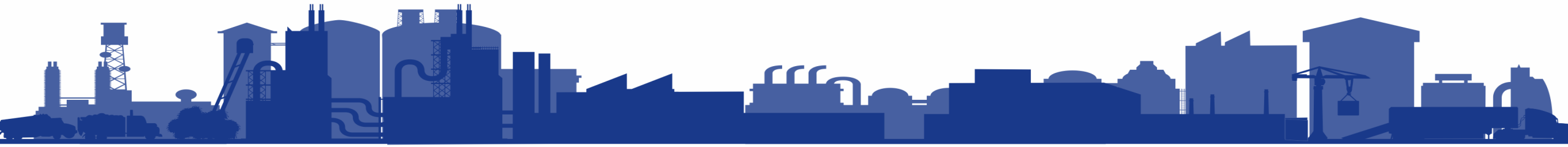
Original Strategy: 11,345,205 kWh
Revised Strategy: 10,346,797 kWh
Savings: 998,408 kWh
Percent Savings: 8.8%

Original Intensity: 1,879 kWh/MG
Revised Intensity: 1,714 kWh/MG

What else can Columbia Heights do?



ENERGY TEAMS



An Engaged Workforce…

UNDERSTANDS the goals and objectives for energy management.

KNOWS their jobs impact energy performance.

Feels **EMPOWERED** to take steps.

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

Are **RECOGNIZED** for their contributions.

Energy Team

Executive Sponsor

Provides resources and sets expectations

Energy Champion

Manages and drives energy program

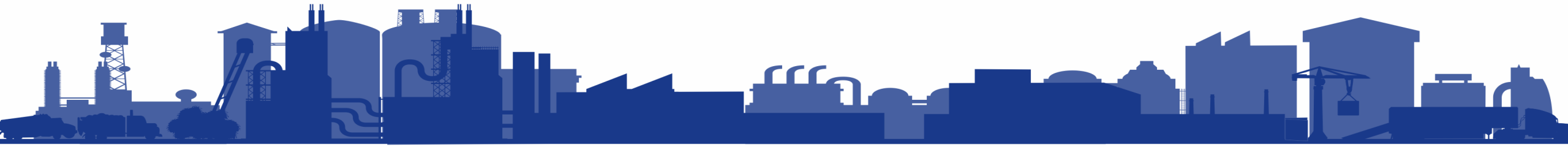
Data Lead

Gathers and delivers timely production and energy data

Energy Team

On your smart phone
Go to: https://kahoot.it/
Game PIN: 5767687

KAHOOT!



Takeaways

- Keep track of energy saving opportunities and see if you can start working on them

- Know the energy intensity of each of your water sources and incorporate this knowledge into your decision making
- Consider having an energy team

Closing

Questions
Comments
Discussion

Email Wendy at:
wendy.waudby@cascadeenergy.com

SEE YOU TUESDAY!

aquafficiency®
Saving energy, one gallon at a time