Metropolitan Water Reclamation District of Greater Chicago

Welcome to the September Edition of the 2024 M&R Seminar Series

November 8, 2024

NOTES FOR SEMINAR ATTENDEES

- Remote attendees' audio lines have been muted to minimize background noise.
  For attendees in the auditorium, please silence your phones.
- A question and answer (Q/A) session will follow the presentation.
- For remote attendees, please use "**Chat**" only to type questions for the presenter. For other issues, please email Pam to SlabyP@mwrd.org.
  For attendees in the auditorium, please raise your hand and wait for the microphone to ask a verbal question.
- The presentation slides will be posted on the MWRD website after the seminar.
- This seminar has been approved by the ISPE for one PDH and approved by the IEPA for one TCH. Certificates will be issued only to participants who attend the entire presentation.

Elizabeth W. Keddy, PE, LEED AP

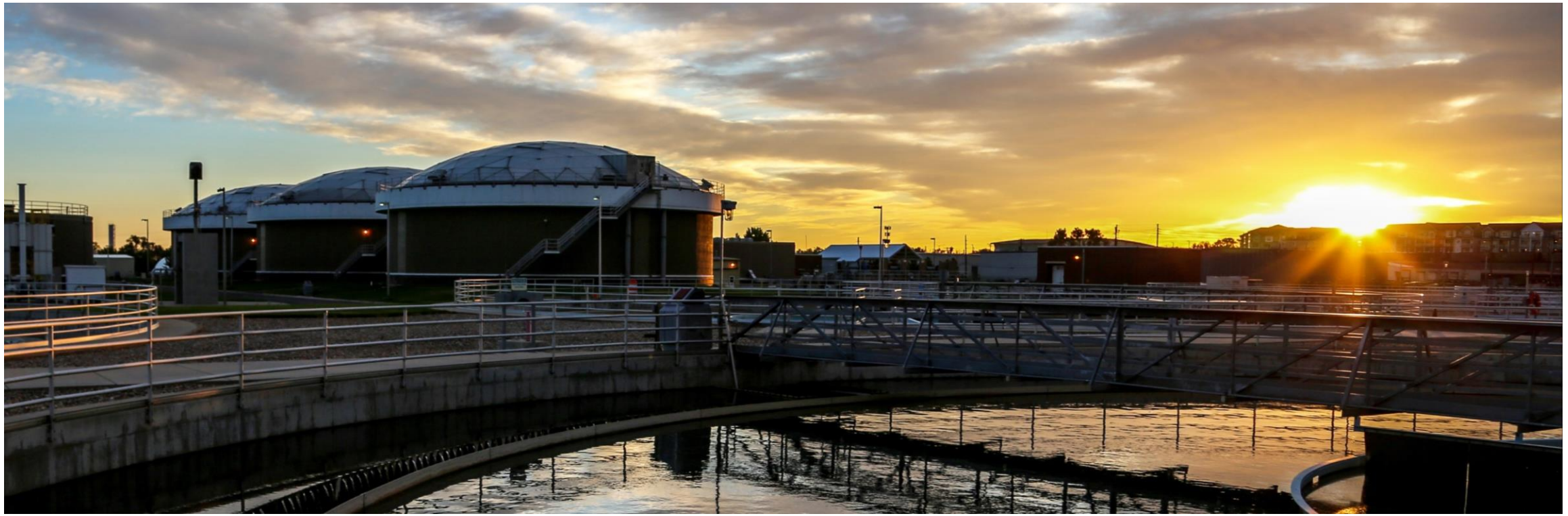
Senior Associate, Hazen and Sawyer, Tampa, Florida

Ms. Keddy is an environmental engineer specializing in energy management, data analytics, asset management, and sustainable and resilient infrastructure. She has over 16 years of experience leading the planning, design, implementation, operation and maintenance of water, wastewater, and energy projects. She has been with Hazen and Sawyer since January 2020. Ms. Keddy is a Licensed Professional Engineer in Florida and Massachusetts and a Leadership in Energy and Environmental Design Accredited Professional (LEED AP) from the U.S. Green Building Council. She is Chair of the FWEA Utility Management Committee and Chair of the FSAWWA Region IV Technical & Education Committee. Ms. Keddy has a Bachelor's and Master's in Environmental Engineering from University of Florida.

Elizabeth Watson Keddy, PE, LEED AP

- Environmental Engineer with 16 years experience:
  - **All Things Water**
  - **Sustainability and Resiliency**
  - **Energy and Asset Management**
  - **Utility Management (Strategic Planning, Organizational Health, Data/Digital, Funding/Finance, etc.)**
- With Hazen for 4 years (Tampa and S FL)
- Energy Manager of SUEZ North America for 7 years
- 5 years in engineering consulting prior
- Go Gators

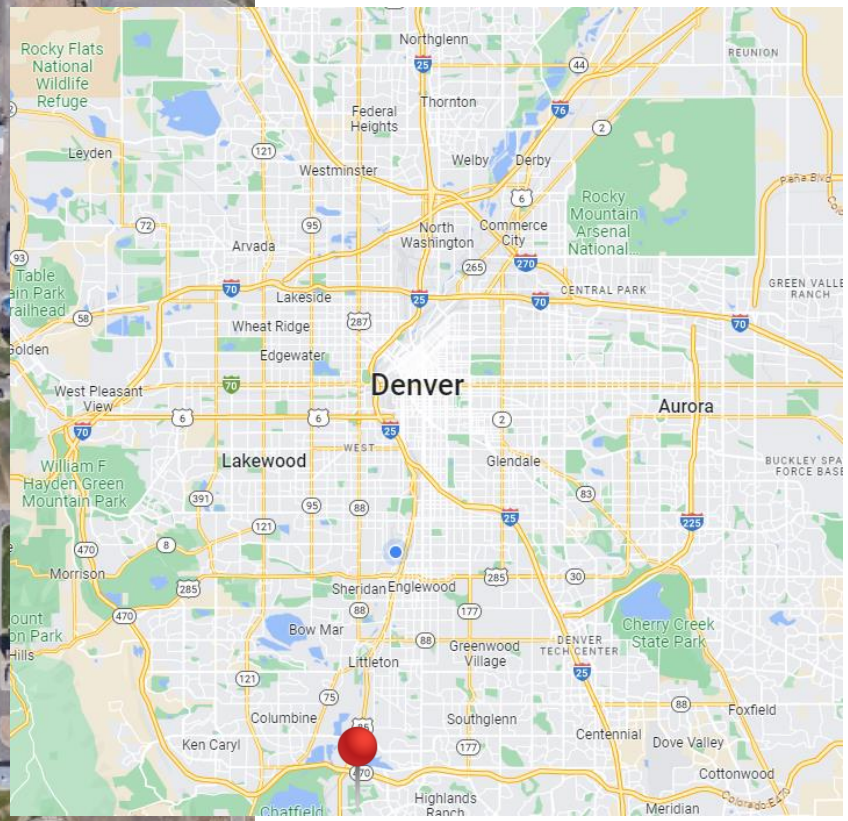
Hazen



Roadmap for Achieving Energy Management Vision and Goals:

South Platte Renew Improves Energy Efficiency While Addressing Regulatory Challenges and Aging Infrastructure in Colorado

Friday, November 8, 2024, at Metropolitan Water Reclamation District of Greater Chicago (MWRDGC)



SOUTH PLATTE RENEW

OWNED BY LITTLETON/ENGLEWOOD

History

- 1977 – Original Construction
- 1991, 1999, 2008 – Major Updates

Size

50 MGD Permitted

18 MGD Average Flow

53 Acres

Process

- Trickling Filters/Aeration
- Digestion/RNG

Energy Usage

- ~20,000,000 kwh/year
- >$2 million/ year

Energy Drivers

Increasing regulatory pressure

Energy Drivers

Increasing regulatory pressure

Aging Infrastructure

Energy Drivers

Increasing regulatory pressure

Aging Infrastructure

Increasing operating costs

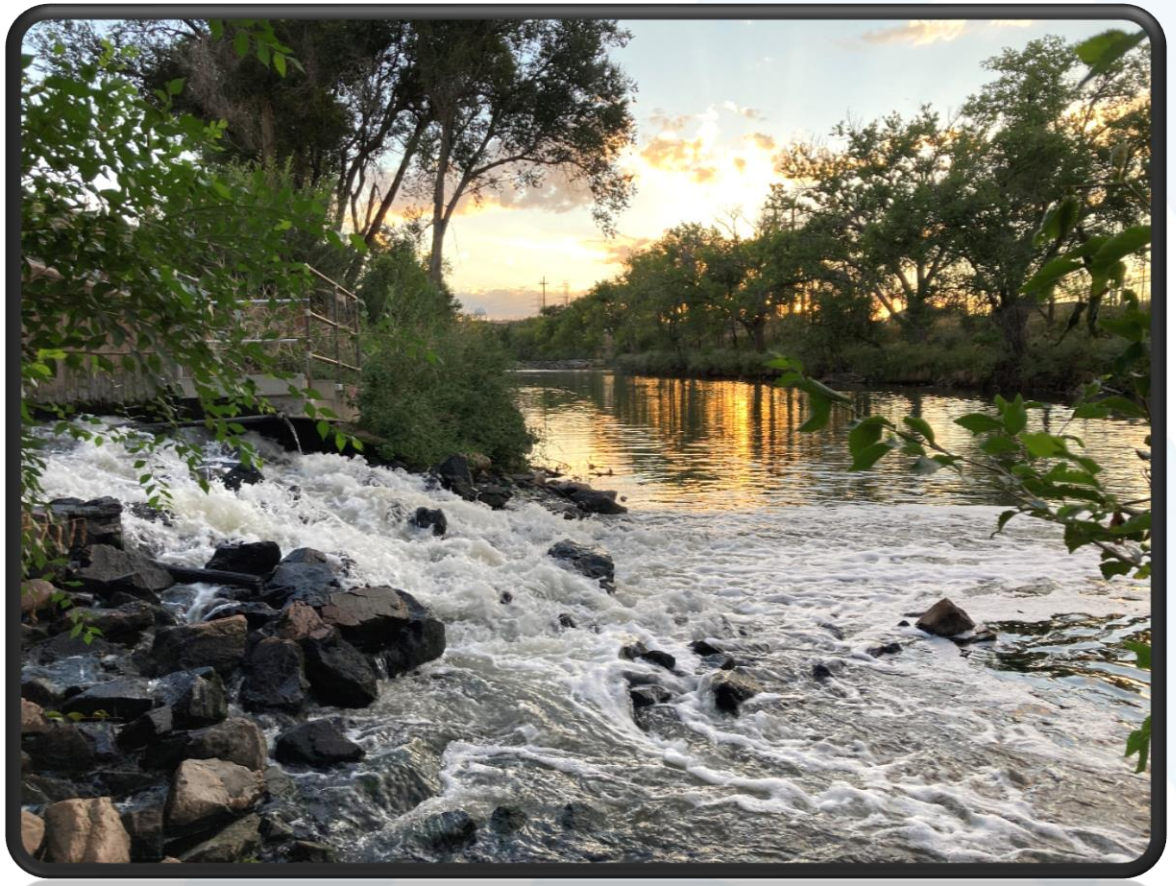
Energy Drivers

Increasing regulatory pressure

Aging Infrastructure

Increasing operating costs

Environmental stewardship



Path to Energy Efficiency

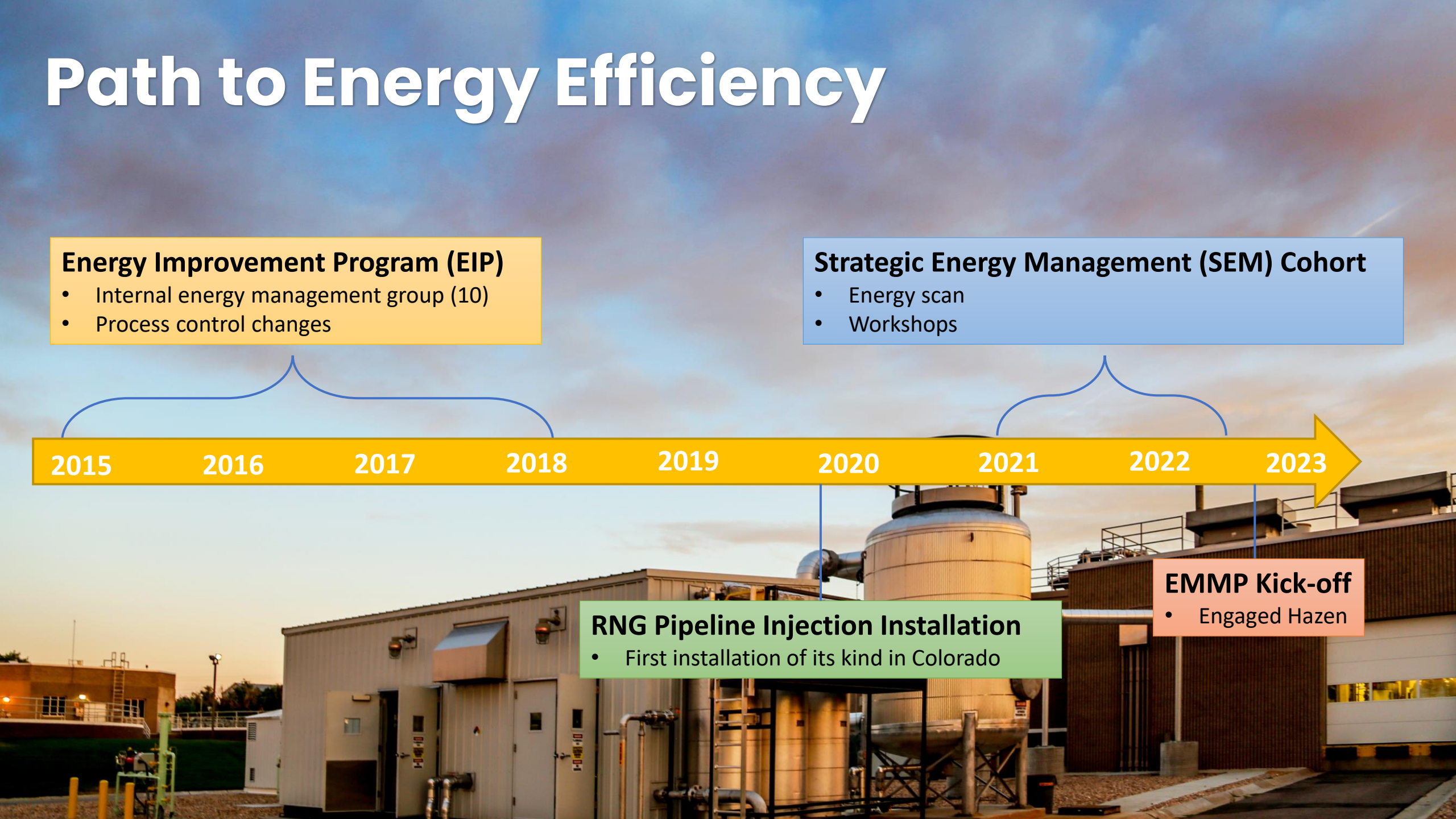
Energy Improvement Program (EIP)
- Internal energy management group (10)
- Process control changes

Strategic Energy Management (SEM) Cohort
- Energy scan
- Workshops

2015 2016 2017 2018 2019 2020 2021 2022 2023

RNG Pipeline Injection Installation
- First installation of its kind in Colorado

EMMP Kick-off
- Engaged Hazen



Energy Management Goals

Decrease energy use and cost without compromising water quality

- Clear pathway
- Organizational longevity
- Best management practices

Energy Management Approach

Energy usage analysis

Project identification

Program planning

Project Approach

Workshop-based approach to develop buy-in from staff at all levels

- A workshop-based approach maintains open lines of communication and meaningful plant staff engagement:

WS1 - Kickoff	WS2 – Task 1 Energy Baselines and KPIs	WS3 – Task 2a Energy Reduction Project Planning and Prioritization	WS4 – Task 2b Energy Production Project Planning and Prioritization	WS5 – Task 3 Energy Program Management Plan
				
• Project vision and goals • Team responsibilities and roles • Management and communication plan • Information/data requests • Schedule & key deliverables • Consensus on scope and anticipated opportunities	• Energy usage/production overview • Comparison to national benchmarks • Consensus on EMMP Key Performance Indicators • Existing Master Plan Coordination • Preliminary energy opportunities • Consensus on Evaluation Criteria	• Overview of energy recovery alternatives • Overview of energy reduction alternatives • Overview of energy management alternatives • Alignment with existing master plans • Eliminate non-feasible opportunities • Finalize evaluation framework	• Finalize Optimization Projects • Propose preliminary EMMP roadmap • CIP integration • Consensus on Technical Memorandums • EMMP dashboard overview (if applicable/accepted)	• Finalize EMMP roadmap • Discuss Energy Management Integration Practices • TM resolution • EMMP dashboard demonstration (if applicable/accepted)

Energy Usage Analysis Overview

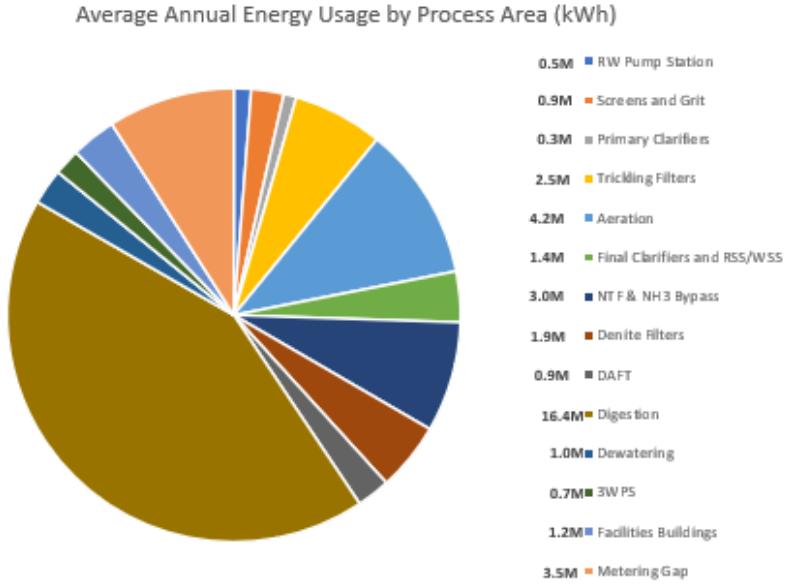
Goal: Establish energy baselines for SPR's EMMP

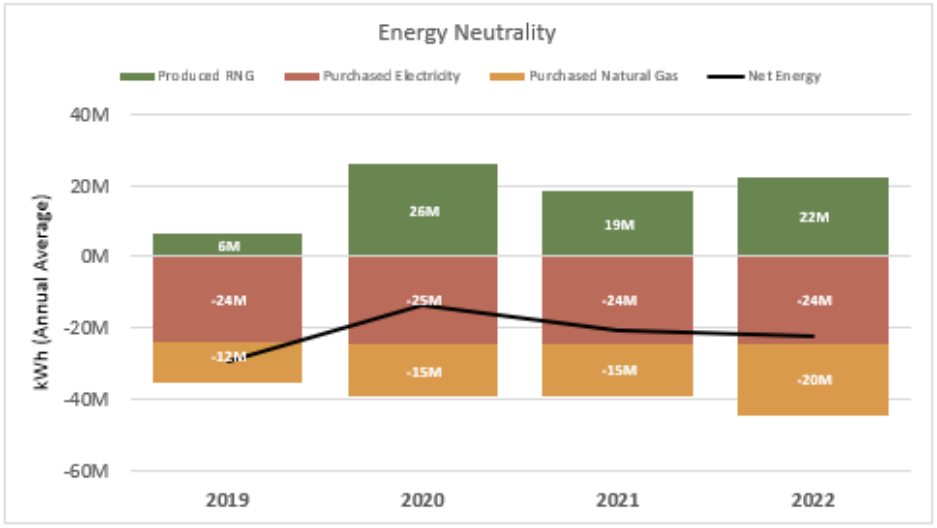
SOUTH PLATTE RENEW

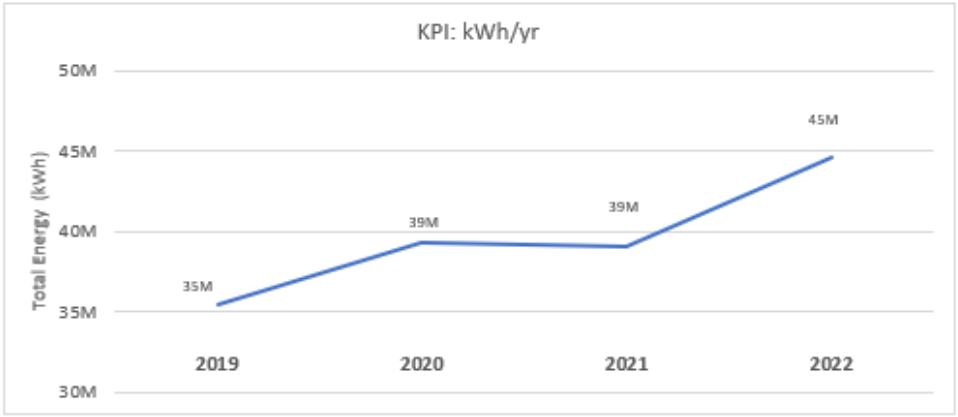
Energy Usage Analysis Tool

Data Range: 2019-May 2022

Data Summary	RW Pump Station	DAFT	3WPS
Plant Flow	Screens and Grit	Digestion	Facilities Buildings
	Primary Clarifiers	Biogas Conditioning	Plant Distribution
	Trickling Filters	RNG Production	
	Aeration	Dewatering	
	Final Clarifiers		
	NTF & NH3 Bypass		
	Denite Filters		



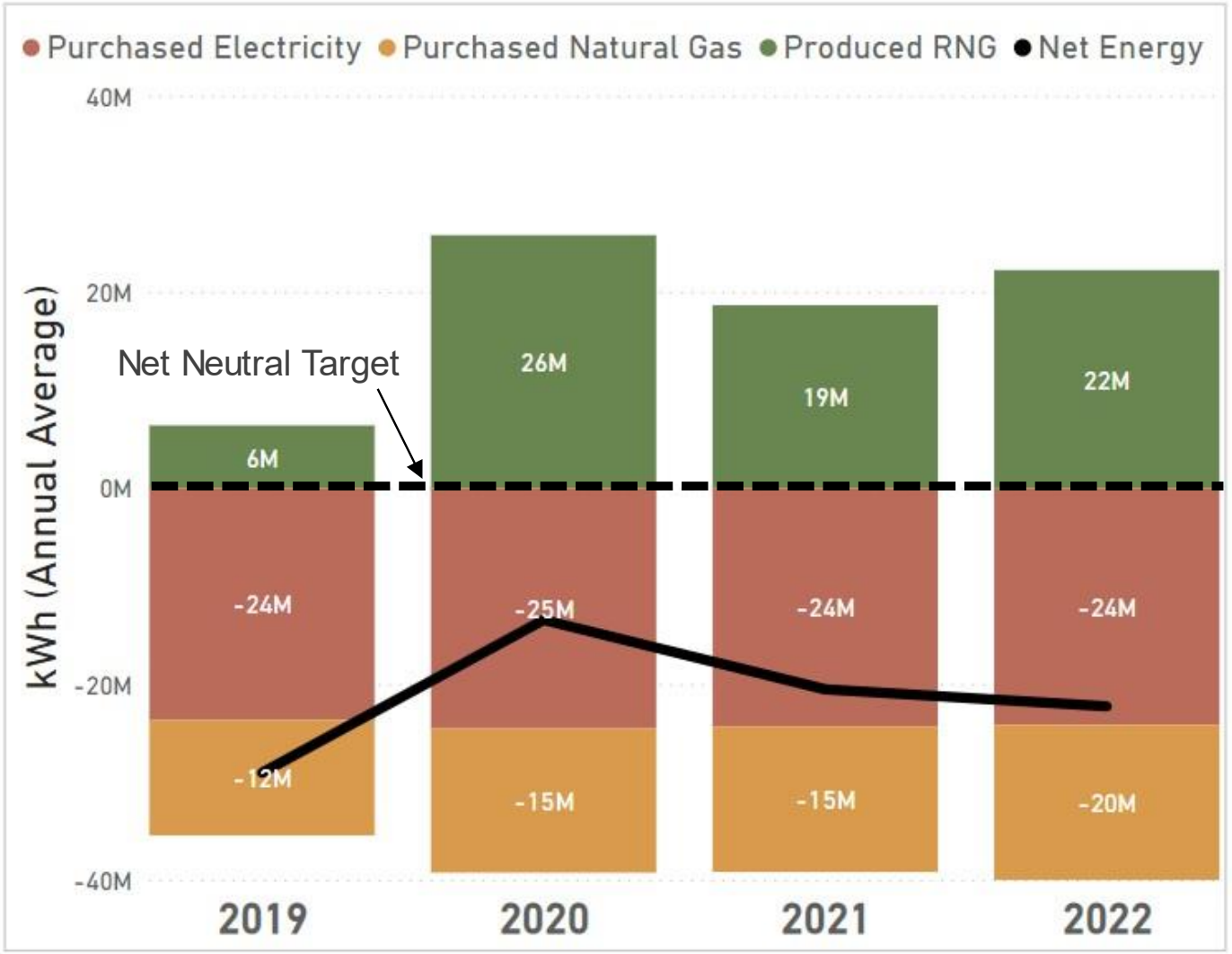




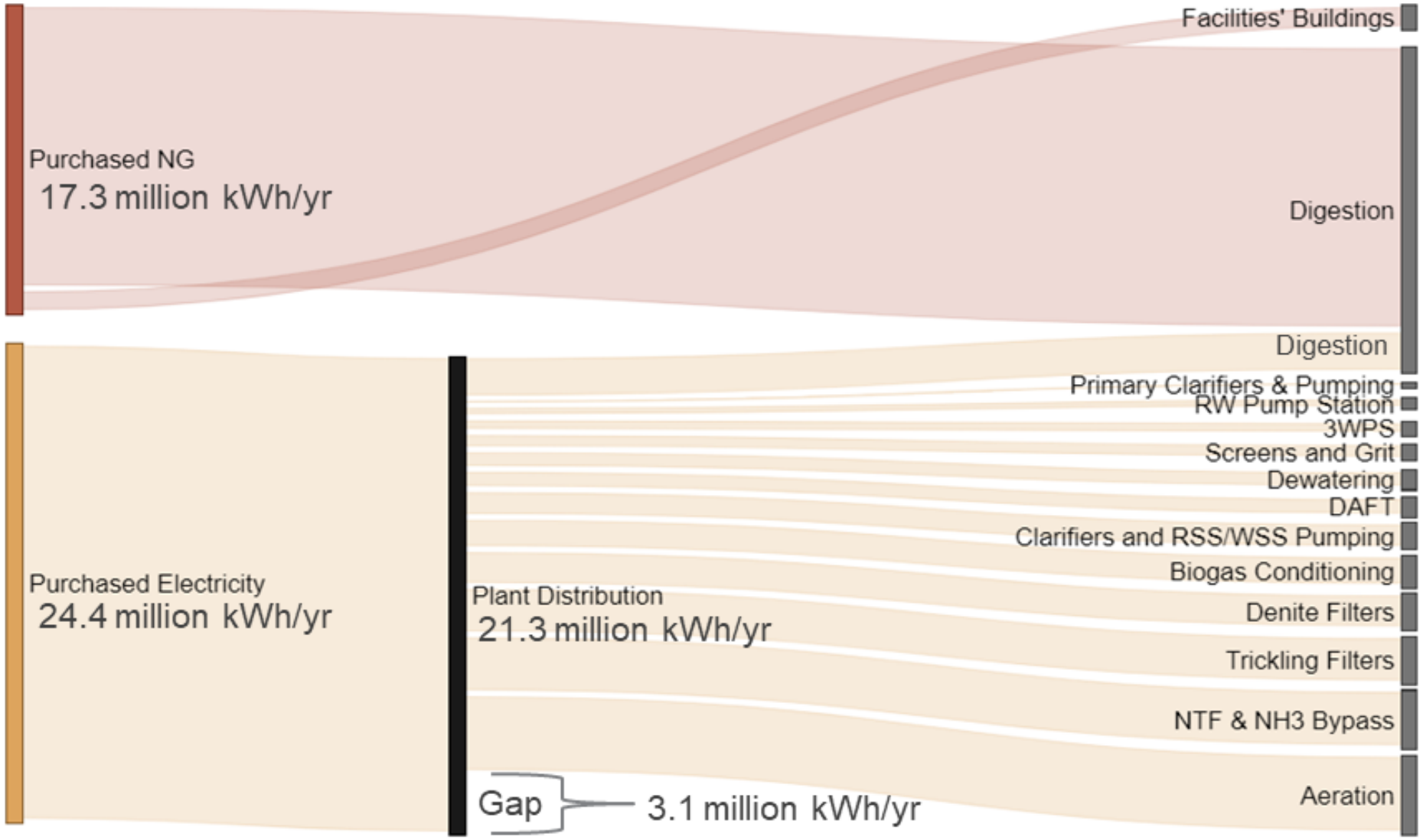
Energy Neutrality Baseline

- RNG = 55% of total energy demand (2020-2022 average)

SPR is much closer to neutrality than most wastewater utilities!

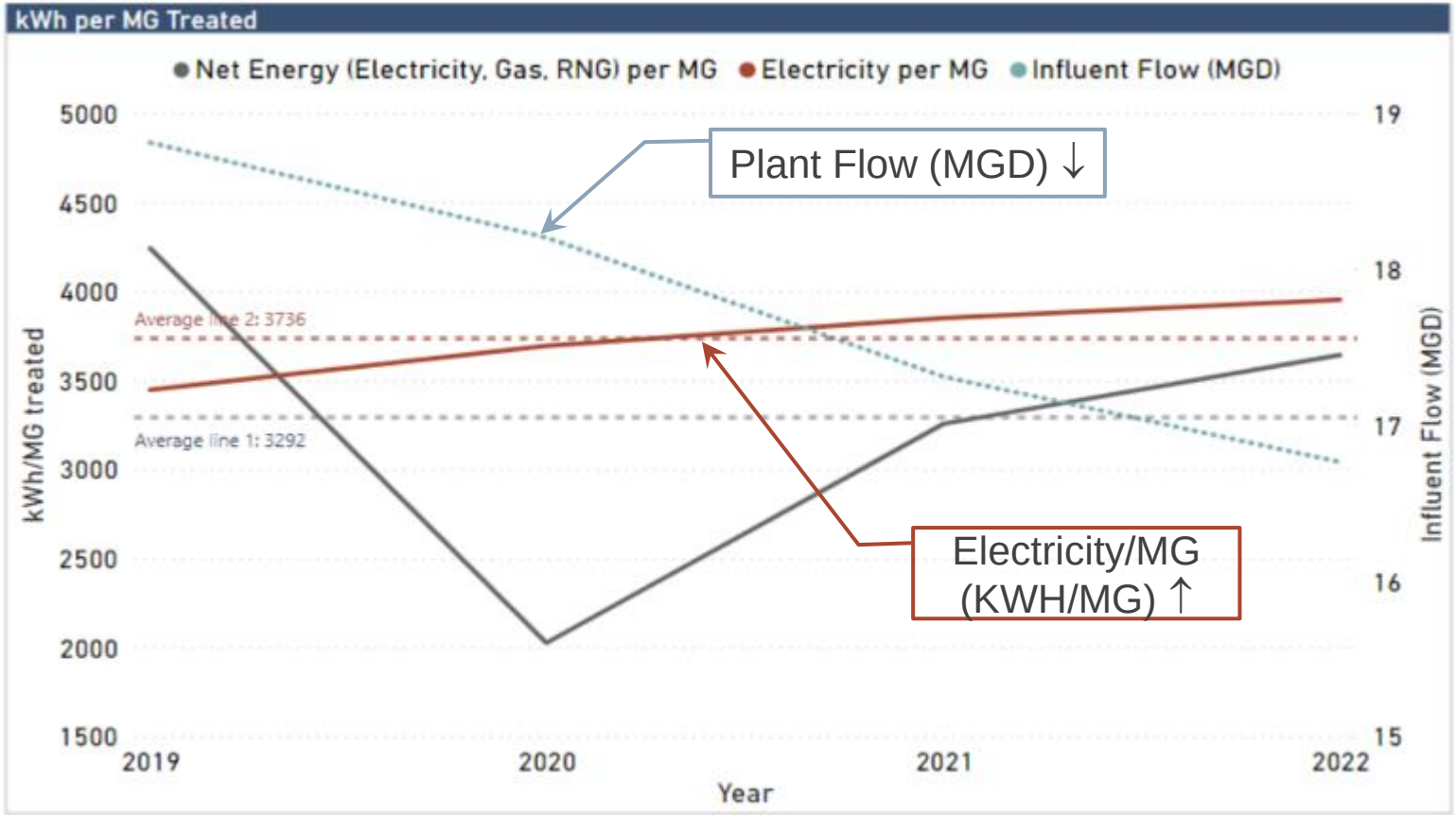


Purchased Energy Flow Schematic (Sankey Diagram)



Key Performance Indicators (KPIs) Recommended

- kWh/MG treated
- Individual equipment (pumps, blowers, etc.) efficiency (%)
- kWh per treatment process (aeration, digestion, NTFs, etc.)
- kWh/pound N removed
- Energy produced vs energy used
- Results of energy projects and operational optimization improvements completed
- Progress towards energy neutrality and energy resiliency



Average energy intensity is 3,100 to 4,700 kWh/MG

Key Findings

Observations	Recommendations
3.1 million Kilowatt-Hour (kWh)/year gap between SPR's existing energy monitoring and electricity purchased from Xcel	Expand SPR's energy monitoring by prioritizing actionable information and integrated implementation
SPR uses between **3,100 and 4,700 kWh/MG,** which is ~50% higher than national benchmarks	Complete a Process Optimization Study, related energy efficiency projects and procedures to reduce kWh/MG
Electricity consumption does not significantly change as the plant flow varies	
Aeration, trickling filters, digesters, Nitrifying Trickling Filter (NTFs), and ammonia bypass pumps are the highest electric uses	
Digestion is the most energy-intensive process due to natural gas heating requiring 33% of total energy use	Complete a Digester Heating Demand Study and Heat Pump Evaluation to identify ways to reduce or offset natural gas (NG)

Project Planning and Prioritization

Prioritization Criteria	Weight
Employee Services	5%
Regulatory Requirements	5%
Community Services	10%
Risk & Resiliency	15%
Operational Compatibility & Operability	15%
Environmental Considerations	10%
Impact to Energy Utilization	10%
Life Cycle Benefit	30%

Recommended Studies and Projects

Rank	Project Name	Cost Estimate	Score
1	Energy Resiliency Evaluation	$100,000 - $250,000	57
2	VFDs on Identified Pumps	$90,000	57
3	Heat Pump Evaluation	$100,000	56
4	VFD on Identified Fan	$20,000	55
5	Lighting and Lighting Controls Retrofits	$70,000	54
6	Biogas Production Optimization Study	$250,000 - $500,000	49
7	Digester Heating Study	$100,000	46
8	Process Optimization Study	$150,000 - $250,000	44

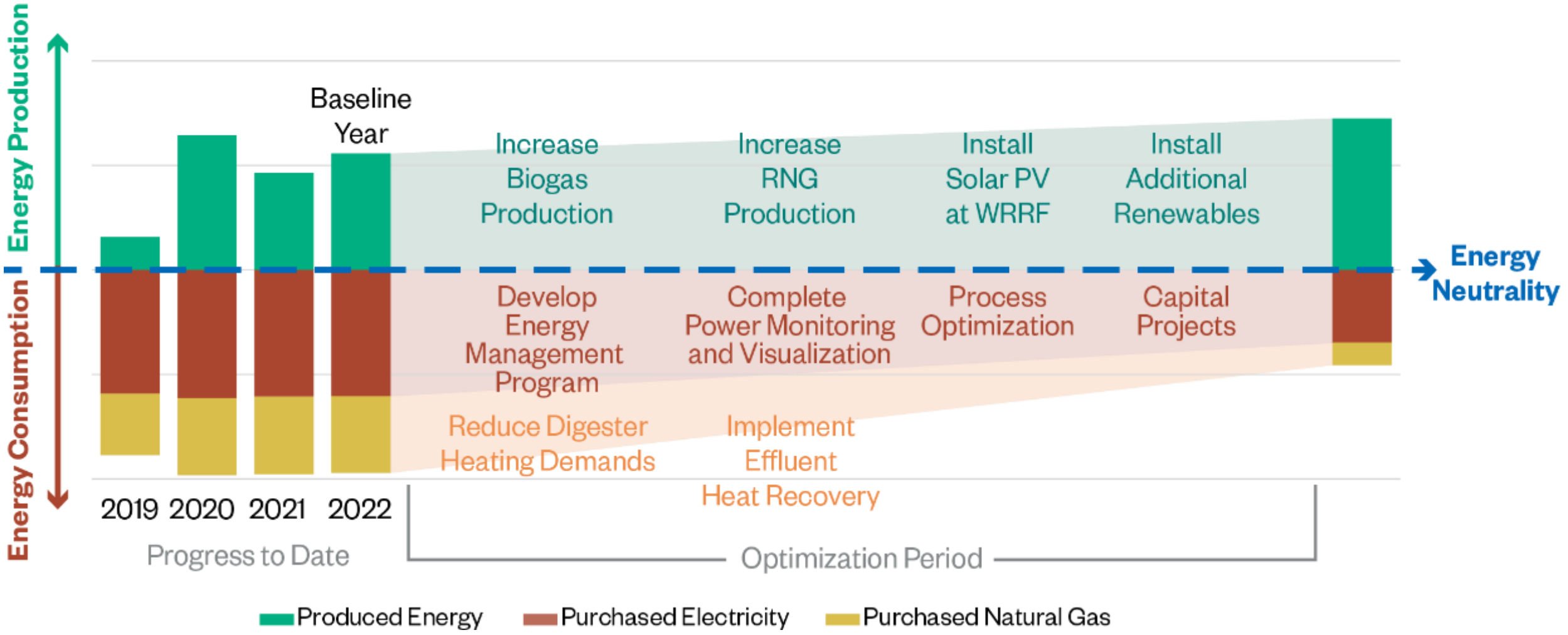
Energy Resiliency Assessment

- ***Capacity to respond to anticipated and unanticipated energy supply and distribution disruptions.***
- Evaluation Recommendations:
  - **Normal and standby power supply.**
  - **Electrical redundancy and flexibility (“single point of failure”)**
  - **Diagnostic capabilities to facilitate timely location and cause of plant energy distribution failures.**
  - **Emergency preparedness and response capabilities.**
  - **System Documentation**
  - **Condition assessments**

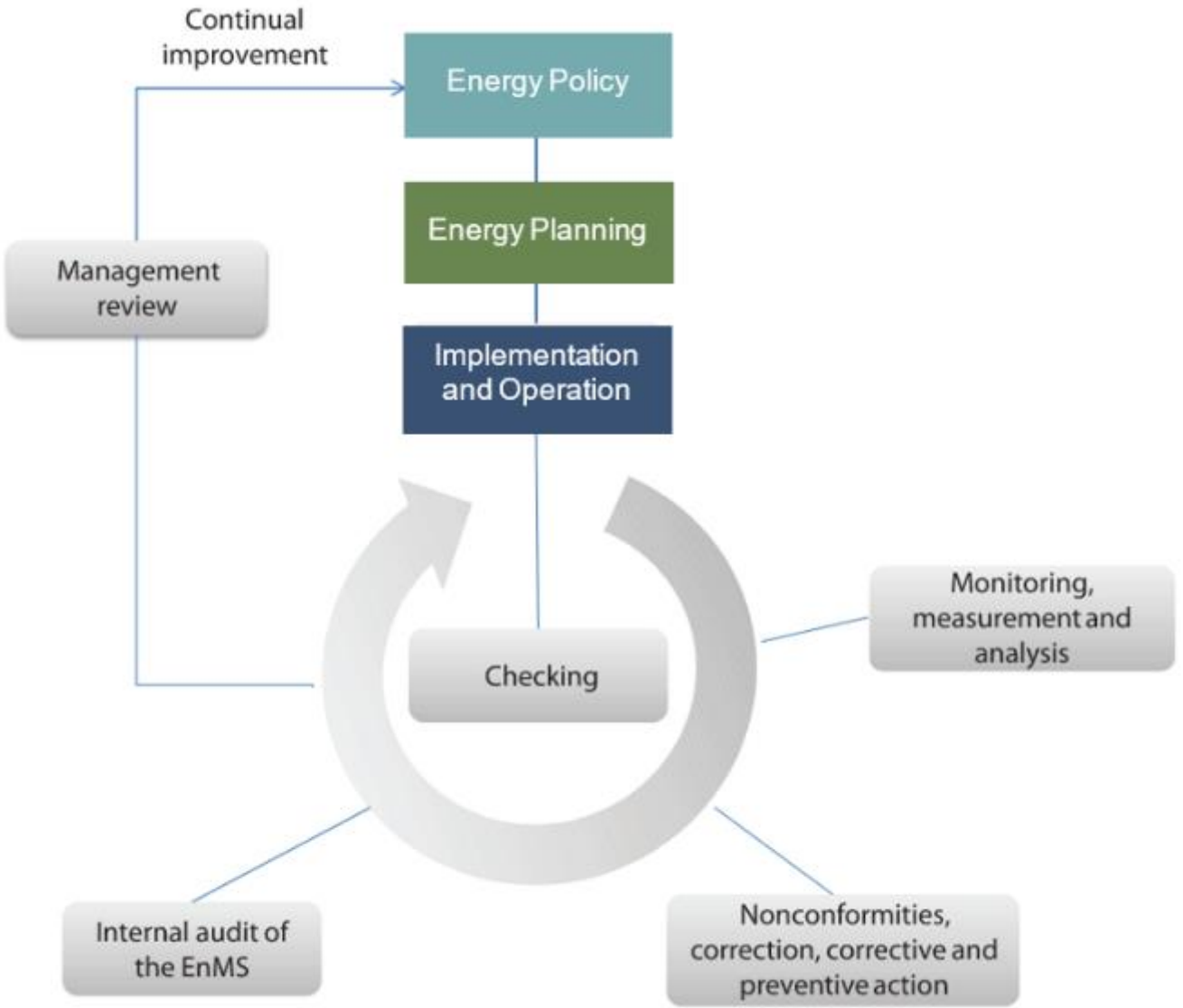
Additional Energy Projects

- **Heat Pump Evaluation:** Confirm the feasibility of using high-temperature heat pumps for effluent temperature reduction and thermal energy recovery for digester and building heating in coordination and alignment with the Digester Heating Demand Study and Biogas Production Optimization Study.
- **Biogas Production Optimization Study:** Identify opportunities to further optimize biogas and RNG production.
- **Digester Heating Study:** Investigate alternatives to reduce digester heating demands by increasing solids concentration and/or improving heat retention. If SPR moves forward with heat pump installation, it may negate the need for decreasing digester heating demand.
- **Process Optimization Study:** Identify “quick wins” that reduce energy consumption with little to no capital cost, such as improved process control strategies, and enhance process turndown capabilities, such as managing the number of online process units and expanding the use of and/or optimizing variable speed systems.

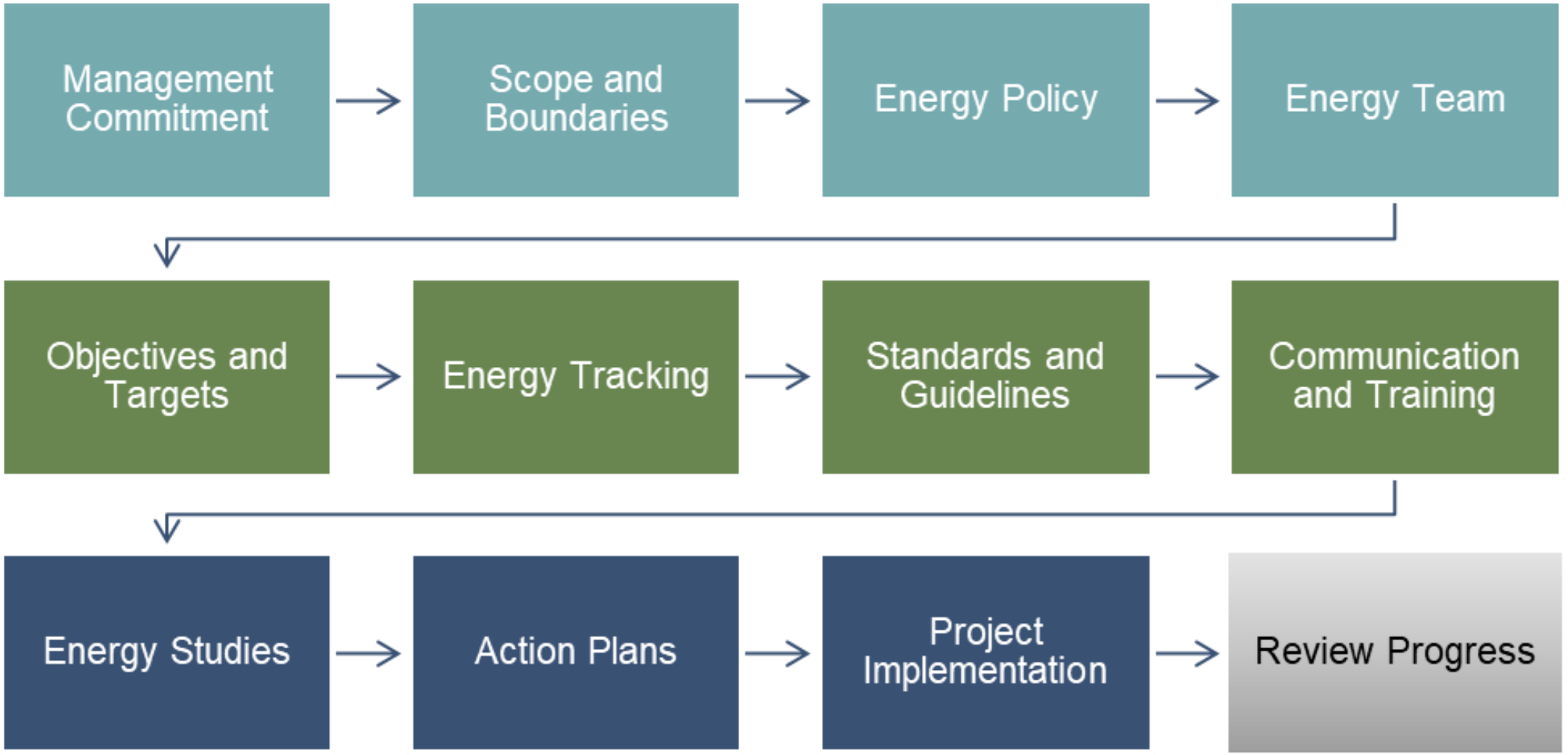
SPR's Path to Energy Neutrality



Recommended Industry Standard: ISO 50001 Energy Management Systems

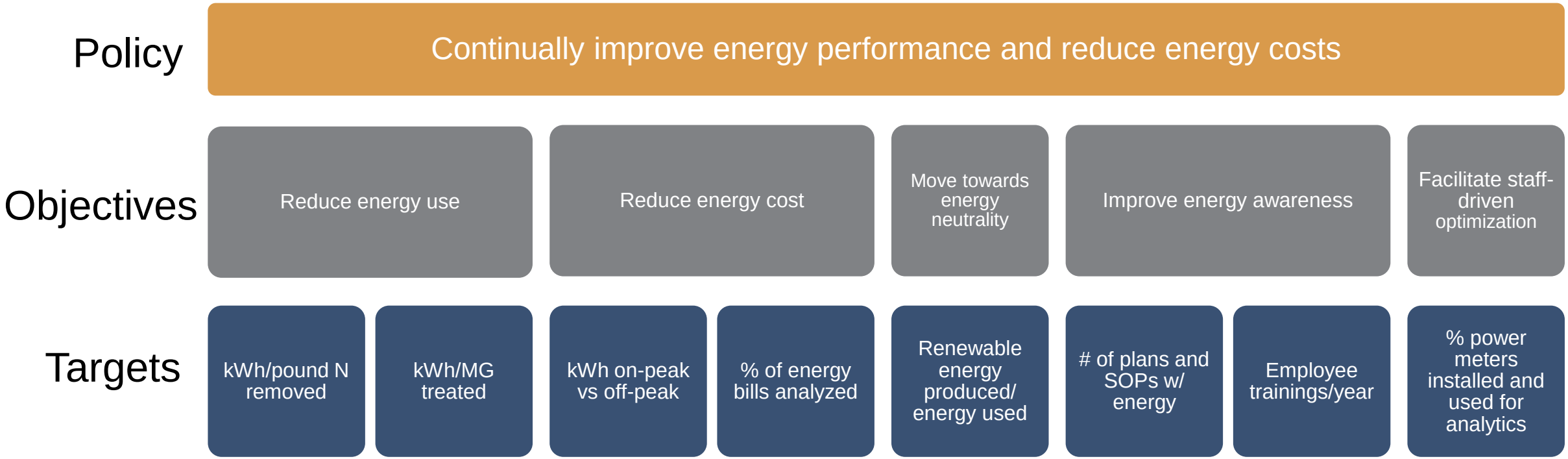


Energy Policy, Planning, Implementation and Operation, and Review Workflows



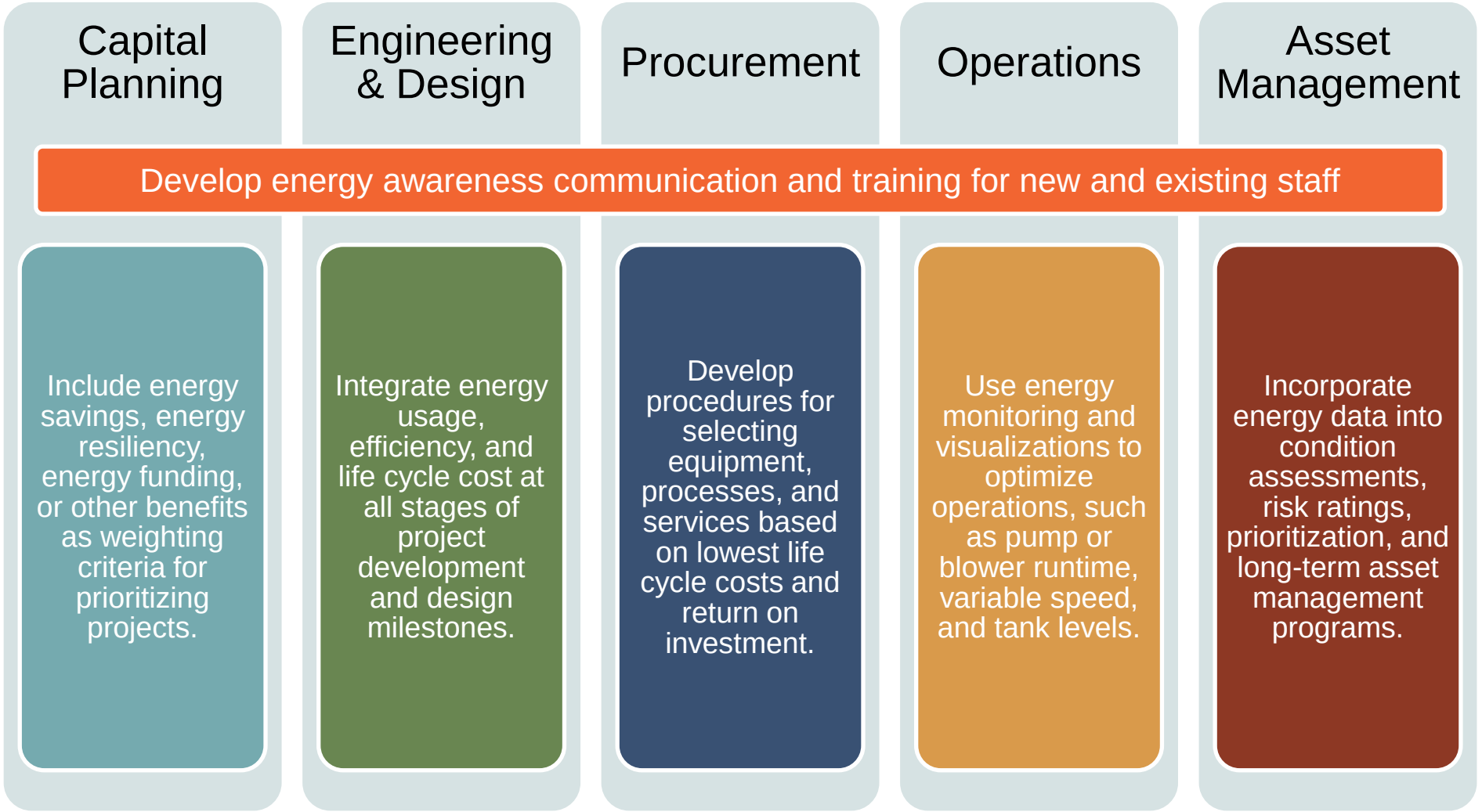
Set Objectives and Targets

Task 12 in the 50001 Ready Navigator

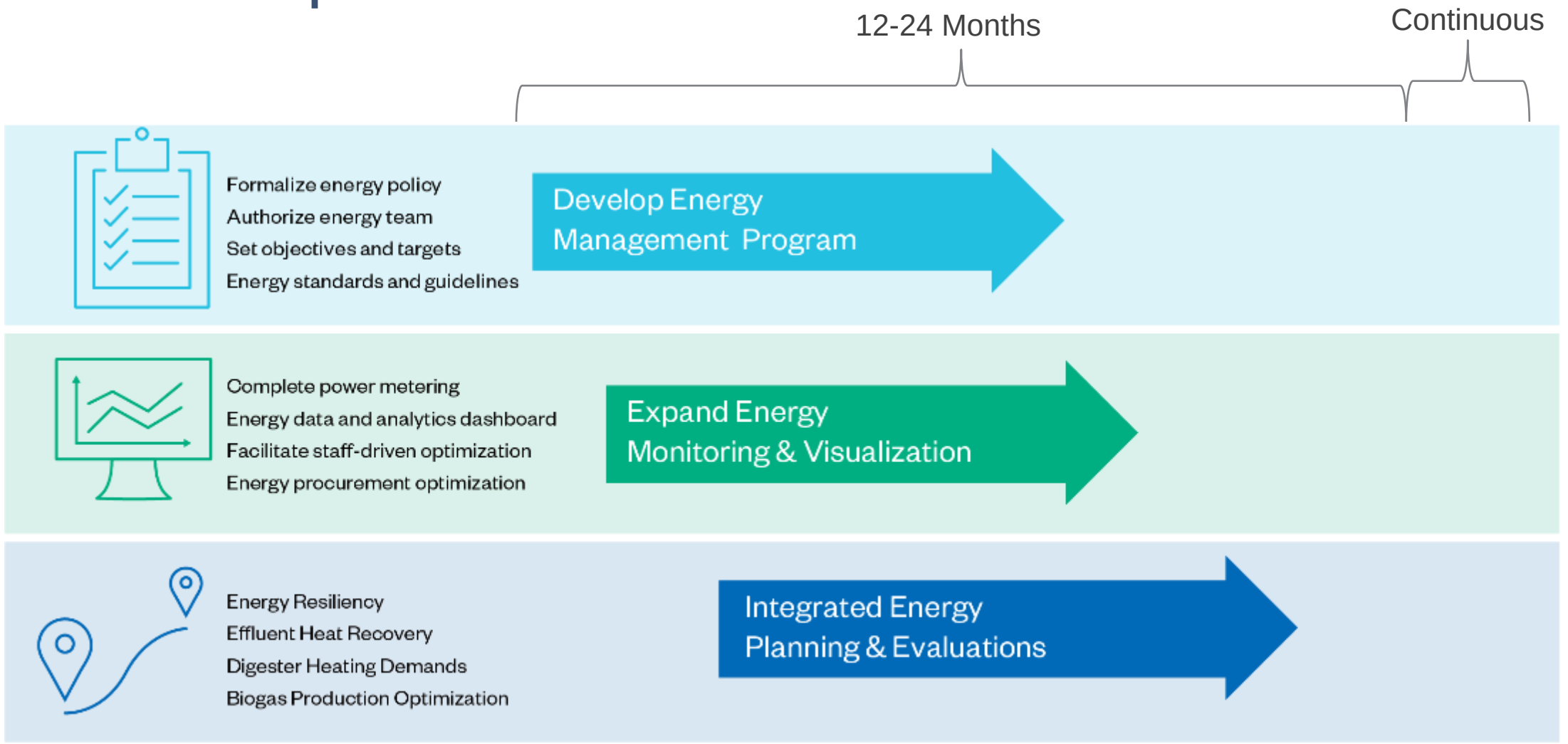


Training, Resources and Communication

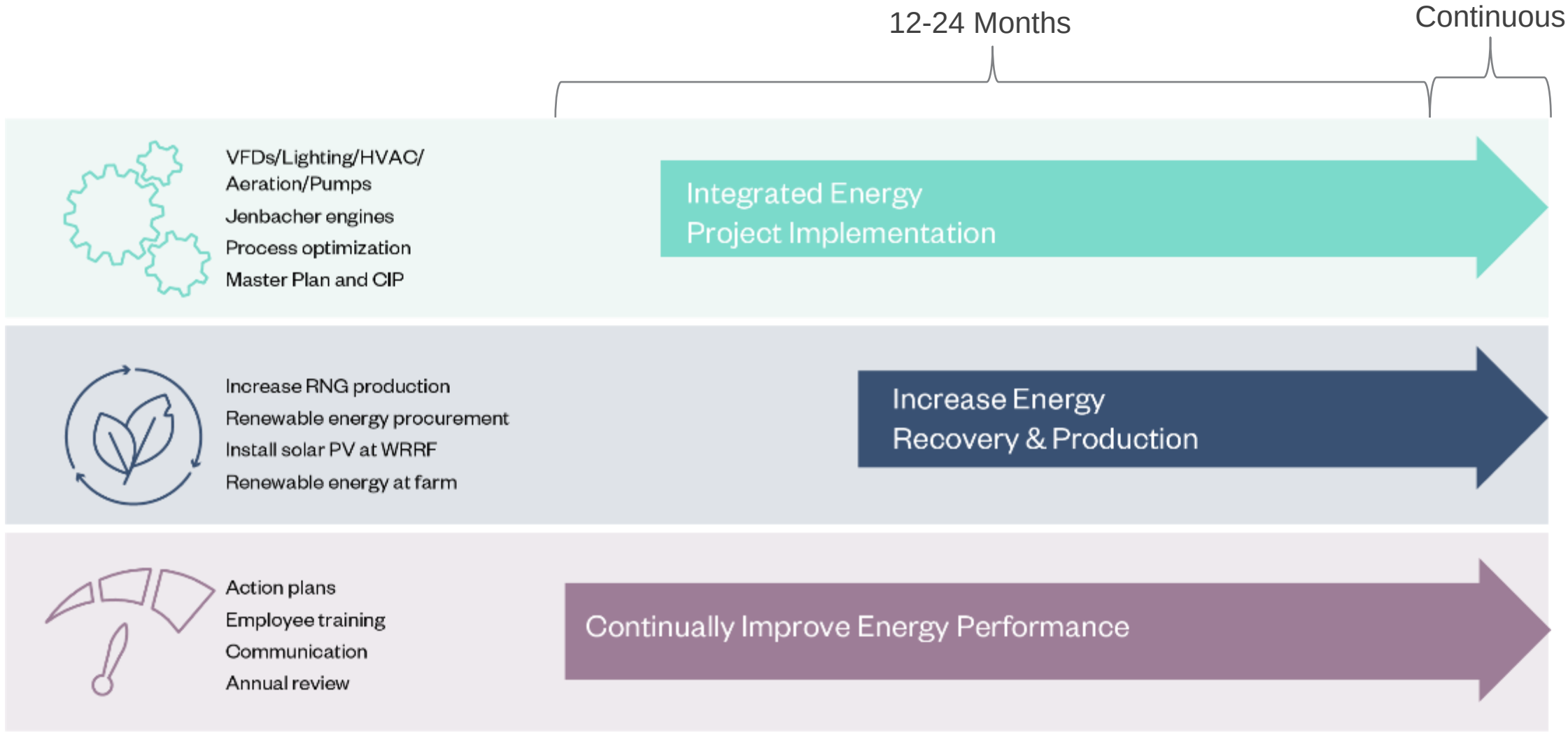
Tasks 6, 14 and 15 in the 50001 Ready Navigator



EMMP Roadmap



EMMP Roadmap (Cont.)



Funding Opportunities

	Type of Funding						Type of Project				
	Grants	Loans	Lease	Bonds	Credit Subsidy	Tax Incentive	Energy Efficiency	Renewable Energy	Combined Head and Power	Hazard Mitigation / Resiliency	Energy Reduction
FEDERAL											
DOE - Energy Infrastructure Reinvestment (EIR) Program		■			■		■	■	■		■
DOE - Title 17 Innovative Clean Energy Loan Guarantee Program		■					■	■	■		■
House of Representatives - Community Project Funding - Subcommittee on Energy and Water Development	■						■	■	■	■	
US Congress - Congressionally Directed Funding - Subcommittee on Energy and Water Development	■						■	■	■	■	
IRS - The Energy Credit or Energy Investment Tax Credit (ITC)						■		■	■		■
IRS - The Production Tax Credit (PTC)						■		■	■		■
EPA - Water Infrastructure Financing and Innovation Act (WIFIA)		■					■	■	■	■	■
Revenue Municipal Bond				■			■	■	■		■
DHS / FEMA - Hazard Mitigation Grant Program (HMGP)	■						■	■	■	■	■
STATE											
State Revolving Fund		■					■	■	■	■	■

For more state, local and utility incentives: dsireusa.org

Next Steps

	Short-term (2023/24)	Mid-term (5-year plan)	Long-term (5+ years)
Program Development	Vision/Mission/Goals/Objectives Energy Team SharePoint Page Energy Tools	Integrate into: Capital projects Procurement Operations & Maintenance	Holistic energy planning Long-term energy team
Planned Projects	Digester Heating Study LED Replacements	Energy Resiliency Assessment	Renewable Energy Assessment

Hazen

Thank You!

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