Wastewater Plant Modernization: Preparing for Regulations & Resiliency Requirements

2025 WEF eShowcase Webcast

OPTERRA
ENERGY SERVICES

Speakers & Agenda

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Topics to Cover

1. Major Challenges Driving the Need to Modernize
2. A Comprehensive Approach to Upgrades
3. Sustainable Microgrids for Resilient Operations
4. Audience Q&A Session

01

Major Challenges Driving the Need to Modernize

Technical Challenges to Address

Pending PFAS Regulations

(Forever Chemicals)

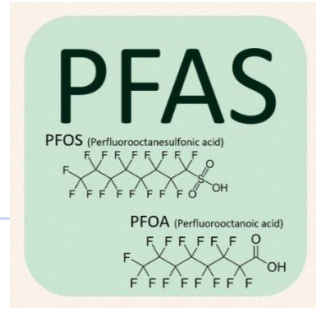
Nutrient Removal Regulations

Grid Power Disruptions

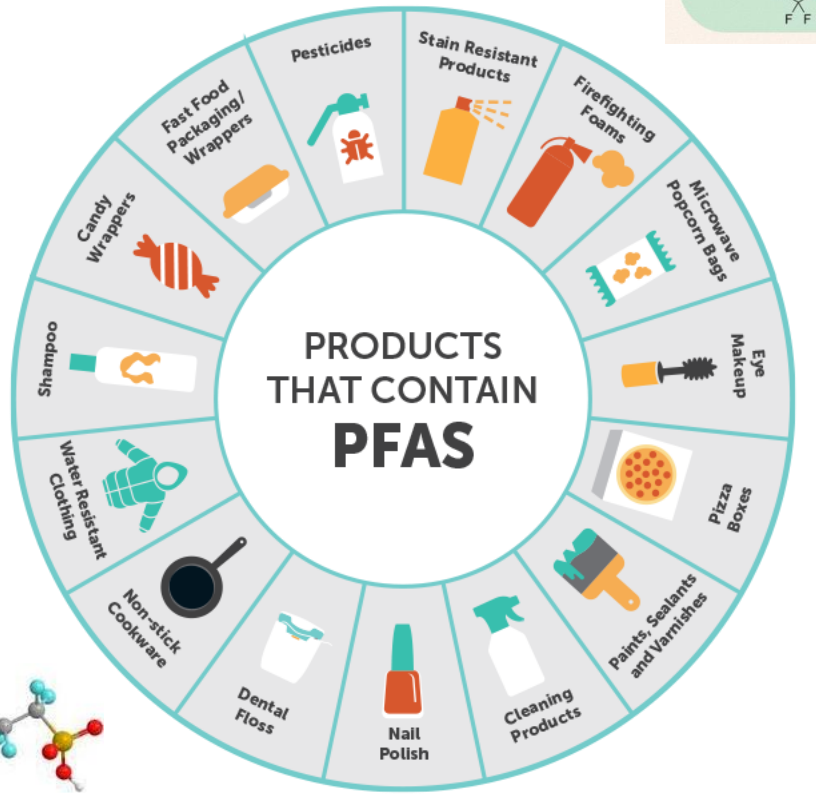
(Energy Resiliency)

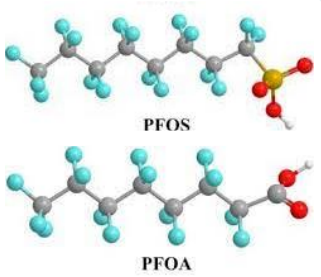
WHAT is PFOS/PFAS?

PFA/PFOS Regulations



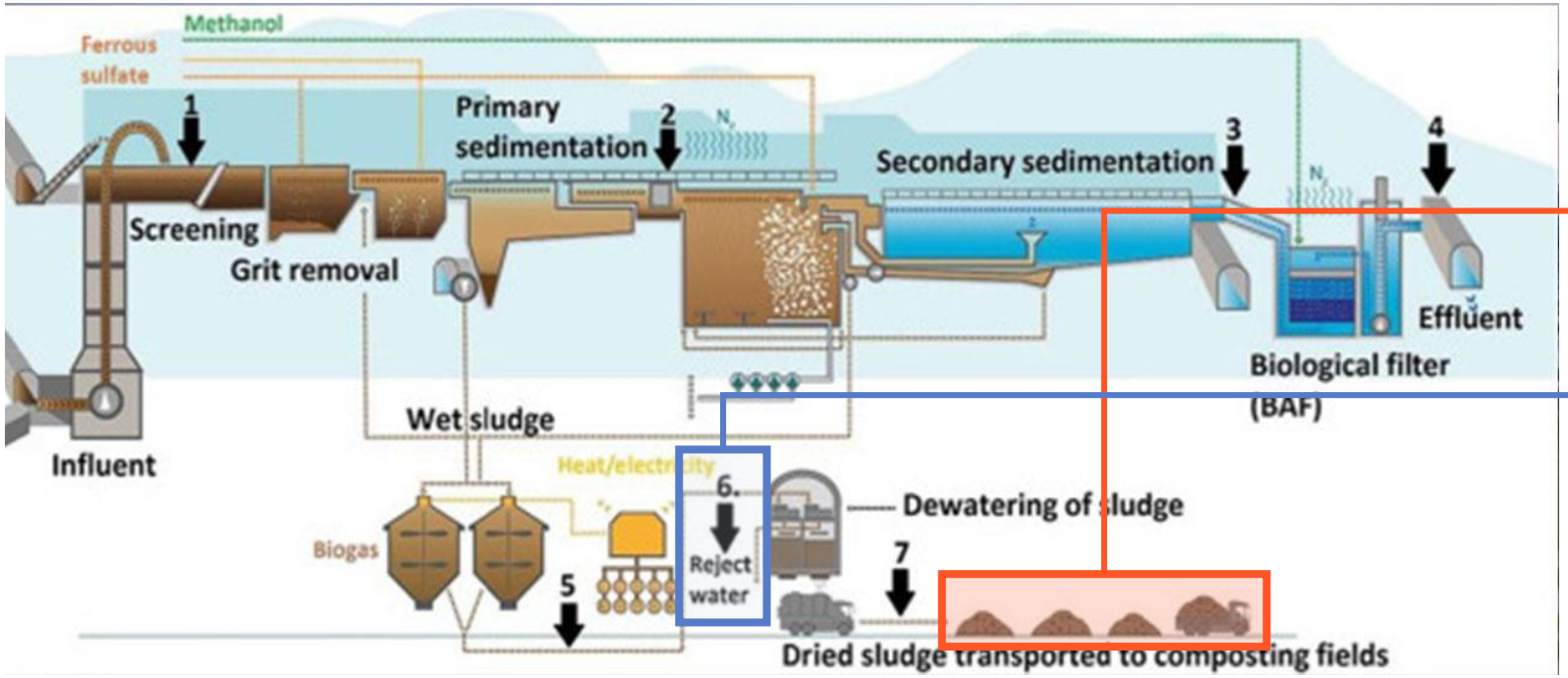
- PFA/PFOS are forever chemicals found in water, air, soil, and organisms
- Incredibly stable molecules that are heat resistant, water resistant, oil resistant, and difficult to remove/break down
  - Mainly exist in water due to their hydrophilic heads and show hydrophobicity due to hydrophobic tails
- The EPA is now regulating all Per- and Polyfluoroalkyl substances
  - Regulations are in place for water treatment facilities and expected soon for wastewater treatment
- Methods for removal in water include electrostatic attraction, hydrophobic interaction, foam fractionation, anion exchange, and ligand exchange (sorbent technology)





Wastewater PFAS Strategies

Biosolids & Dewatering Sidestream Treatment



Biosolids are where PFAS primarily concentrates

Solids dewatering is another area of PFAS concentration

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PFAS EPA LIMITS Set Starting 2024

- EPA is setting enforceable Maximum Contaminant Levels (MCLs) at **4.0 parts per trillion** for PFOA and PFOS, individually
  - This standard will reduce exposure to PFAs in drinking water (lowest levels feasible for effective implementation)

- For PFNA, PFHxS, and HFPO-DA (GenX chemicals), EPA is setting MCLs of **10 parts per trillion**

Source: EPA Presentation - Final PFAS National Primary Drinking Water Regulation

Current Implementation Timeframes for Water Systems

2024–2027

Within **three years** of rule promulgation

- Initial monitoring must be complete

2027–2029

Starting **three years** following rule promulgation

- Results of initial monitoring must be included in Consumer Confidence Reports (i.e., Annual Water Quality Report)
- Regular monitoring for compliance must begin, and results of compliance monitoring must be included in Consumer Confidence Reports
- Public notification for monitoring and testing violations

Starting 2029 →

Starting **five years** following rule promulgation

- Comply with all MCLs
- Public notification for MCL violations

Source: EPA Presentation - Final PFAS National Primary Drinking Water Regulation

What does this mean for Wastewater regulations?

More Stringent Biosolids Regulations for Disposal

1. Reduced ability to land apply biosolids to prevent reintroduction of PFAS
2. Higher costs of disposal for biosolids with PFAS compounds present
3. A focus on technologies that remove these compounds from biosolids such as gasification

Dewatering Sidestream Treatment in Process

1. In a location where concentrations of these compounds are naturally concentrated in the treatment process in smaller liquid volumes making removal more effective

Eventual treatment of effluent as scalable options become cost effective

Current & Upcoming Nutrient Removal Regulations

Why Focus on nutrients?

- Nitrogen and Phosphorus occur naturally but in increased concentrations caused by human activities (causes environmental problems)

Eutrophication of waterways.

- Eutrophication is the increase of organic matter in a system, in this case water, and the effects of that increase such as:
  - Changes in chemical and physical characteristics of waterways (i.e. blue-green algae)
  - Toxicity to aquatic life, and other wildlife including humans
  - Changes in aquatic life including food and habitat
  - Impacts on public health and how water is used especially for recreation
- Nutrient reductions through major dischargers like wastewater facilities are in essence a “low hanging fruit” in combatting nutrient pollution
- Other sources are often more difficult to gauge let alone control

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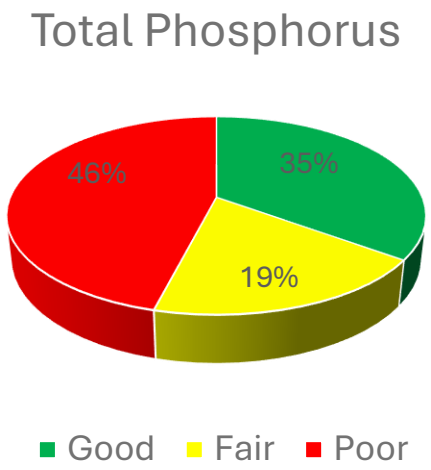
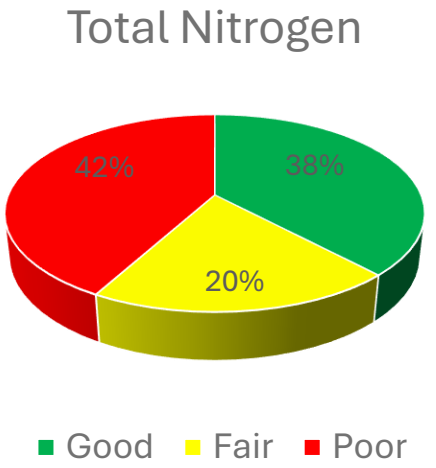
Nutrient Pollution (Rivers and Streams)

- National Rivers & Streams Assessment
  - Surveyed more than 1.2 million miles of streams and waterways
  - The survey found:
    - 42% of river and stream miles surveyed had high levels of nitrogen
    - 46% of river and stream miles had high levels of phosphorus
    - There is a strong correlation between high levels of nutrients and poor water quality and degradation of healthy macroinvertebrate populations
  - Lakes were found to have similar and sometimes worse statistics

For more information visit the EPA's NPDES website

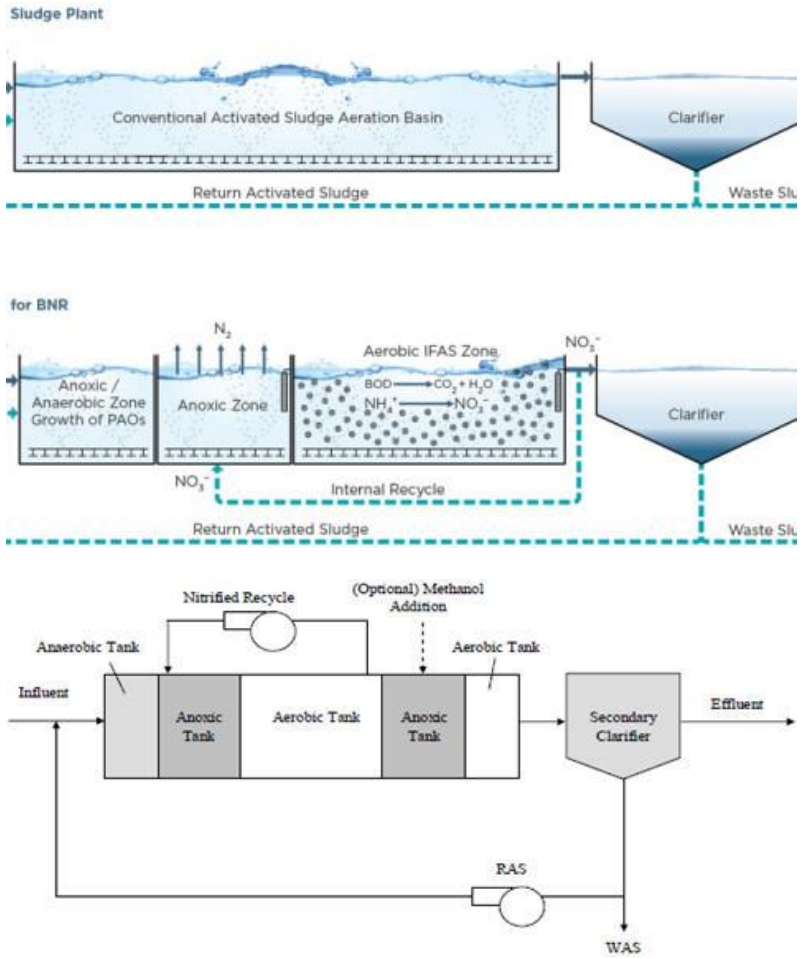




What can plants do to meet regulations?

Implementing nutrient removal is often a cost with no operational or financial gain for the facility

- Many plant configurations can be upgraded or retrofitted to include nutrient removal process changes and allow plants to meet upcoming nutrient regulations
- Often a more comprehensive plant upgrade can help pay for nutrient removal technologies by finding savings in other areas of the plant
  - Examples include:
    - Aeration
    - Pumping & Pump optimization & Equalization
    - Anaerobic Digestion & Renewable Natural Gas
    - Co-digestion
    - Biosolids handling, drying and disposal
    - Automation of systems
    - Onsite hypochlorite generation
    - UV Retrofits
    - Non-Wastewater Upgrades like Solar, Lighting etc.
- Be aware of emerging technologies that can help reduce operational costs such as biosolids gasification



What is Energy Resilience?

The ability to withstand and rapidly recover from power outages and continue operating energy-dependent services. A resilient power system reduces the likelihood of long-duration outages, limits the scope and impact of outages when they do occur, and rapidly restores power after an outage.

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What is Driving Demand for More Resilient and Sustainable Power Systems?

Regulatory Requirements (TX)

Natural Disasters

Power System Reliability

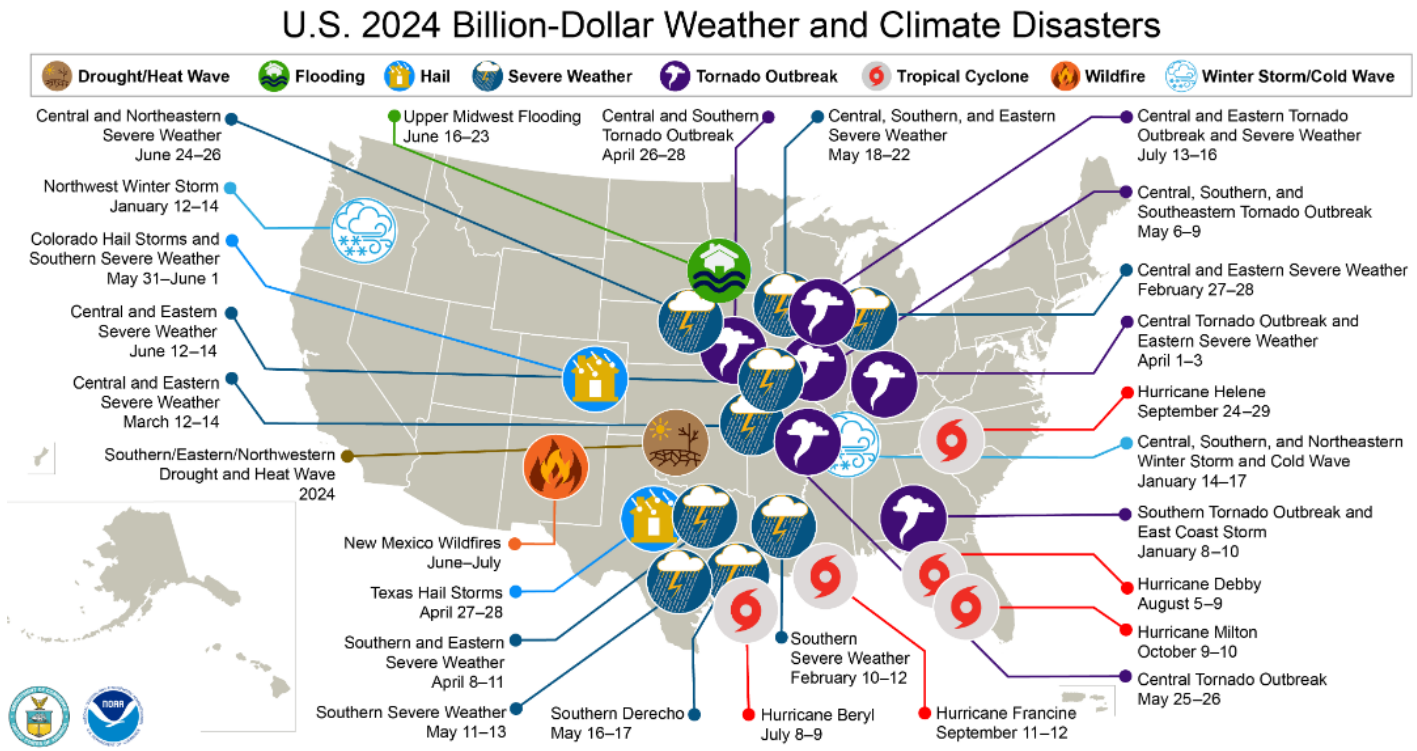
- Deferred maintenance and lack of investment in aging infrastructure
- Electrification and increasing energy demand
- Integration of intermittent resources
- Cybersecurity concerns

Safety & Sustainability Goals

- Drive to decarbonize U.S. energy infrastructure (Inflation Reduction Act)
- Community resiliency programs

Technology Advancements

- Renewable, distributed generation
- Battery energy storage
- Advanced controls and predictive analytics



*This map denotes the approximate location for each of the **27 separate billion-dollar weather and climate disasters that impacted the United States in 2024.***

Source: https://www.ncei.noaa.gov/access/billions/

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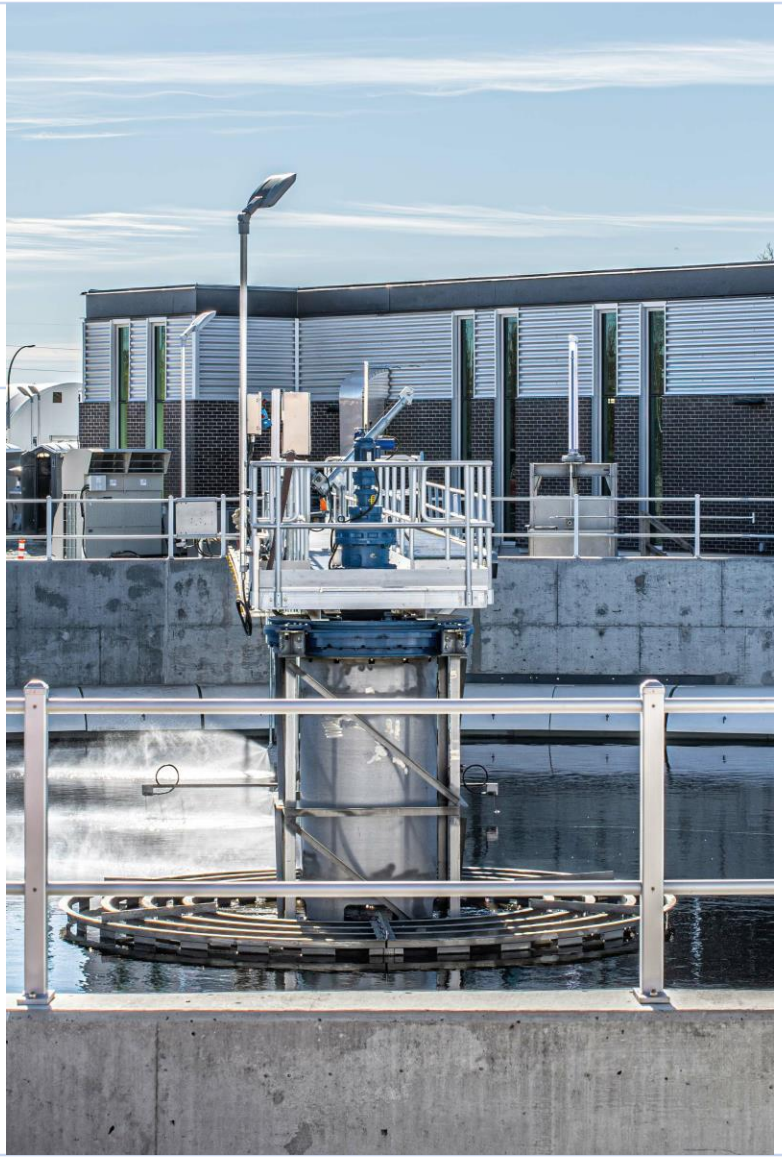
A Comprehensive Approach to Upgrades



About OPTERRA Energy Services

We partner with public institutions to build safer, healthier, and more resilient communities through efficient facilities and infrastructure.

50+ Years
of Experience

9,000+
Energy Projects

300 Employees
Across the U.S.

LS Power

OPTERRA is part of the LS Power family.

50,000 MW
of Power Generation

$65 Billion Invested
In N.A. Infrastructure

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Sectors We Serve

Education

K–12, Community Colleges, Universities

Local Government

Cities, Counties, States

Federal Government

Department of Defense, General Services Administration, Veterans Administration

Special Districts

Wastewater Treatment, Transportation, Ports

Healthcare

Hospitals, Healthcare Systems

Our Wastewater Facility Upgrades Expertise

OPTERRA's improvement services cover all wastewater treatment processes, from ingestion of influents through discharge of treated water and disposal of sludge.

Aeration Systems

- Coarse to fine bubble diffusers
- High efficiency blowers
- Dissolved oxygen controls
- Mixer replacements

Biosolids Handling

- Digesters
- ATAD systems
- Gasification
- Thermal drying

Biogas Production

- Anaerobic digestion (codigestion)
- Cambi
- Gas cleaning

Demand Reduction

- Aeration
- Pumping
- Process optimization

Disinfection

- Onsite generation
- Ultra-violet

Automation

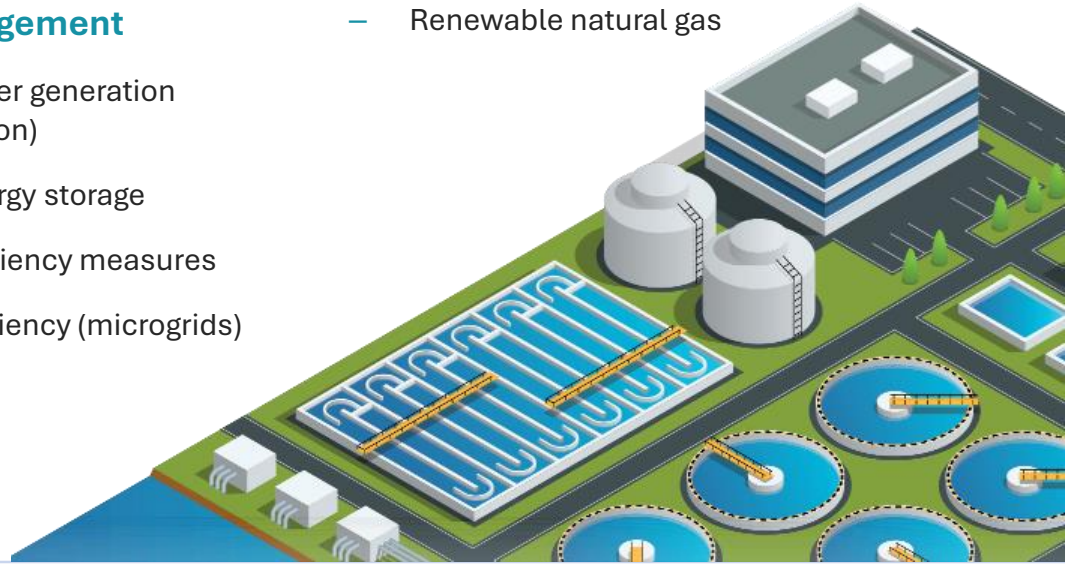
- Controls
- SCADA
- Remote monitoring

Energy Management

- Onsite power generation (cogeneration)
- Battery energy storage
- Energy efficiency measures
- Energy resiliency (microgrids)

Revenue Enhancement

- High strength waste
- FOG (fats, oils & grease)
- Recycled food waste
- Renewable natural gas



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Our Comprehensive Approach

OPTERRA is with you every step of the way for seamless integrations and optimal operations – we can design, build, finance, operate, and maintain energy related wastewater plant upgrades.

Planning

- **Infrastructure assessment:** state of current equipment and operations (needs assessment)
- **Solution integration:** technology options and configurations
- **Financial analysis:** cost and savings estimates, incentives, financing and ownership structures
- **Stakeholder engagement:** communications, outreach and approvals

Implementation

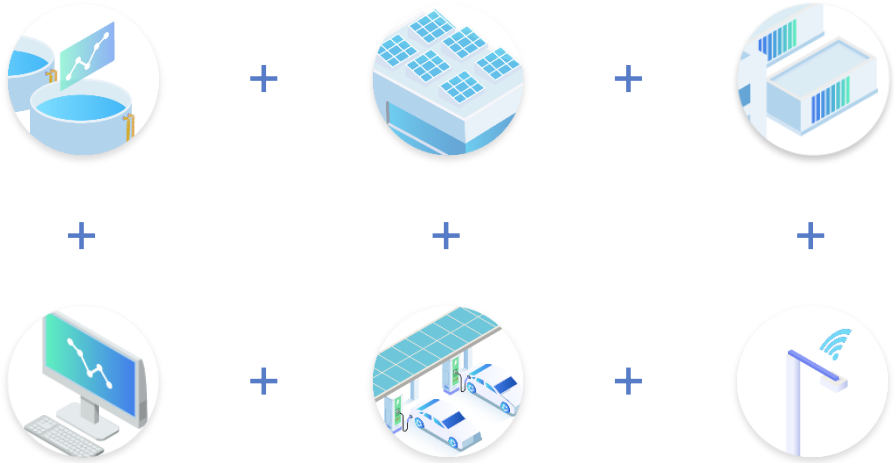
- **Site design:** engineering, mechanical and electrical design
- **Incentive applications:** filing and compliance support
- **Procurement:** equipment and smart control software
- **Installation:** construction, testing and commissioning

Operation

- **Operations & maintenance:** preventive maintenance and repairs including IOT platforms (automatic/remote controls, outage detection, repair dispatch)
- **Measurement & verification:** system performance reports (including energy savings)
- **Community engagement:** programming and project impact

Bundling Projects Into Programs

Upgrades across facilities can fund programs that improve services for your community.



More Savings	More Incentives
Leverage long-term and short-term ROI, and a combination of energy, water and operational savings	Use government/utility incentives to pair technologies or locate projects in certain areas

Deployment Efficiencies	Community Engagement
Work through backlogs of deferred maintenance with fewer disruptions to operations	Add value through special events, internships, living-labs, STEM curriculum, and workforce development

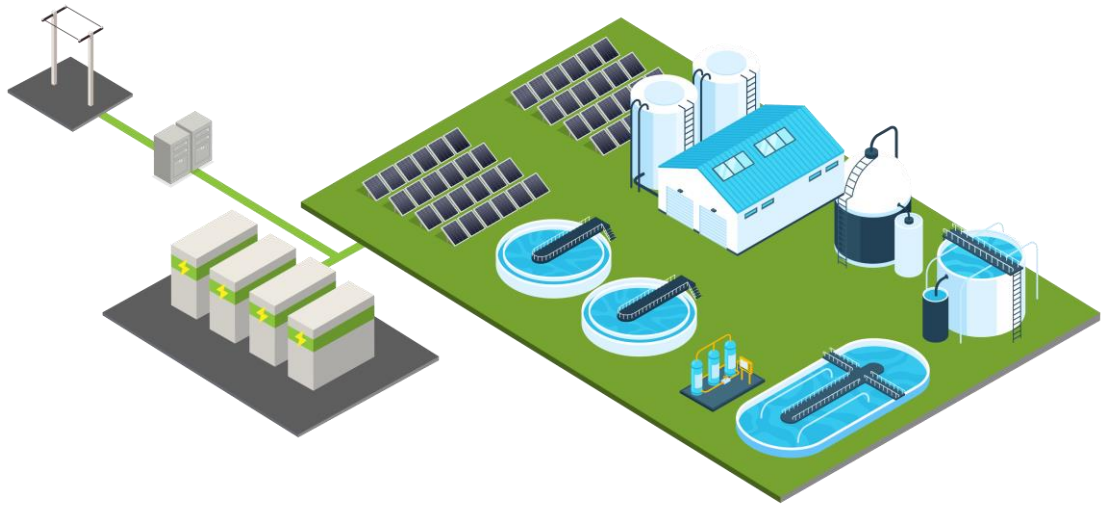
03

Sustainable Microgrids for Resilient Operations

Energy Resiliency Solution: Sustainable Microgrids

A sustainable microgrid is a permanent, next-generation **emergency power** solution that also works to **control energy costs and carbon emissions** every day.

- In a wastewater setting, the infrastructure typically consists of:
  - Onsite solar PV and/or cogeneration system (biogas)
  - Battery energy storage
  - A source of backup generation
  - Microgrid controller
- When the utility grid is operating normally, solar PV and cogeneration provide power while battery storage reserves that energy for both possible outages and ongoing operations.
- When power is interrupted, the microgrid can “island” and maintain critical loads by drawing from the solar PV system, battery storage, and backup generation as needed.



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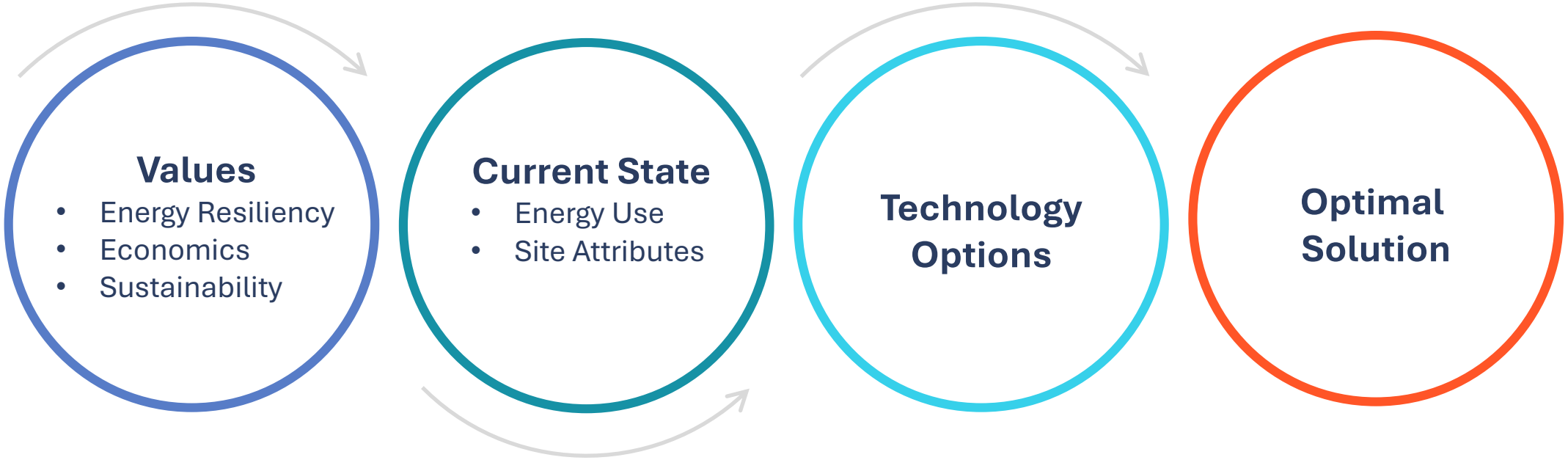
Process for Determining the Optimal Resiliency Solutions



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Factors in Sizing Energy Resiliency

1. How much load do you need backed up?

Least Energy Load

Critical loads

Entire site

Most Energy Load

2. For how long?

Minutes

Hours

Days

Multiple days

3. What is it worth to you?

$

Must deliver positive financial return

$$

Balance between reliability and cost

$$$

Reliability at any cost

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04

Wastewater Plant Modernization Case Studies

Yucaipa Valley Water District (YVWD)

ENABLING CLEAN ENERGY RESILIENCY

More Wildfires Triggering More Power Outages

YVWD needed to meet long-term resiliency goals and ensure safe, clean, and reliable power to key water and wastewater facilities during ongoing public safety power shutoff (PSPS) events.

Solution

YVWD contracted with OPTERRA for a comprehensive microgrid solution:

- Up to **14 MW** of stand-alone power across 3 new microgrids during outages
- Includes **7.45 MW solar PV, 3.3 MW/13 MWh** energy storage system, **3.2 MW** natural gas gensets, and microgrid controllers
- OPTERRA builds, owns and operates the systems on behalf of the district
- 28-year fixed Power Purchase Agreement (PPA)

Benefits

- Expected to save **$82 million** in cost efficiencies over the lifetime of the program
- YVWD will receive nearly **$7 million** in incentives under California's SGIP alone
- District's 22,000 ratepayers will benefit from clean energy resiliency for their vital water and wastewater services
- Will greatly improve YVWD's capacity to serve residents and keep rates stable while hedging against rising energy costs

www.sbunified.org

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West County Wastewater District

COMPREHENSIVE INFRASTRUCTURE PROJECT

Need for New Energy Infrastructure and Process Improvements

West County Wastewater District in Richmond, California was facing looming state regulations on short-lived climate pollutants (SLCP) and a need to reduce ongoing disposal costs. A comprehensive plan was developed with OPTERRA to include improvements to energy infrastructure and plant processes.

Solutions

OPTERRA will implement all plant improvements and maintain the equipment for 20 years under an energy savings performance contract.

- Sustainable microgrid
  - 1.1 MW solar PV system
  - 450 kW cogeneration system powered by biogas
  - 3.1 MWh BESS
  - Diesel backup generator
- Process improvement upgrades to generate Class A biosolids for agricultural and reclamation uses
- Energy efficient LED lighting and EV charging stations

Benefits

- **Generates $83 million** in net savings
- **Lowers greenhouse gases by 93%** over the program life
- **Improves process control** over wastewater treatment and digestion
- **Reduces disposal costs** of organic material destined for landfills
- **Robust community impact program** with internship opportunities and career paths for students

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Broward County Wastewater Plant

COST-EFFECTIVE WASTEWATER TREATMENT UPGRADES

An Opportunity to Maximize Treatment Capabilities & Reduce Costs

In 2011, with the goal of lowering its overall operating costs, Broward County began investigating ways to better process fats, oils, and grease (FOG) and leverage cogeneration technologies at its wastewater plant.

Solution

OPTERRA designed and implemented a turnkey, process improvement solution:

- New system collects FOG for more efficient treatment in anaerobic digesters
- Biogas cleaning system for the conditioning and transfer of gas to a cogeneration engine
- Cogeneration system capable of producing up to **1.99 MW of power**
- Electrical and control integration for operation of the new systems

Benefits

- Cogeneration system **offsets 25% of the electricity** the plant would otherwise purchase from the grid
- Reduces greenhouse gas emissions by **8,893 metric tons** annually, equivalent to removing 1,879 cars from the road
- **$26 million in guaranteed savings** over 17 years
- County received both **regional and statewide recognition** for sustainability leadership

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Questions?

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