# CAWWA/WEA Webinar Series

## Water Reuse – A User's Perspective

**Joseph Walsh,** *Covanta Energy*
**Eppa Rixey,** *Lagunitas Brewery*
**Baji Gobburi,** *Cambrian Innovations*
**Joel Bowdan,** *Michael Baker*

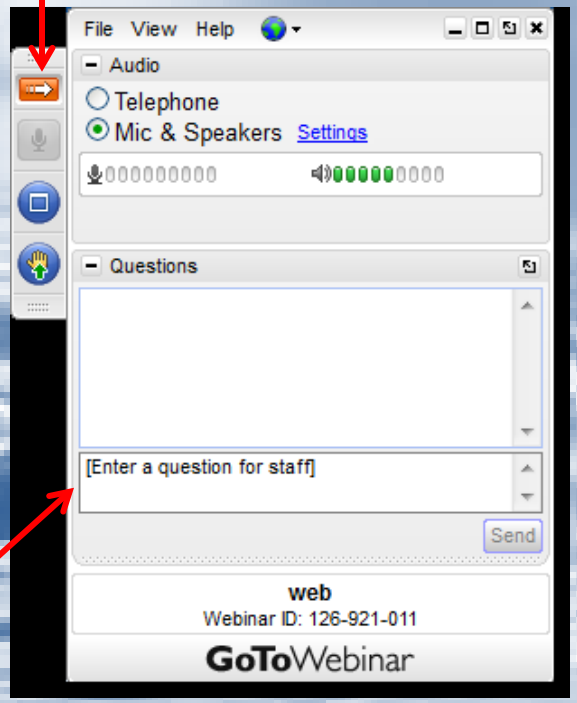
**Hosted by the Joint CAWWA/WEA Water Reuse Committee**

**May 19, 2016**

Sustainable Solutions for a Thirsty Planet®

# Before we begin…

**Grab Tab: Hide/unhide the Control Panel**




**Submit questions at any time.**
**The Organizer will read each question for the presenters to answer.**

**Questions: If you have any questions during the webinar, type your question into the Questions pane and click Send.**

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- CWEA has been approved to provide Continuing Professional Competency (**CPC**) credit for MD PEs
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# Agenda

- **Purpose and Goals:**
- **Moderators:**

  **Leita Bennett, GHD Inc.**

  **Steve Skripnik, LimnoTech**
- **Presentations:**
- **Final Q&A**

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# Purpose of Today's Webinar

- **Understanding reclaimed water from the User's perspective**
- **User's needs and challenges**
- **How we can assist our User's to promote reuse**

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# Joint AWWA/CWEA Water Reuse Committee Goals

- **Public outreach and advocacy**
- **Public education**
- **Coordination with regulatory agencies and other stakeholders**
- **Representation of AWWA/CWEA**
- **Understanding all Stakeholder's needs**

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# **Joseph Walsh,** Covanta Energy

- **Regional Environmental Manager for Covanta's Mid-Atlantic Region.**
- **Responsible for environmental management and oversight of Energy from Waste, transfer station, metals recycling and e-waste processing operations in Pennsylvania, Virginia and Maryland.**
- **Over 25 years' experience in the not-for-profit, consulting and industry sectors.**
- **Certified Hazardous Materials Manager.**
- **Masters in Urban Affairs and Planning from Virginia Tech.**
- **Chairman of the Environmental Commission in Sparta. NJ.**

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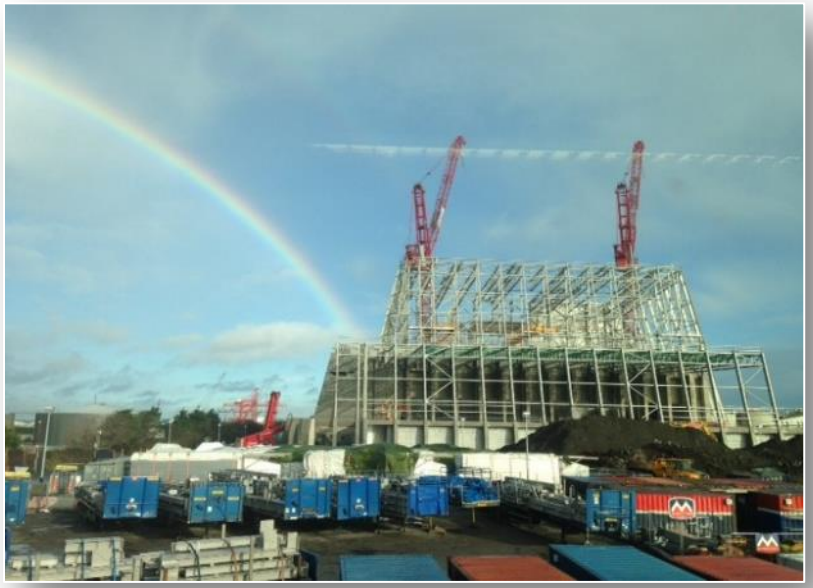

# Water Reuse

## Chesapeake Water Environment Association

## May 19, 2016

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# Covanta Overview

**Waste Disposal**

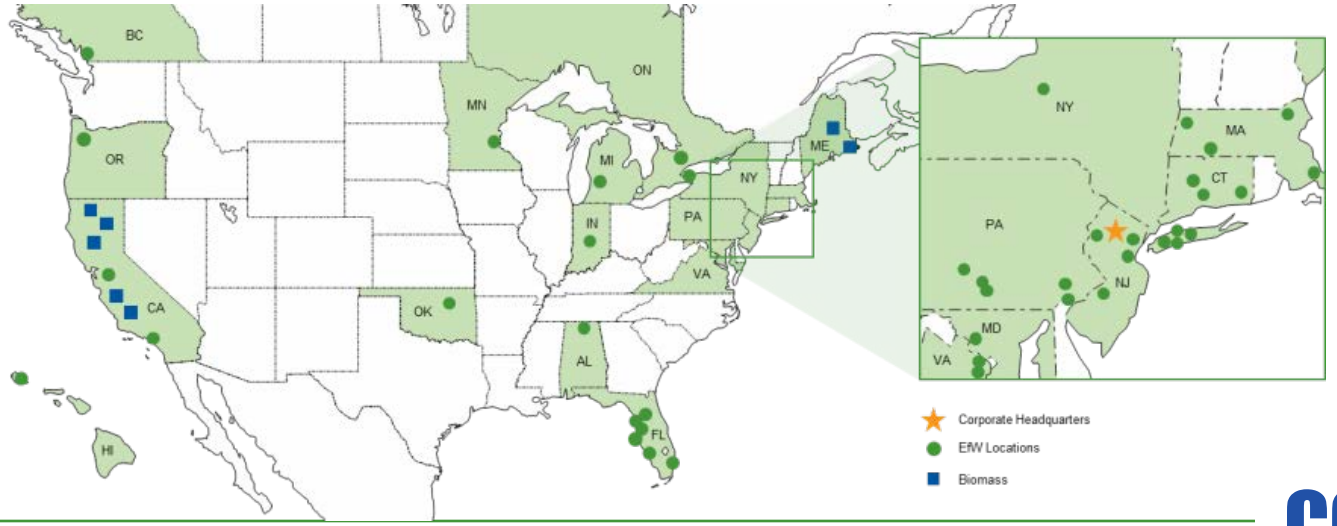
- 45 EfW facilities
- Process ~20 million tons of waste annually

**Energy Generation**

- >1,500 MW base load electricity capacity
- Renewable energy for one million homes

**Metals Recycling**

- Recycle ~500k tons of ferrous and non-ferrous metal annually
- Five Golden Gate Bridges and over one billion aluminum beverage cans



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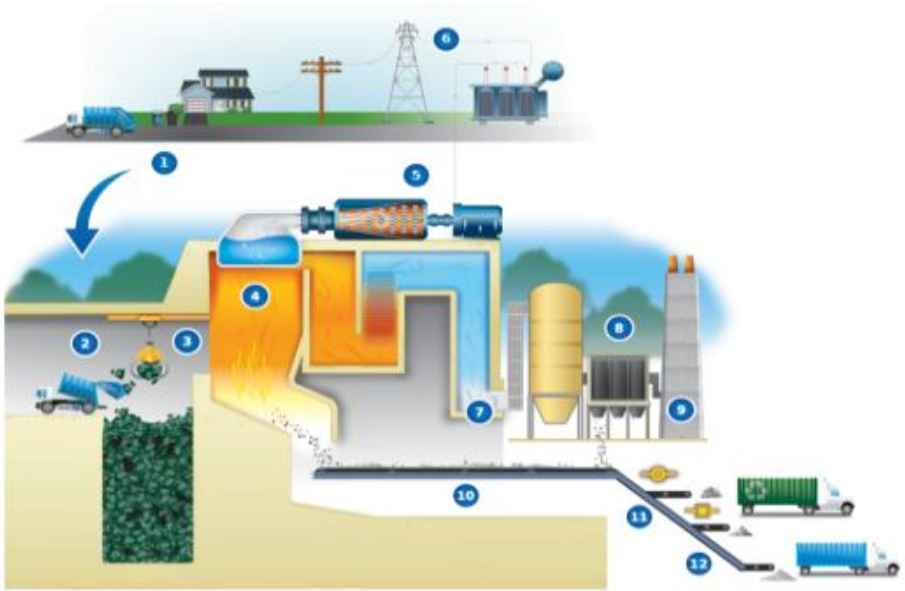
# Energy-from-Waste Process

After reducing, reusing and recycling, the remaining materials are used to produce clean renewable energy in Covanta Energy's EfW facilities.

## How We Do It:

1. Post-recycled waste is picked up
2. Delivery to EfW Bunker
3. Transferred to Combustion Chamber
4. Clean Combustion Heats $H_2O$ to make steam
5. Steam is used to generate electricity
6. Electricity is distributed to local grid
7. State of the art air pollution control technologies captures and cleans gases
8. Fabric filter baghouse controls emissions
9. Emissions are continuously monitored
10. Particulate matter is collected
11. Metals are recovered for recycling
12. Residual material is beneficially reused or disposed of in landfill

**One Ton of Municipal Solid Waste (MSW)**



**500 – 750 kWh of Power**

**~50 lbs. of Recycled Metal**

**Ash: ~10% of Original Volume**



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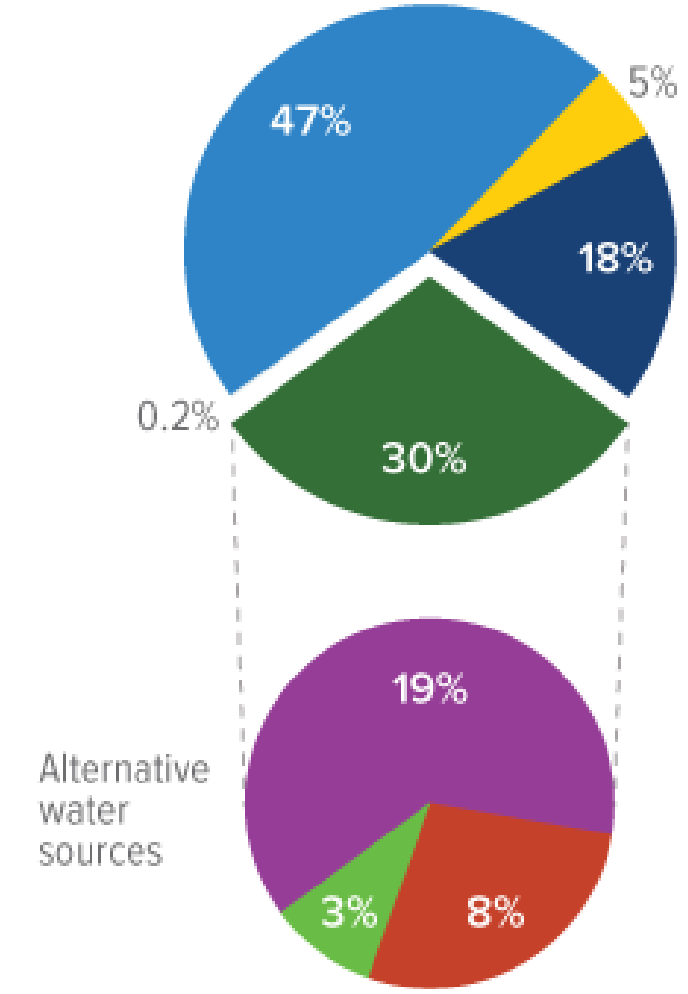
# What Do We Use Water For?

- **Steam Cycle / Boiler Feedwater**
  - Requires highest quality water
  - High temperature & pressure steam applications require demineralization process, either through ion exchange or reverse osmosis
  - Generally a closed-loop process with make-up for boiler blow-down
  - Combined heat & power (CHP) or steam export facilities have higher make-up requirements because of incomplete condensate return
- **Cooling Towers**
  - Largest water demand
  - Make-up required to replace evaporation loss and blow-down
- **Scrubber Process Water**
  - Used for temperature control and acid gas reduction
  - Opportunity for water reuse
- **Ash Quenching**
  - Water added to ash to control dust
  - Opportunity for lower quality water use

# Where Do We Get Our Water?

**Currently, about 30% of our water use is met by alternative sources**

- city water
- well water
- river water
- alternative water sources
  - reclaimed wastewater
  - saline aquifer
  - cooling discharge
  - stormwater



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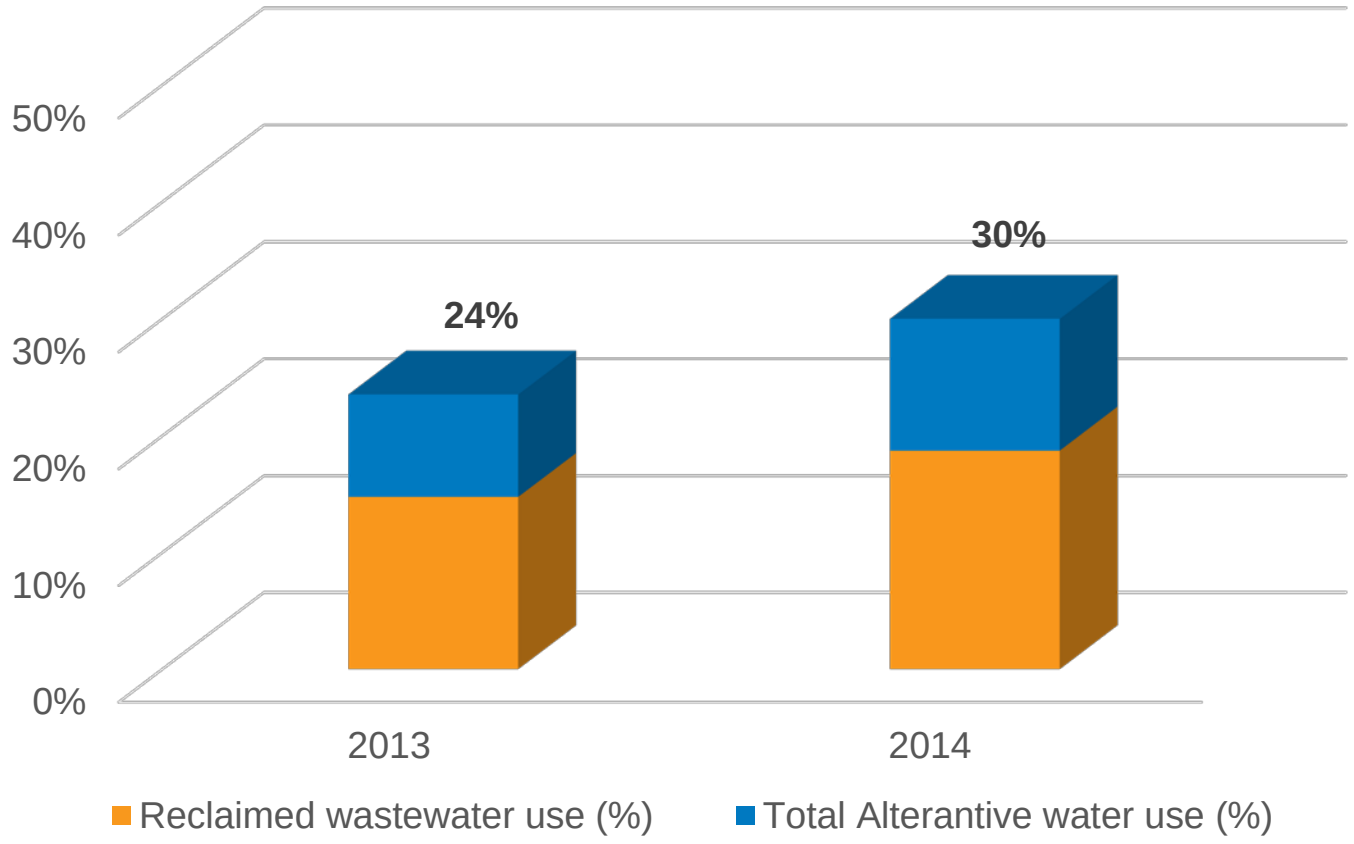
# Growth in Alternative Sources

**From 2013 to 2014, our total use of alternative water sources has grown from 24% to 30%, and our reclaimed wastewater use has grown from 9% to 11%.**



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# Drivers of Water Reuse Projects

- **Primary Benefits: Reducing potable water usage & lessening environmental impacts**
- **Availability of alternative water source / infrastructure**
  - Several facilities well positioned relative to POTWs
- **Revenue opportunity**
  - Some industrial waters can be used in our process
- **Water quality**
  - Can it be cleaned up to meet needs? And at what cost?
  - Are there components in the water that are beneficial to the process?
- **Ownership structure**
  - ~50% of our facilities are municipally owned, which can help facilitate certain reuse projects

# Project Example: Delaware Valley

- **Water Source: POTW Discharge**
- **Water Use: Cooling Tower**
- **Uses GE RePAK system**
  - Reverse osmosis (RO) coupled with ultrafiltration
- **Commissioned in 2014**
- **Recipient of GE's Return on Environment Award**
- **Reduced treated city water consumption by ~1.3 MGD**
- **Cost savings ~$600 - $700k / year**

# Additional POTW Discharge Reuse


- **3 Additional Florida Facilities**
  - Hillsborough County
  - Pasco County
  - Lee County
- **Key Drivers:**
  - Proximity
  - Co-ownership (Covanta operates the facilities on behalf of municipal clients)



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# Project Example: Industrial Wastewater

- **Facility: Southeastern Massachusetts**
- **Water Source: Non-Hazardous Industrial Wastewater**
- **Water Use: Air Pollution Control Equipment (Scrubbers)**
- **Provides an additional revenue stream for the facility**
- **Some wastewater may result in co-benefits:**
  - Our Niagara and Indianapolis facilities have been able to reduce air pollutant control reagent (ammonia) usage by processing ammonia-containing liquid waste streams




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# Project Example: Water Reduction

- **Facility: Indianapolis**
- **Water Source: RO Reject Water**
- **Equipment: Concentrated Reject Reverse Osmosis System (CRRO)**
- **Reduces RO reject water by 80 million gallons / year**
- **Subsequent reuse of CRRO water in process reduced city water use by 80 million gallons / year**

# Project Example: Cooling Water Discharge

- **Facility: Montgomery County Resource Recovery Facility**
- **Water Source: Dickerson Generating Station cooling water discharge canal**
- **Water Use: Cooling tower water**




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# Challenges

- **Return on Investment (ROI) / Competition with our capital needs**
- **Availability of alternative supplies**
  - Location
  - Consistency
  - Size
- **Overall water consumption may increase**
  - Treatment necessary can generate a wastewater stream, e.g. alternative water sources requiring reverse osmosis treatment
- **Be realistic about O&M costs & time**

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# Thank You

# **Eppa Rixey,** Lagunitas

- **Studied Mechanical Engineering at Vanderbilt University.**
- **Worked for  Bain and Company**
- **After years of home brewing and obsessing over craft beer, he was able to merge his personal and professional interests by landing his dream job as**
- **Strategic Planning Manager for Lagunitas Brewing Company**
- **Works on a variety of projects related to operations, sustainability, and corporate strategy.**

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# **Baji Gobburi,** Cambrian Innovations

- **Industrial water executive with two decades of leadership in water and clean energy industries**
- **Leads Cambrian's global business development for**
- **Previously with Energy Recovery Inc. and held various management positions at General Electric (GE) Water & Process Technologies.**
- **MBA from Chicago's Booth School of Business and M.S. in Hazardous Waste Management from Wayne State University**
- **CE degree from Osmania University in India.**

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# ECOVOLT® SUSTAINABLE WASTEWATER TREATMENT

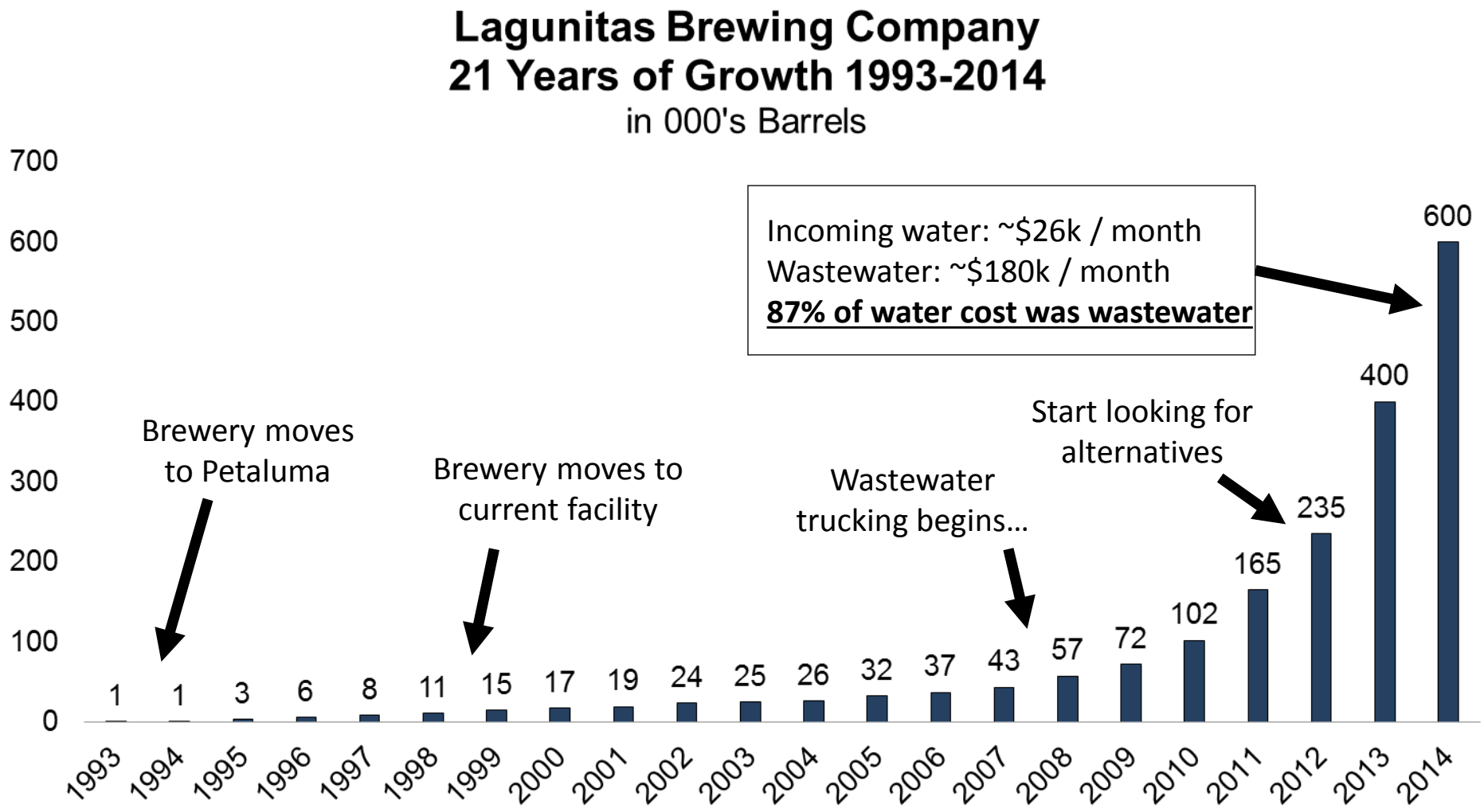
## Industrial Water Reuse at Lagunitas Brewing Company

CAMBRIAN INNOVATION

LAGUNITAS BREWING
PETALUMA, CHICAGO, & THE WORLD

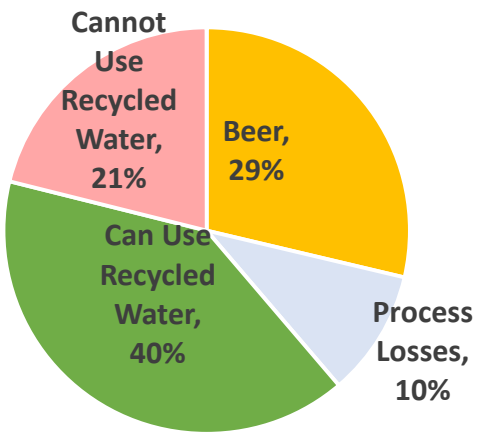
**Eppa Rixey**
Strategic Planning Manager | Lagunitas Brewing Company
**Baji Gobburi**
VP of Sales & Marketing | Cambrian Innovation

# Lagunitas and Water

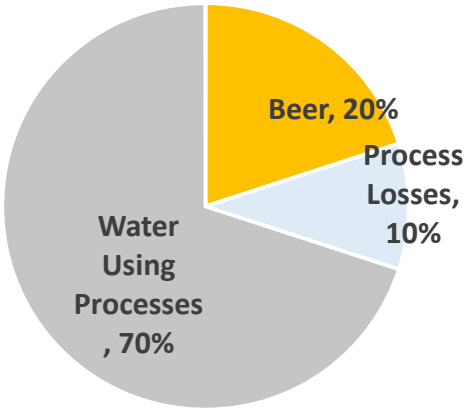


# Water:Beer

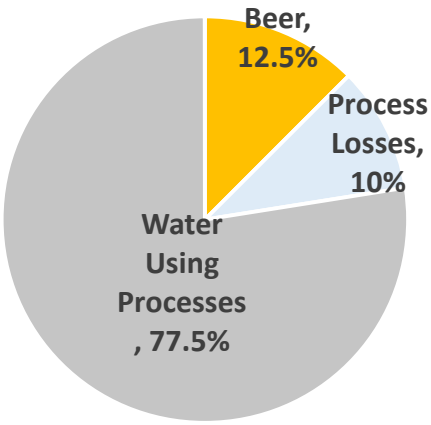
## Reuse Brewery - 2.5:1




## Efficient Brewery - 4:1

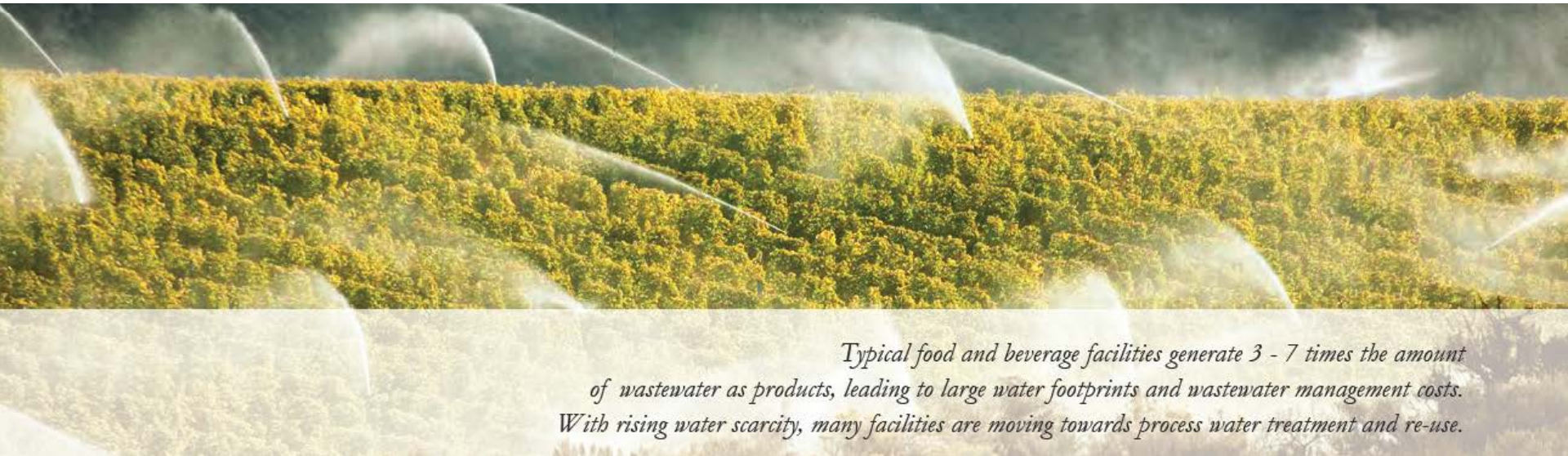



## Typical Brewery - 7:1



# Brewery Wastewater Problem

- Breweries and other industrial food and beverage producers generate high biological oxygen demand (BOD) wastewater that is **expensive to treat**.
- **Opportunity: Wastewater contains energy – up to 3 kWh per kg BOD.**
- Cambrian's EcoVolt leverages a cutting edge biological process to simply and robustly capture this energy, turning an economic drain into a source of operational savings and sustainability.



*Typical food and beverage facilities generate 3 - 7 times the amount of wastewater as products, leading to large water footprints and wastewater management costs. With rising water scarcity, many facilities are moving towards process water treatment and re-use.*

# EcoVolt® Is the Next Generation of Wastewater-to-Methane Systems

**1859** - First AD built in India

**1895** – Biogas from sewage used to power street lamps in England

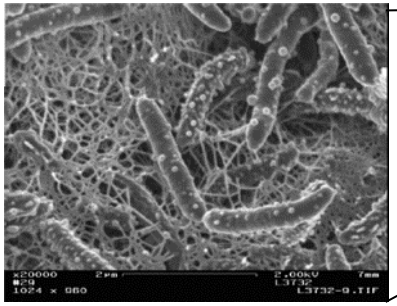
**1930s** – Methanogens discovered

**1970s** – First high rate ADs based on granulating solids developed

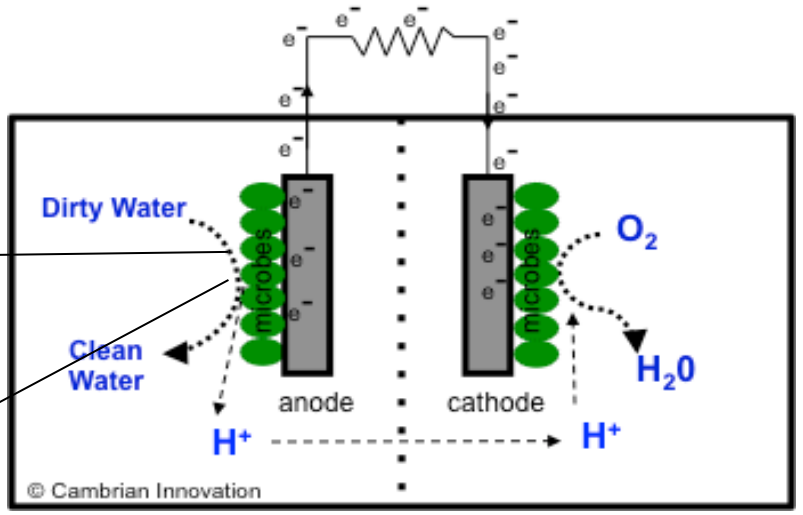
**1980s & 1990s** – UASB derivatives developed – EGSB, IC

**2013** – First bioelectrically enhanced anaerobic treatment

# Bioelectrical Systems (BES)



Nanowires produced by *Shewanella putrefacians* (From Gorby et al., 2006).



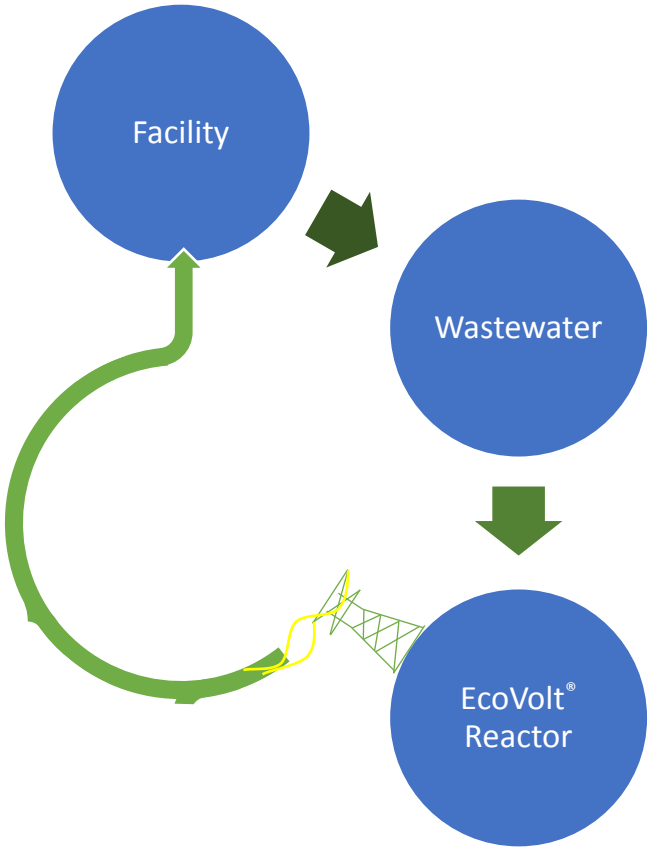

**Electrically Active Microbes Help:**

- "Anodes" treat wastewater
- "Cathodes" generate products
- ***System collects operating data from living microbes***

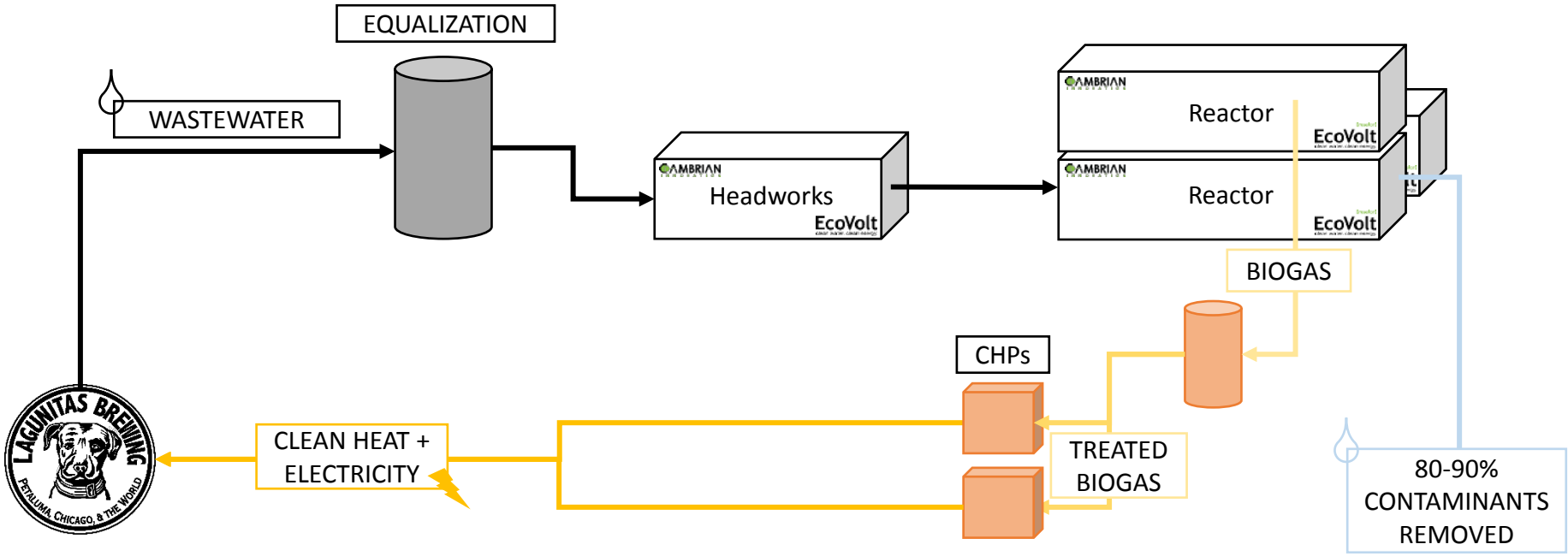
# ECOVOLT® REACTOR

World's First Bioelectrically Enhanced Wastewater Treatment System

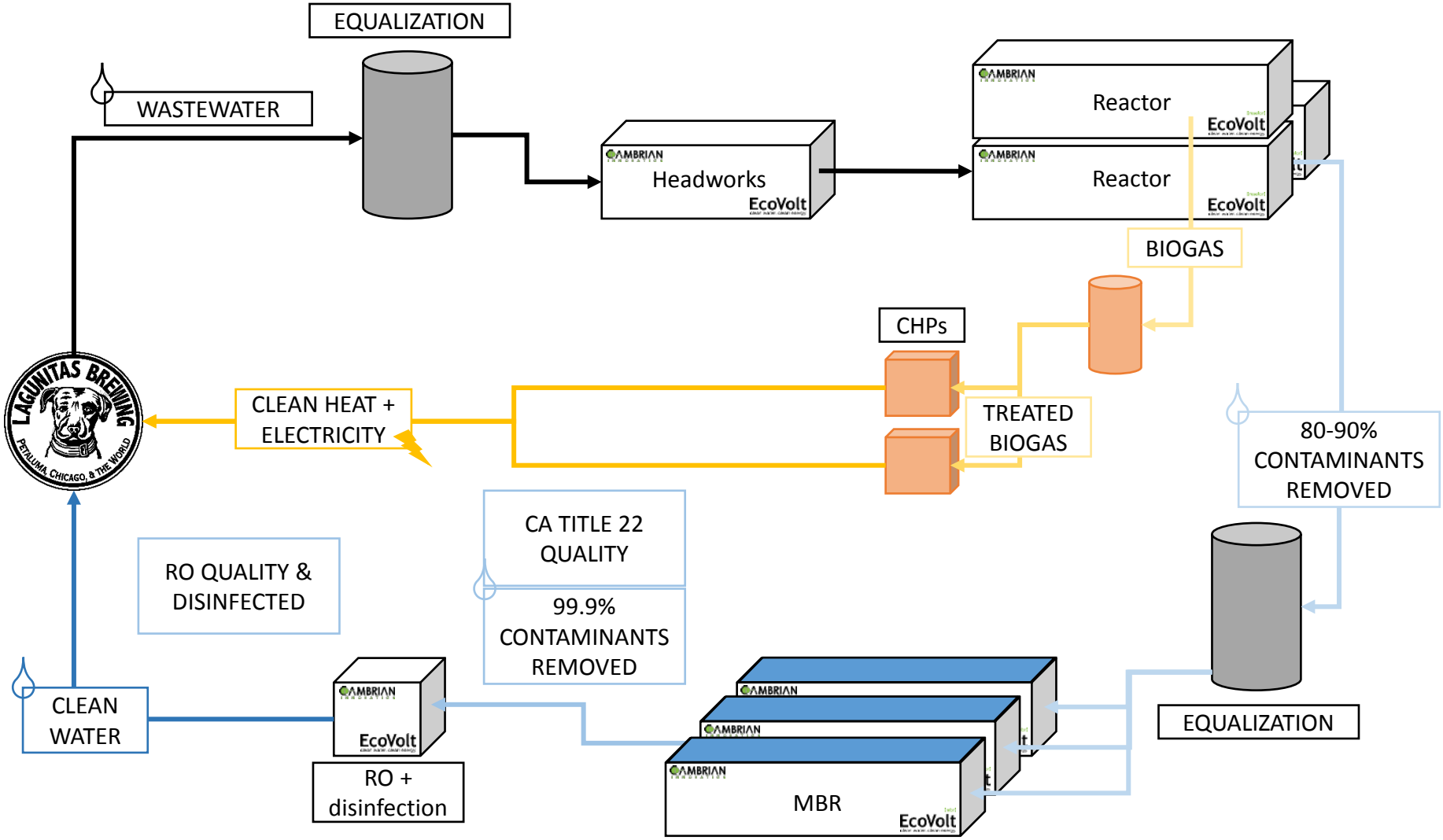
# Closed-Loop Two-Part Solution for Energy and Water



# EcoVolt Energy Extraction and Management



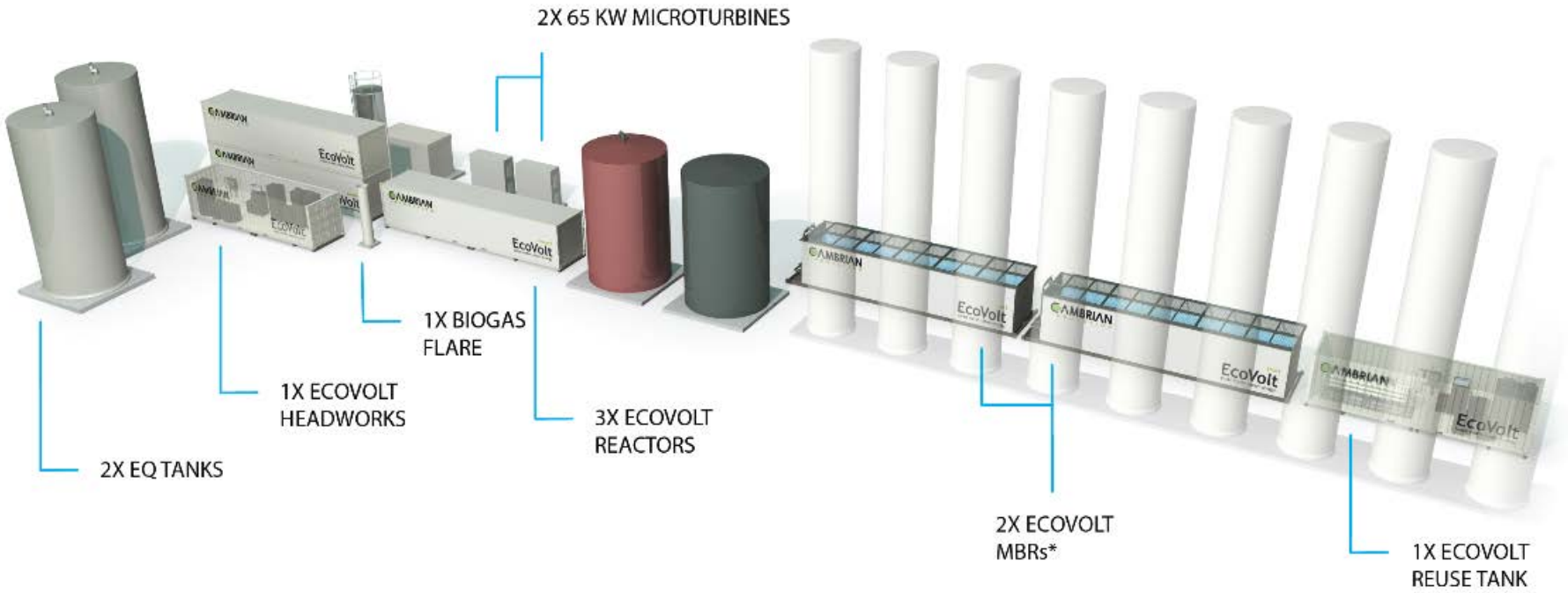
# EcoVolt Reuse w/ Secondary and Tertiary Treatment



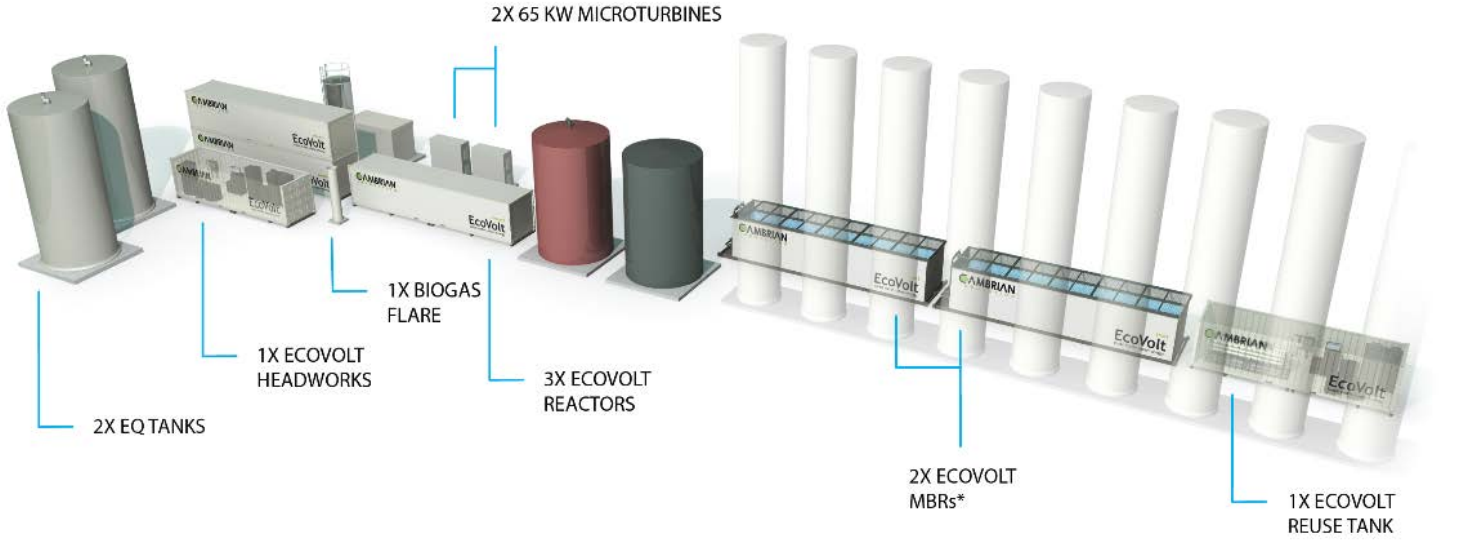
# The Cambrian Innovation Solution at Lagunitas



# EcoVolt at Lagunitas




*At full capacity there will be 3x EcoVolt MBRs




- Impact…
  - 120 KW of clean energy
  - 80,000 GPD of potable water
  - > 40% reduction in facility input water needs
  - > 70% reduction in the facility's total water discharge
  - > 1,600 metric tons of $CO_2$ per year eliminated
  - Very positive IRR; payback period <3 years

# Joel Bowdan III, PE

**Joel Bowdan lll, PE**
Technical Manager

Michael Baker
INTERNATIONAL

- **23 Years Experience in Water/Wastewater**
- **12 Years Recycled Water Design & Retrofit**
- **Civil PE (CA & MI)**
- **Member AWWA**
- **CA WateReuse Industrial Reuse Committee**

- **Co-Principle Investigator for WRF 12-03**
  ***"Evaluation of Historical Reuse Applications and Summary of Technical/Regulatory Issues and Related Solutions for Industrial Reuse Projects"*** (https://watereuse.org/research/research-projects/)

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# Keys to Successful Industrial Water Reuse

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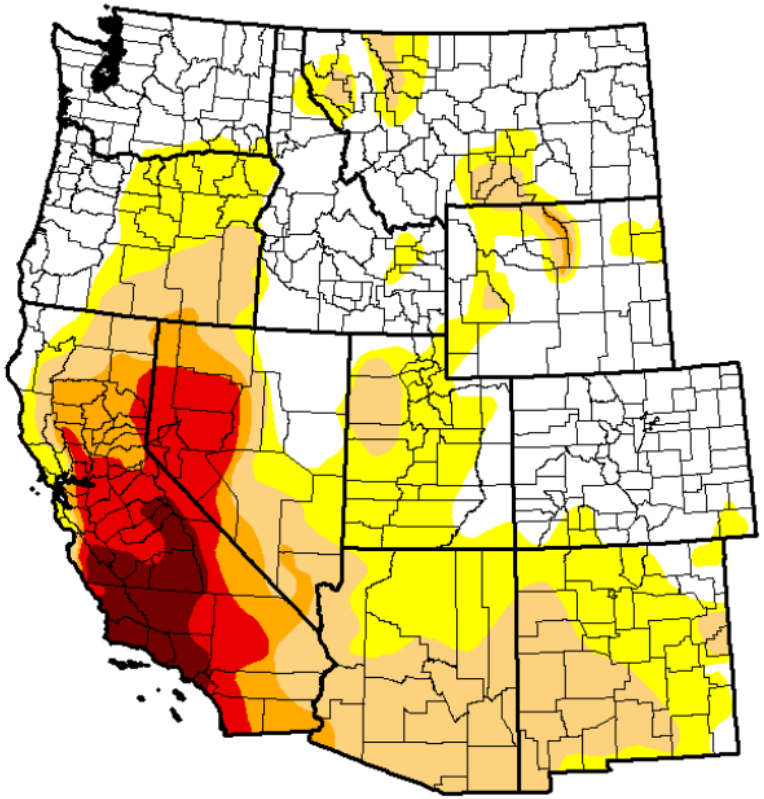
# Why Reuse?

***U.S. Drought Monitor***

## West



**May 3, 2016**

***(Released Thursday, May. 5, 2016)***

**Valid 8 a.m. EDT**

*Drought Conditions (Percent Area)*

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|
| **Current** | 43.75 | 56.25 | 33.05 | 13.85 | 8.71 | 2.81 |
| **Last Week** *4/26/2016* | 38.85 | 61.15 | 34.76 | 14.79 | 8.71 | 2.81 |
| **3 Months Ago** *2/2/2016* | 37.77 | 62.23 | 38.46 | 21.39 | 11.69 | 5.70 |
| **Start of Calendar Year** *12/29/2015* | 33.17 | 66.83 | 45.07 | 29.30 | 15.92 | 6.85 |
| **Start of Water Year** *9/29/2015* | 22.77 | 77.23 | 57.81 | 42.42 | 26.50 | 7.62 |
| **One Year Ago** *5/5/2015* | 23.35 | 76.65 | 63.22 | 39.05 | 17.54 | 7.95 |

*Intensity:*

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

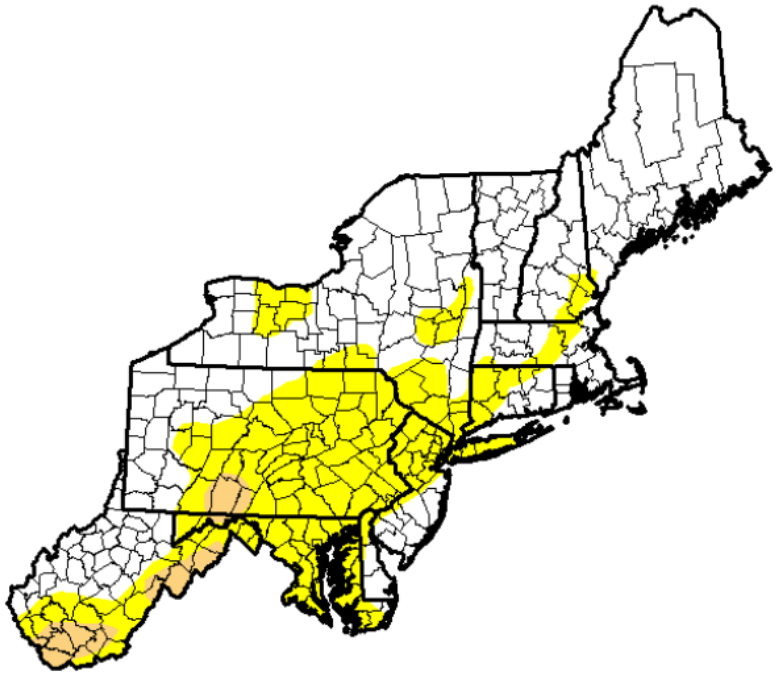
**Author:**
*Brian Fuchs*
*National Drought Mitigation Center*

**http://droughtmonitor.unl.edu/**

# Why Reuse?

***U.S. Drought Monitor***

## Northeast



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*Drought Conditions (Percent Area)*

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|
| **Current** | 62.87 | 37.13 | 3.47 | 0.00 | 0.00 | 0.00 |
| **Last Week** *4/26/2016* | 60.97 | 39.03 | 5.04 | 0.00 | 0.00 | 0.00 |
| **3 Months Ago** *2/2/2016* | 71.89 | 28.11 | 3.27 | 0.00 | 0.00 | 0.00 |
| **Start of Calendar Year** *12/29/2015* | 62.10 | 37.90 | 6.60 | 0.00 | 0.00 | 0.00 |
| **Start of Water Year** *9/29/2015* | 42.41 | 57.59 | 9.00 | 0.00 | 0.00 | 0.00 |
| **One Year Ago** *5/5/2015* | 49.64 | 50.36 | 0.00 | 0.00 | 0.00 | 0.00 |

*Intensity:*

- D0 Abnormally Dry
- D1 Moderate Drought
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- D4 Exceptional Drought

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*National Drought Mitigation Center*

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# Recycled Water (Reuse) Implementation Challenges - Clients

- Recycled water quality generally poorer than potable (TDS, nutrients, etc.)
- Reuse clients must understand their process WQ requirements to determine “fit for use” and additional treatment
- Regulatory/permitting/inspection requirements for reuse not clearly understood at client level.
- Timelines for regulatory and permitting approvals.

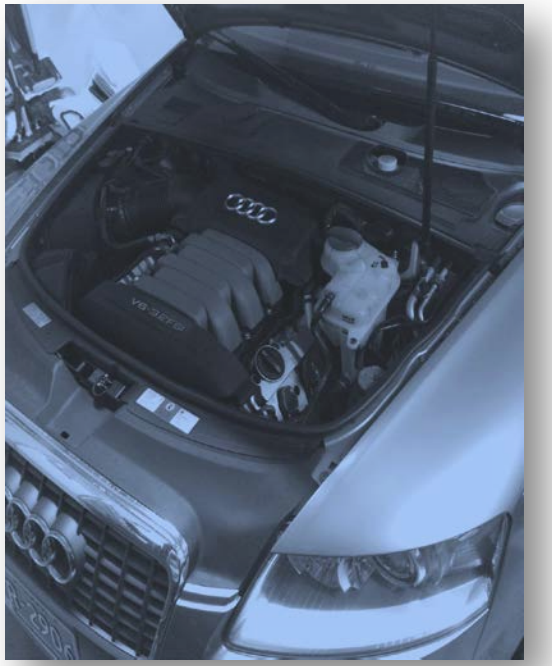
# The Inspiration

***"It shouldn't be this difficult."***

- Potable water shortages are dictating that the world needs more IWR
- Industry is understanding that it needs to implement IWR
- Let's make it cheaper, faster, better & **easier**

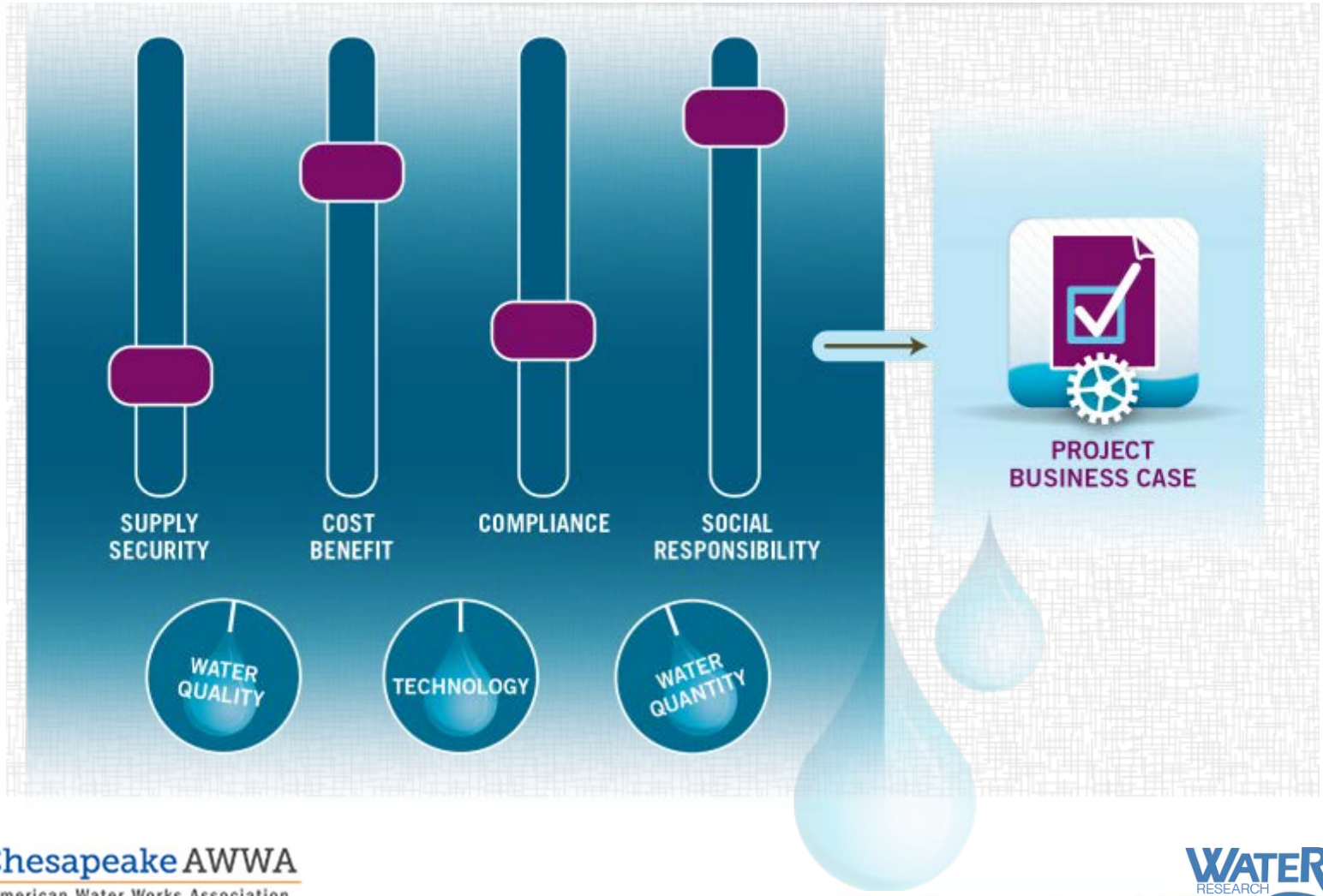
# Methodology

***Looking under the hood* of recently completed projects…**

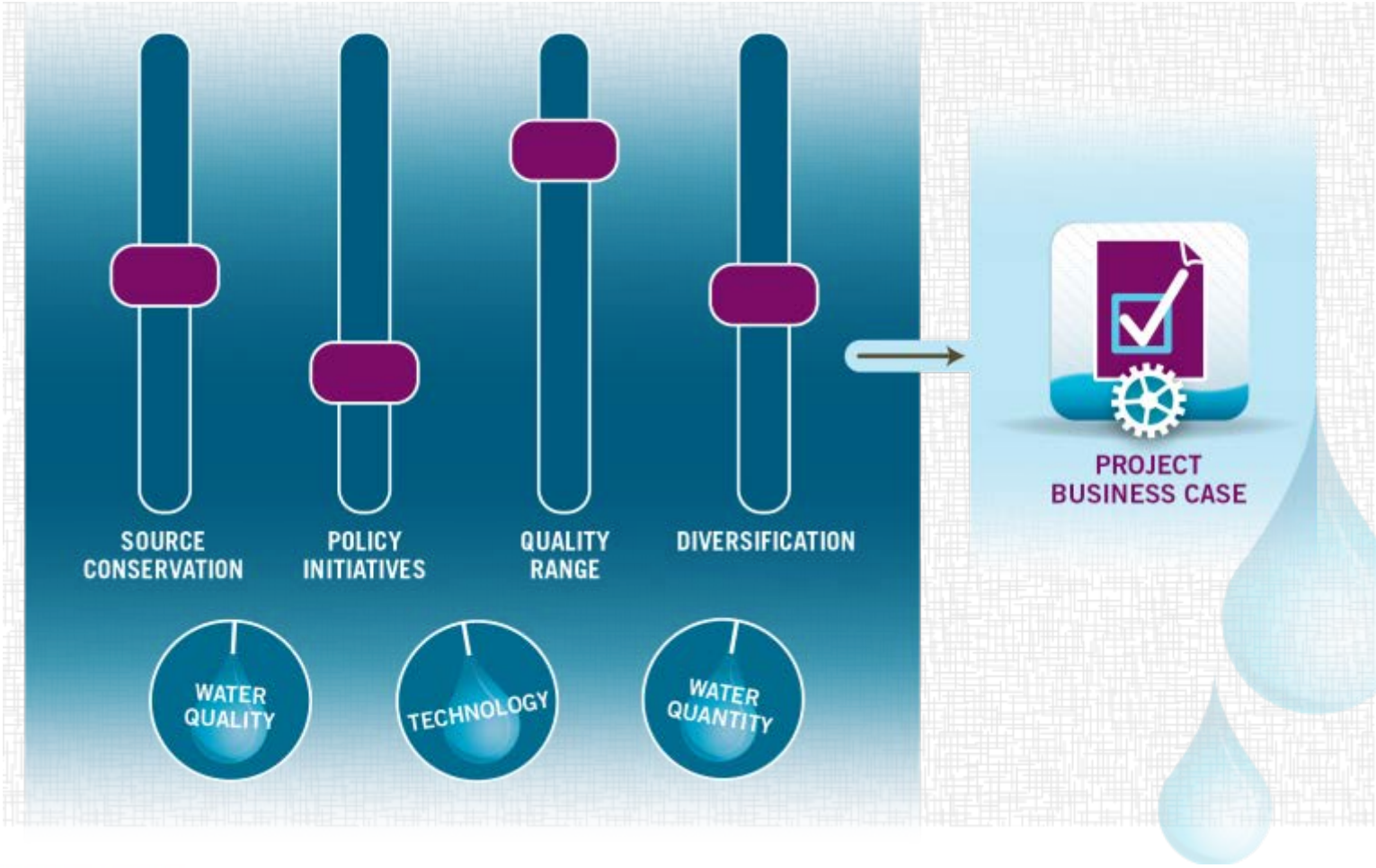


- Interviews & Case Studies
  - Experience: What worked/didn't work?
  - What do they wish they had known?
  - What would they do differently?
- Establish WQ parameters for typical industrial applications
- Develop Model Template & Project Charter

# Identification of Drivers: Reuse Customers



# Identification of Drivers: Reuse Customers



# Findings: Points of Departure

- Business Drivers & Objectives
- Views of Time & Money
- Measures of Success
- Decision Making Processes
- Regulatory Landscape
- Language & Terminology

# Drivers & Objectives

## Water Customer

- Supply Security
- Cost-Benefit
- Compliance
- Social Responsibility

## Water Provider

- Source Conservation
- Policy Initiatives
- Diversification
- Minimize Wastewater Disposal Costs

# Views of Time & Money

## Water Customer

- Time IS Money
- Single Source Funding
- Minimal Approval Process Required
- Implement Quickly & On-Schedule

## Water Provider

- Generally Used to Long Periods
- Regulatory Approvals
- Multiple Source Funding
- Cost “Pass-Through”

# Metrics & Measures of Success

## Water Customer

- ROI of 6-12 Months for Small Projects
- Overall Cost Savings
- Operational Benefits
- Reliability
- Other Internal Goals

## Water Provider

- ROI 5-10 Years for Infrastructure
- Social/Environmental Benefits > Cost Savings
- Minimize Customer Complaints

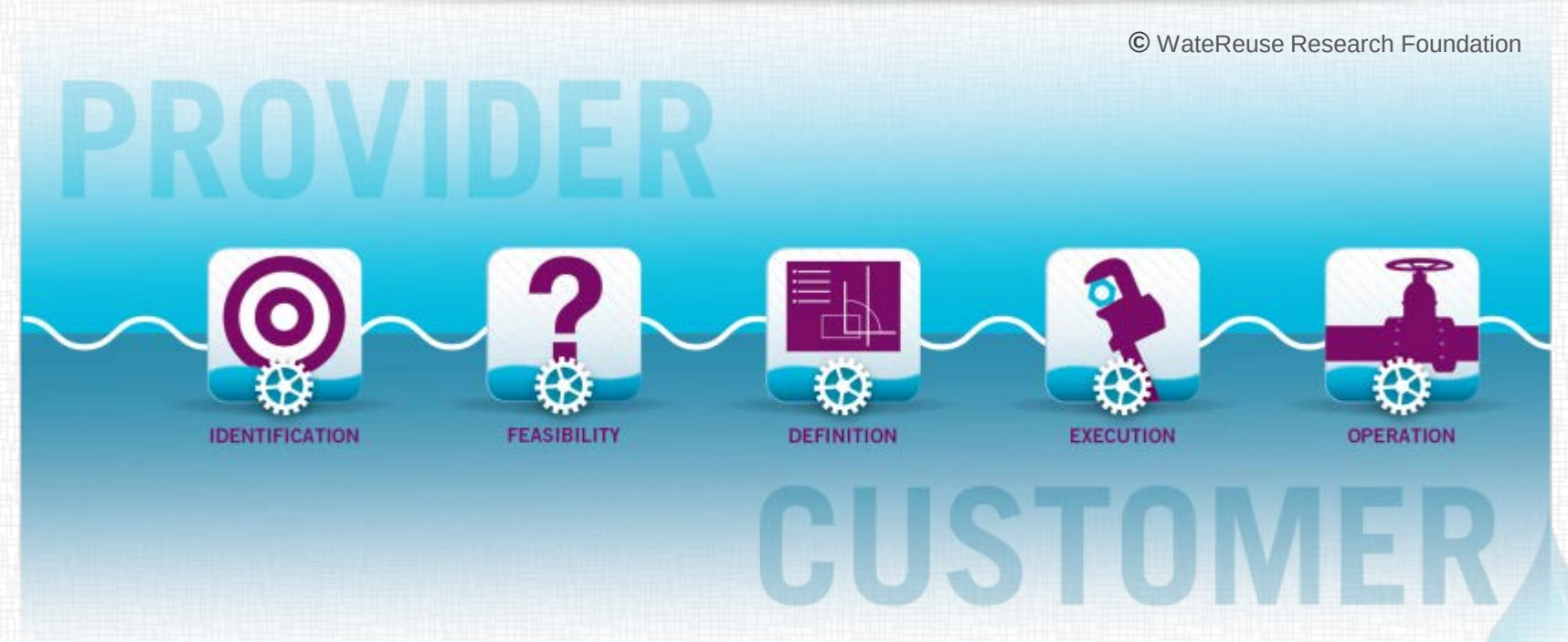
# Departure to Convergence…

**Solution:** bring providers and end users *together* with a shared template to plan & implement projects

**Advantages/Best Practices:**

- Clearly identify & align goals & objectives
- Maintain a consistent sequence of activities
- Surface and manage risks end-to-end
- Foster communications / engage all stakeholders

# Shared Framework for Reuse




- **Purpose:** to provide a common process/interface through which providers and customers can align efforts and collaborate more effectively in the development of IWR projects

# Model Overview

*Document business drivers and identify customer industries/operations with high potential for reuse*


**IDENTIFICATION**

*Document business drivers and review operations infrastructure for potential reuse applications*

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# Model Overview

*Assess system infrastructure, capacity/ demand, regulatory issues, funding scenarios, etc.*


*Consider constraints, cost/benefit, operational impacts, risks/unknowns, possible showstoppers, etc.*

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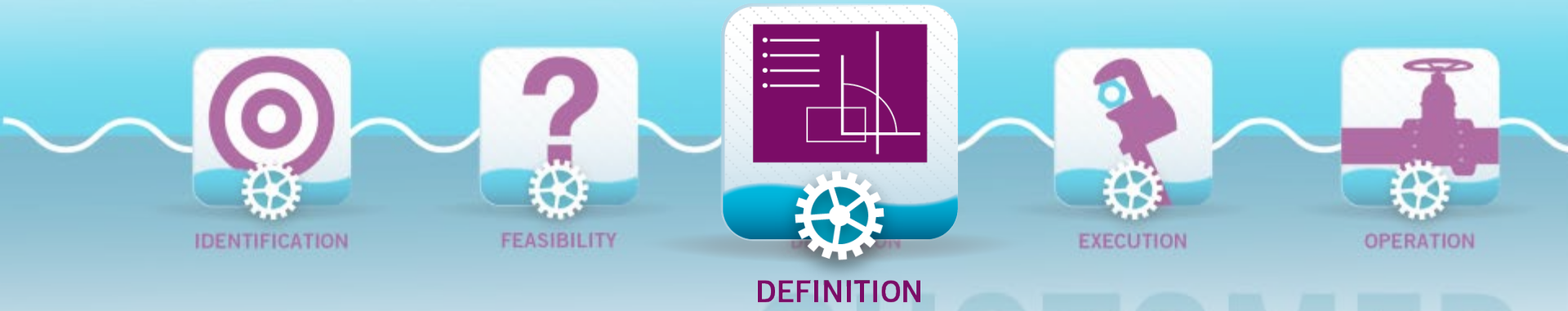
# Model Overview

*Finalize agency business case, explore reuse supply options, select optimal project approach*




*Finalize plant business case, explore reuse source options, select optimal project approach*

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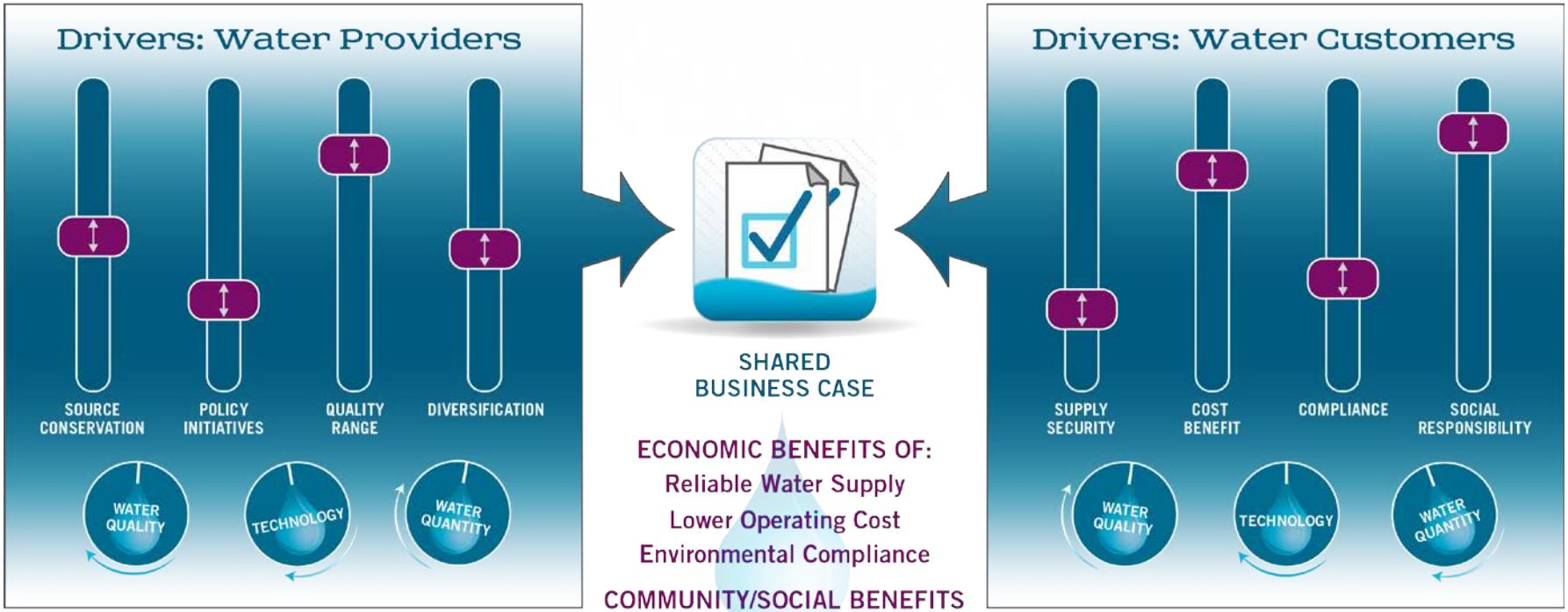
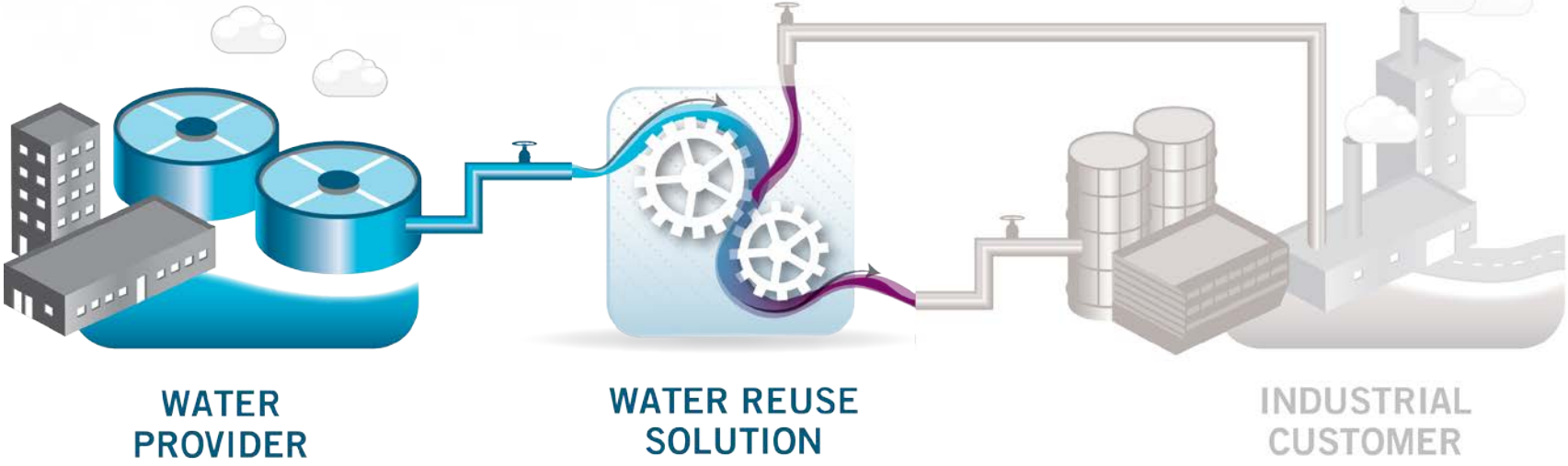
# Shared Business Case

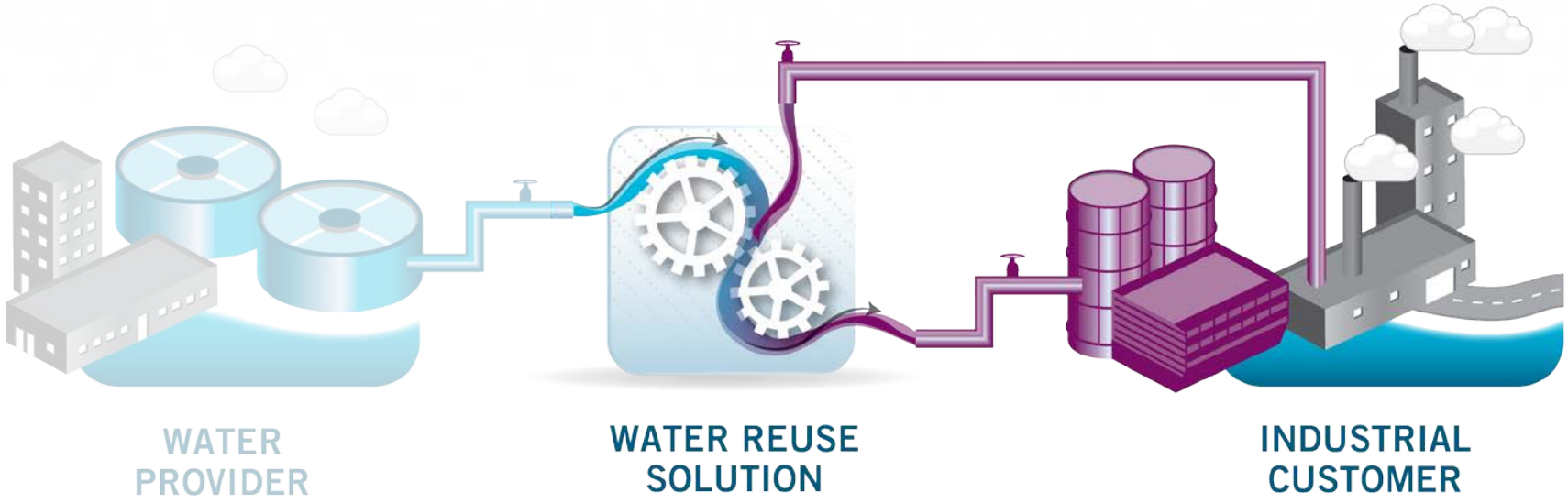


# Development Options



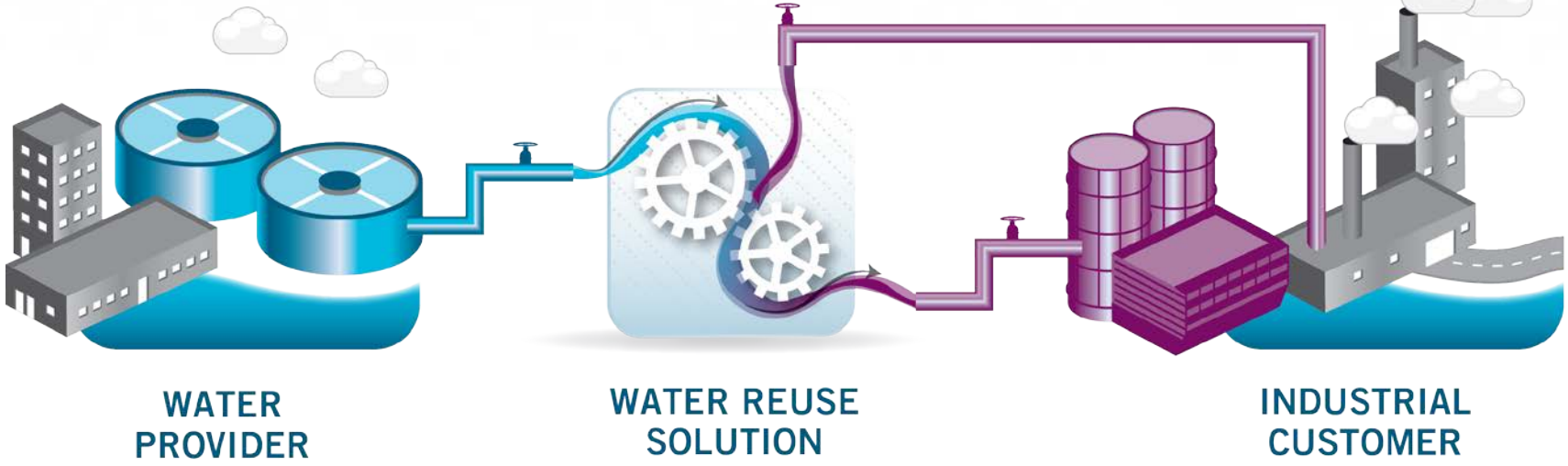

## Provider-Owned

# Development Options




## User-Owned

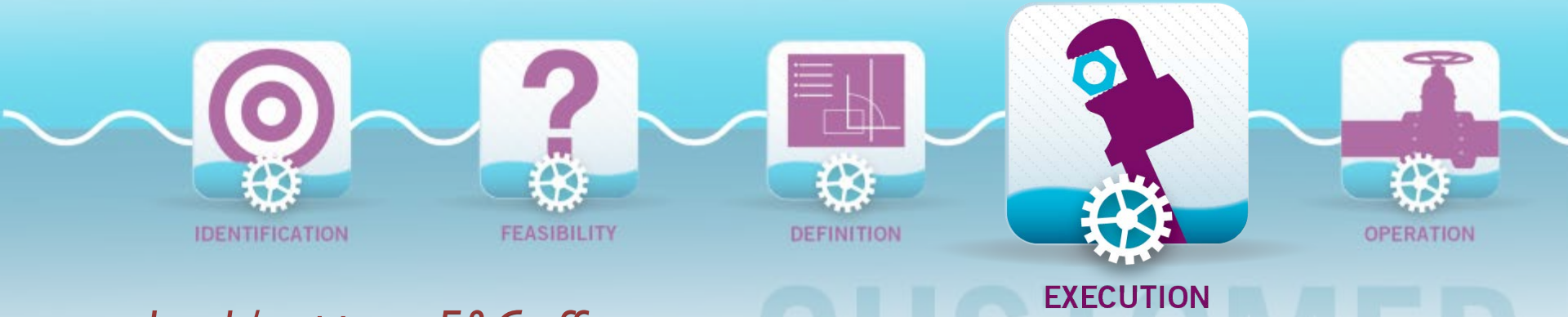
# Development Options




## Jointly-Owned

# Model Overview

*Lead / support E&C effort as appropriate to selected option; staff the integrated project team*



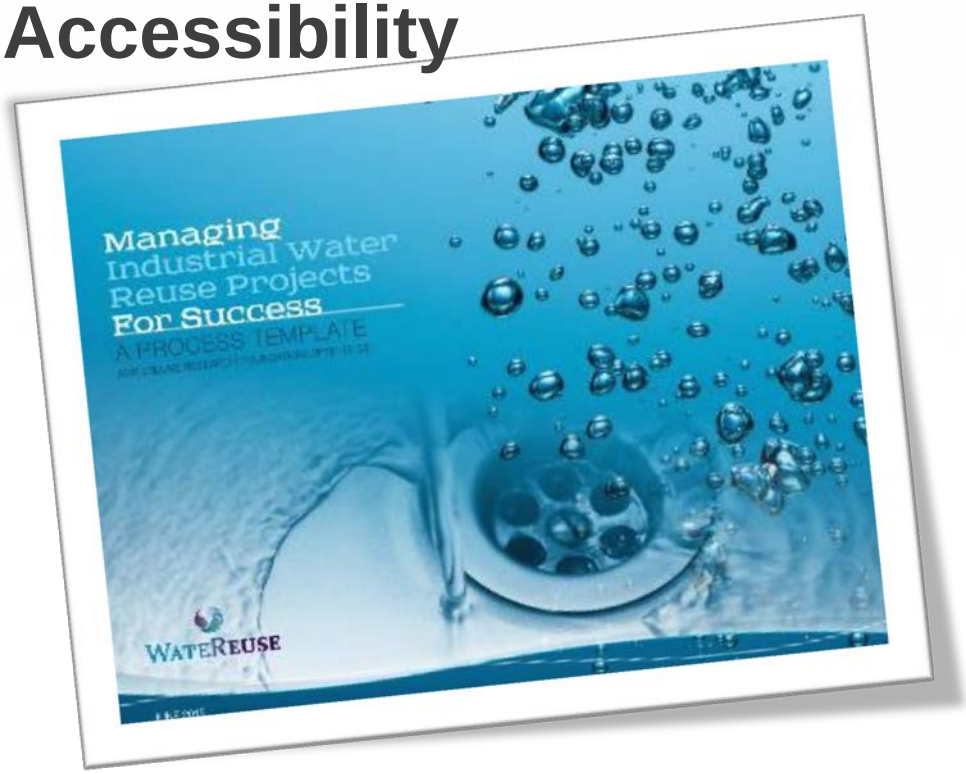

*Lead / support E&C effort as appropriate to selected option; staff the integrated project team*

# Model Overview

*Option 1: Operate & maintain agency-owned facility supplying recycled water to customer*


*Option 2: Operate & maintain company-owned facilities treating recycled source supply*

# Model Template & Project Charter Accessibility





*WRF 12-03: "Evaluation of Historical Reuse Applications and Summary of Technical/Regulatory Issues and Related Solutions for Industrial Reuse Projects"* (https://watereuse.org/research/research-projects/)

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# Contact / Questions


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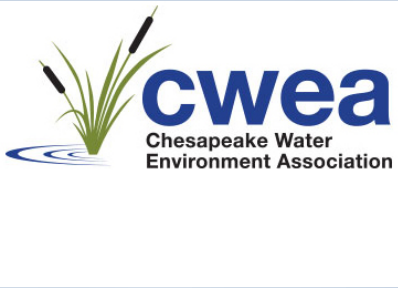



- Fall 2016 Water Reuse Seminar
- Looking for topics
  - Relevant
  - Timely
  - Innovative

…watch your inbox for announcements with additional details

# 2016 Webinar Schedule

Have Suggestions or topics to present? Contact the Technical Education Committee.

Steve Skripnik – sskripnik@limno.com

Ed Shea – eshea@Greeley-Hansen.com

- Join CWEA and get involved!

  **www.chesapeakewea.org**

- Upcoming free CWEA webinars
  - Announced through CWEA email
  - Calendar at **chesapeakewea.org**

| Month | Hosting Committee |
|---|---|
| February | Stormwater |
| May | Water Reuse |
| June | Biosolids and Residuals |


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# Questions?