The State of Water Resource Recovery

Wastewater Industry Insights
Structuring a National Test Bed Network to Support Water Innovation
Jim McQuarrie, Chief Innovation Officer

A State of Resource Recovery
Agenda – Industry Insights

- What We’re Doing
- What We Envision
- What We Need to Work out

What We’re Doing

[H1: influent channels]
You are here

Average ~130 mgd
No District water rights
85% of S. Platte 6 months/year

Denver Water can reuse up to 120 cfs

Biosolids (Nitrogen)
82 dry tons/day (2015)
1.64 tons/day plant available nitrogen
75% applied on private property
25% applied on METROGRO Farm

Effluent (Water)
Average ~130 mgd
No District water rights
85% of S. Platte 6 months/year

1.64 tons/day plant available nitrogen
75% applied on private property
25% applied on METROGRO Farm

Combined Heat and Power (CHP)
Average ~4.5 MW/day
38% of plant electricity consumption

Water in the South Platte Basin
Wastewater Flow and Population in the Denver Metro Area

- Population Growth
- Water Conservation
- Wastewater Strength
- One Water/Fit for Use
- Denver Water’s Efforts

Sidestream – Shortcut Nitrogen Removal

- 15% to 20% of influent nitrogen load
- 75% nitrogen elimination with Anammox
- Half the aeration energy requirement
Sidestream – Phosphorus Recovery

- 220-mgd Bio-P facility
- 15% to 40% of influent P could be recovered
- Understanding total value of phosphorus recovery
  - struvite in solids processes
  - impacts on dewatering
  - chemical costs
  - water quality
  - revenue
- Understanding the role of cations (K\(^+\), Mg\(^{2+}\))

Coupling Sidestream Technologies

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<th>Return Nutrient Load, lb/d</th>
<th>Phosphorus</th>
<th>Nitrogen</th>
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<td>Current</td>
<td>10,008</td>
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<tr>
<td>Pearl/Anitamox</td>
<td>3,290</td>
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<td>WASSTREP/Pearl/Anitamox</td>
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 Resource Recovery and Reuse
METROGRO Farm

- Dedicated beneficial reuse site since 1993
- 20 truckloads per day
- 120-mile round trip
- 52,000 acres
- Corn and wheat
- Nitrogen, micronutrients, soil conditioner
- Managed by the District

Recovering Energy at the Hite Facility

- Since 2000
- Energy Service Agreement with Suez
- No gas cleaning
- Nominations and Grace Energy Allowance

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<th>Cost</th>
<th>Electrical Production</th>
<th>Electrical Tariff</th>
<th>Heat Recovery</th>
<th>CHP O&amp;M</th>
<th>Net Cost-Benefit</th>
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What We Envision

Innovation Program
Resource Recovery Study Areas
Carbon Energy Capture
Envisioning a Transition

- +/-38% self-produced power
- All of our process heating
- Traditionally a “by-product”
- The “sunk investment” effect
- Enhanced AD (e.g., THP)
- Biogas upgrading and CHP
- Smart co-digestion program
- Carbon redirection
- Shortcut nitrogen removal

Thermal Energy Recovery

RWHTF South Final Effluent MWAT

[Graph showing temperature fluctuations]
Thermal Energy Recovery
Envisioning Partnerships/Sustainable Solutions

![Graph showing Net Energy Supply and Temperature Reduction](image)

**Renewable Natural Gas**

Gas produced, scrubbed, and compressed at Grand Junction’s Persigo WWTP
5.7-mile pipeline to City/County fueling facility

![Picture of renewable natural gas](image)

Fueling up

Biogas connection to fuel station
Increasing Recovery of Resources

Figure 2. MSW Recycling Rates, 1960 to 2012

- Glass ($0.66)/ton
- Aluminum Cans $1,232/ton
- #1 PET Bottles $242/ton
- #2 HDPE $365/ton

What We Need to Work on
1. Strategic Direction

2. Inter-Utility Industry Collaboration
Innovations at the Nexus of Food, Energy and Water Systems (INFEWS) proposal

Leaders Innovation for Technology (LIFT) initiative
HPO  Drying lagoons  Thermal drying  Composting