Energy Efficiency at Minnesota Drinking Water Utilities

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Project Background

Drinking Water Utilities

- Treat and distribute drinking water

- 655 cities in Minnesota with DNR permits for municipal water usage

- Wide variety of treatment methods

- Little research for water utilities serving less than 100,000 people

- Joined project in September 2019

Project Overview

- **15 interview sites across the state**
  - Smallest: 570 people and 16 MGY
  - Largest: 117,000 people and 4,375 MGY
- **Focus on energy conservation**
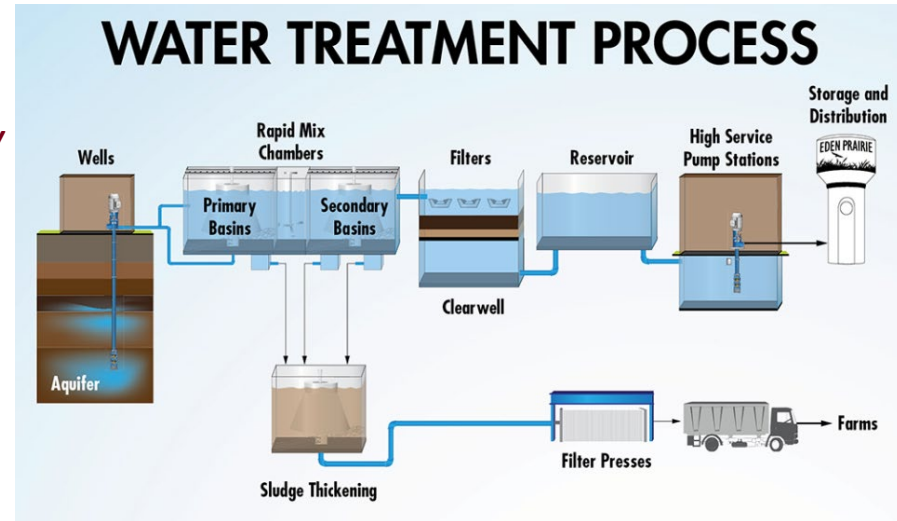 - MN WTPs use ~379 million kWh/year

Image credit: City of Eden Prairie

Approach

- Interview sites to get an understanding of operations

- Analyze energy data to find efficiency opportunities

- Gather more data to learn more about identified opportunities (ongoing)

Site Configuration

- **Acquisition**
  - Includes pumping water from source (i.e. wells or a surface water source)

- **Treatment**
  - Includes disinfecting and/or filtering incoming water for safe consumption

- **Distribution**
  - Includes pumping finished water to the customer

# of Plants	Water source	Treatment	Distribution
3	Wells	Chemical addition at well	Wells pump to system
7	Wells	Filtration and chemical addition	High service pumps
1	River	Rapid mixing, flocculation, chemical addition	High service pumps
1	River and wells	Lime softening, ozonation	High service pumps
2	Wells	Lime softening and chemical	High service pumps
1	Wells	Reverse osmosis and biofilters	High service pumps

Energy Footprints in kWh/MG

Size	High	Low	Average	Acquisition	Treatment	Distribution
GW Small	3000	1900	2300	900	400	1000
GW Medium	2150	970	1600	700	330	570
GW Large	3100	1600	2200	670	800	830
Overall	**3100**	**970**	**2000**	**750**	**530**	**820**

Energy footprints

- **Most intense energy user has the most intensive treatment system**
- **Second most intense energy user has high acquisition energy**
  - Different approach to pump operation
- **Treatment is usually the least energy intensive**
  - Treated as zero in any plant that does not have a main treatment plant
- **Distribution energy is the hardest to isolate**
  - Pumps are typically not metered separately in a treatment plant

Identified Opportunities

- Well and pump rehabilitation

- Variable frequency drive installation and optimization

- Well optimization

- Water loss reduction

- Customer conservation

My Experience

- Energy analysis

- Team work and the importance of individual efforts

- Data organization

- Self motivation and working from home

- Communication and coordinating meetings