Water Reduction at Electric Machinery

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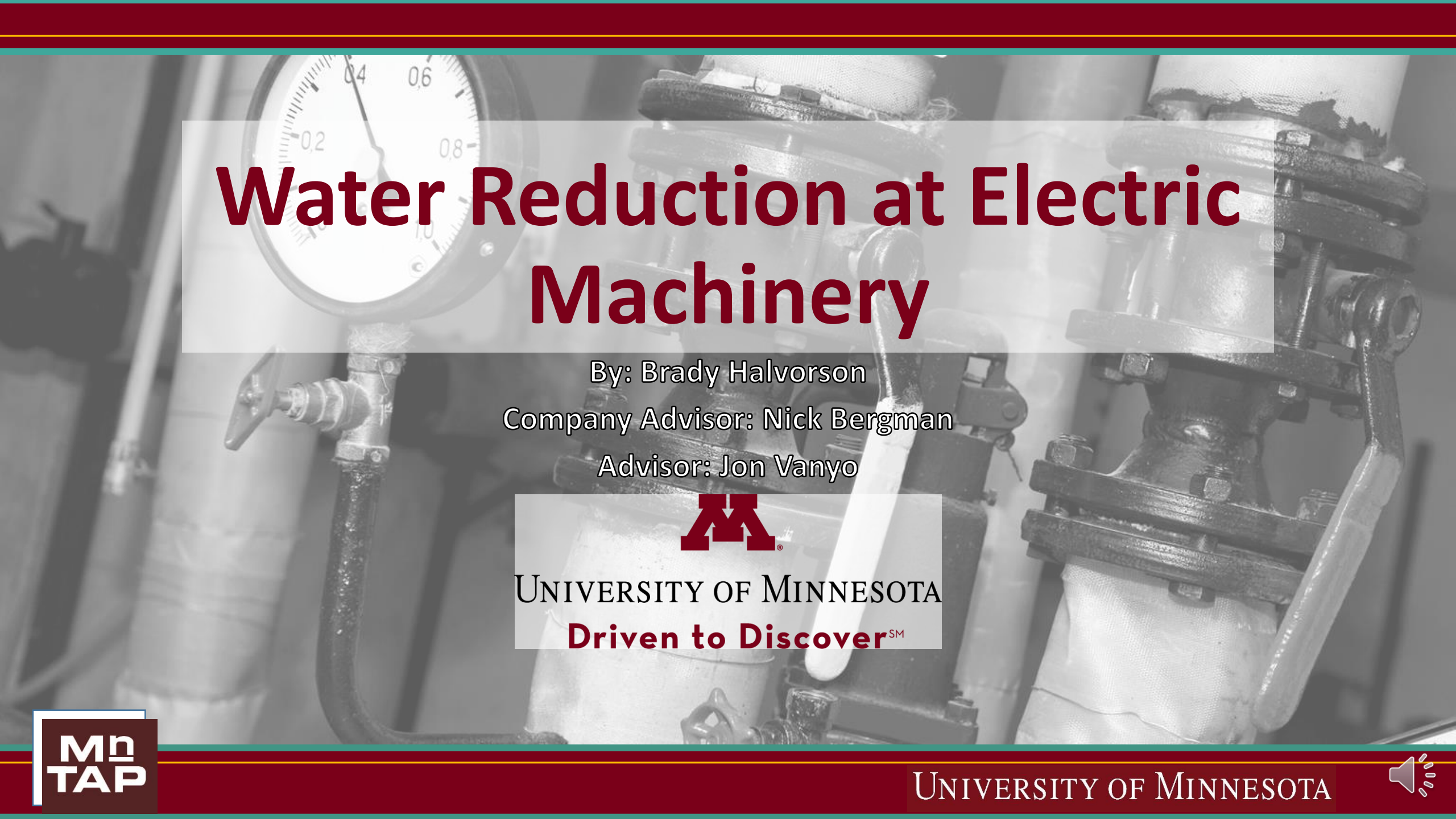
Driven to Discover℠

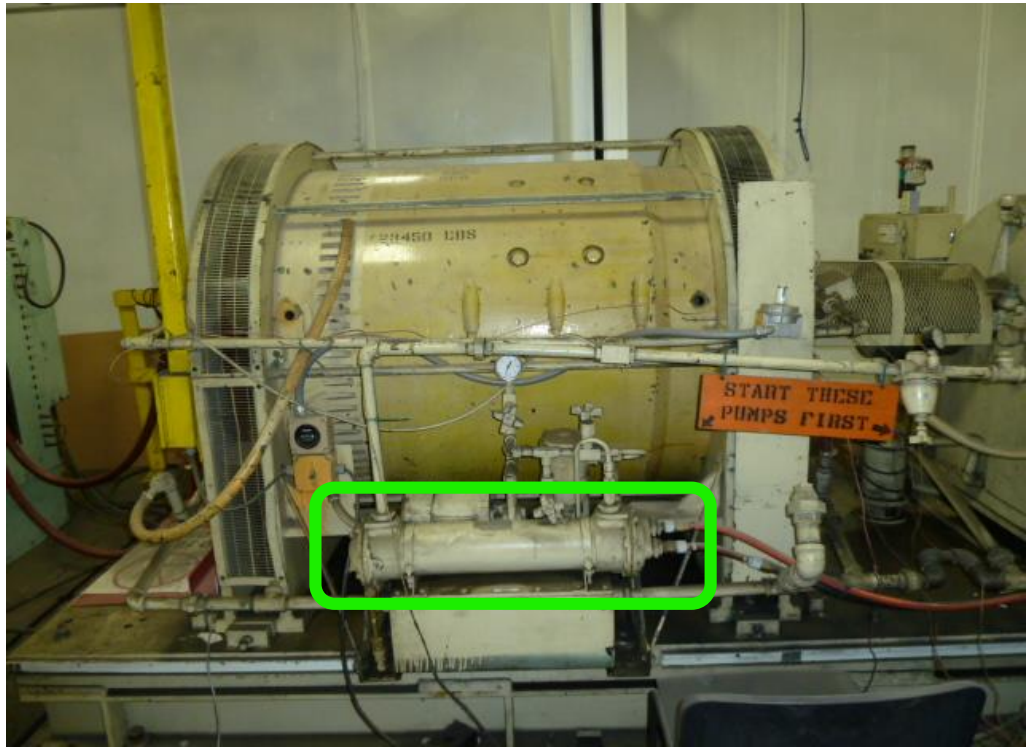


Background

- Founded in 1891
- Custom manufactures motors and generators
- Large scale production
  - 150,000 HP
  - 200,000 KVA

Project Goal

- Completely reduce water used for non-contact cooling
- Remove chemical treatment
- Eliminate wastewater permit requirements on EM's stormwater permit.



First Steps

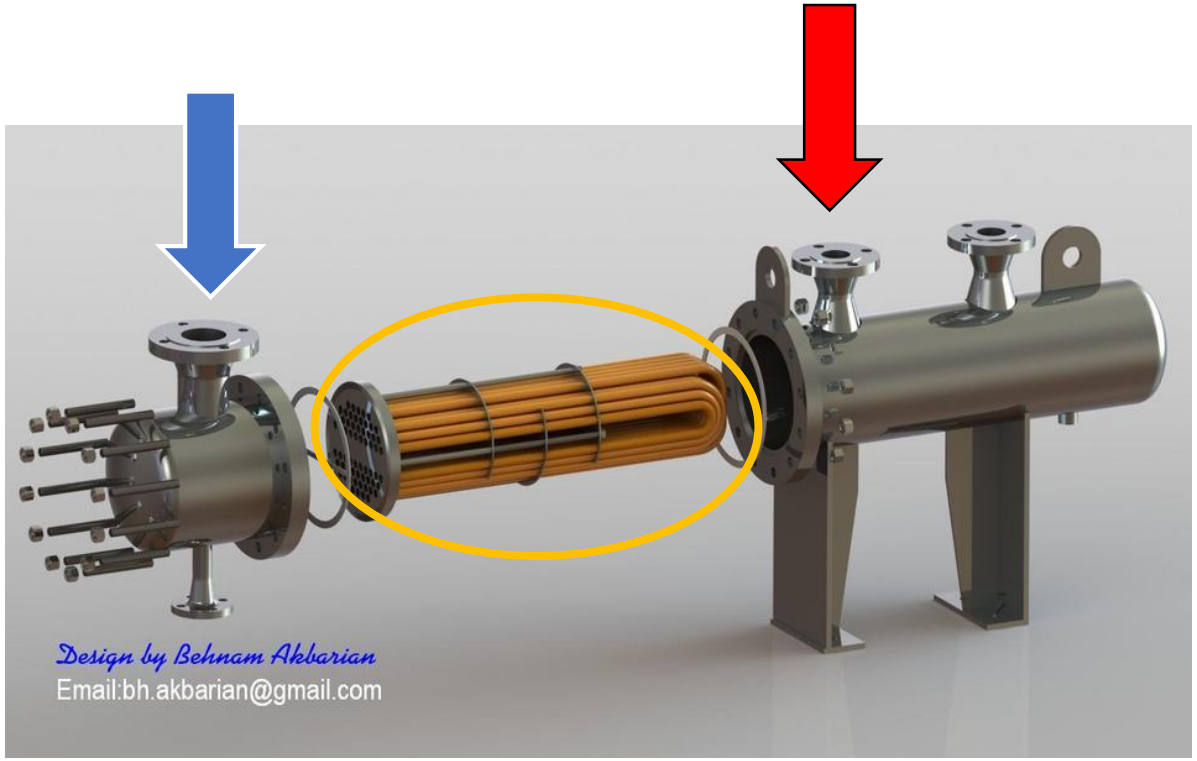
- **Identify sources of water use**
  - Maintenance department
- **Calculate total water use**
  - MPCA reports
- **Gather total savings potential**

Gathering Data

- **Test Department**
  - Cliff Anderson
- **Flow meters**
- **IR camera**
- **Past data**

Water Reduction

- **Opportunity to Eliminate Water**
  - Portable Lube Systems
  - Gearboxes
  - Generators

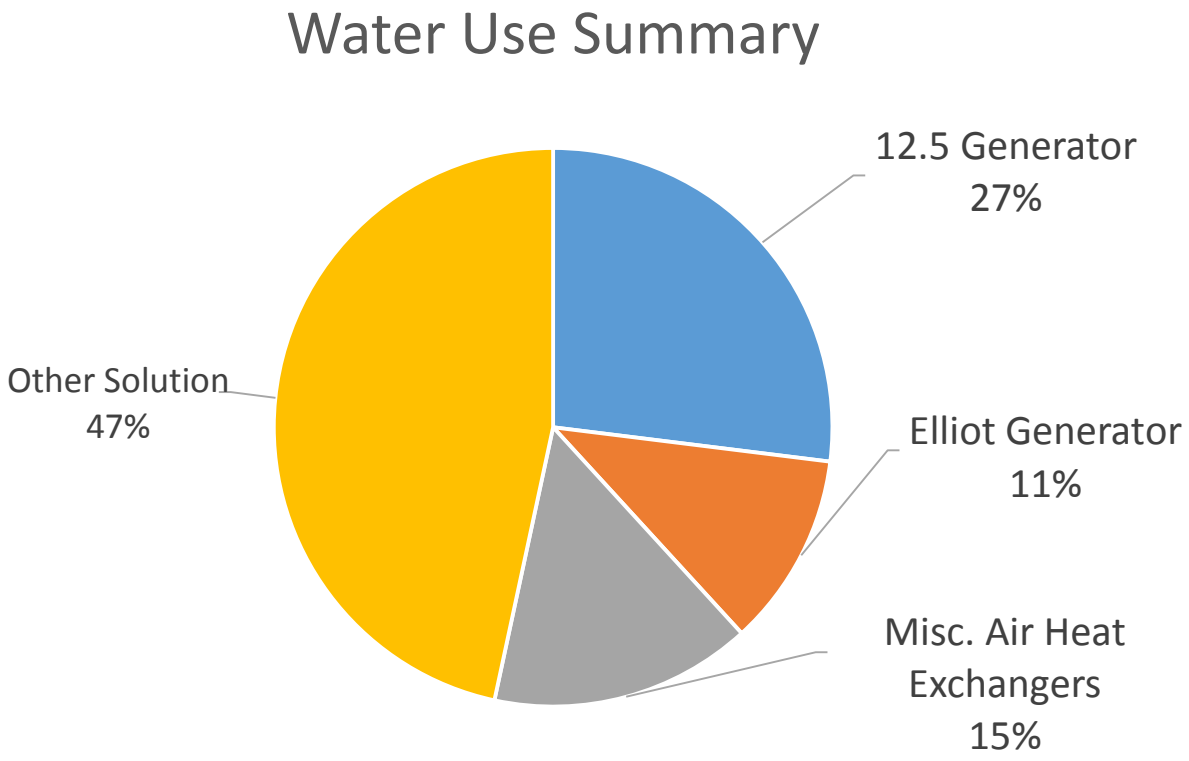


Replacements Considered

- Water Chillers
- Large Scale Recirculation
- Air cooled heat exchangers

Opportunity for Air Cooled Heat Exchangers

- **Non-Contact Water Users**
  - 12.5 Generator
    - 480,000 GPY
  - Elliot Generator
    - 200,000 GPY
  - Misc. Air Heat Exchangers
    - 270,000 GPY
  - Other Solution
    - 830,000 GPY
  - Total Non-Contact Water Use
    - 1,780,000 GPY

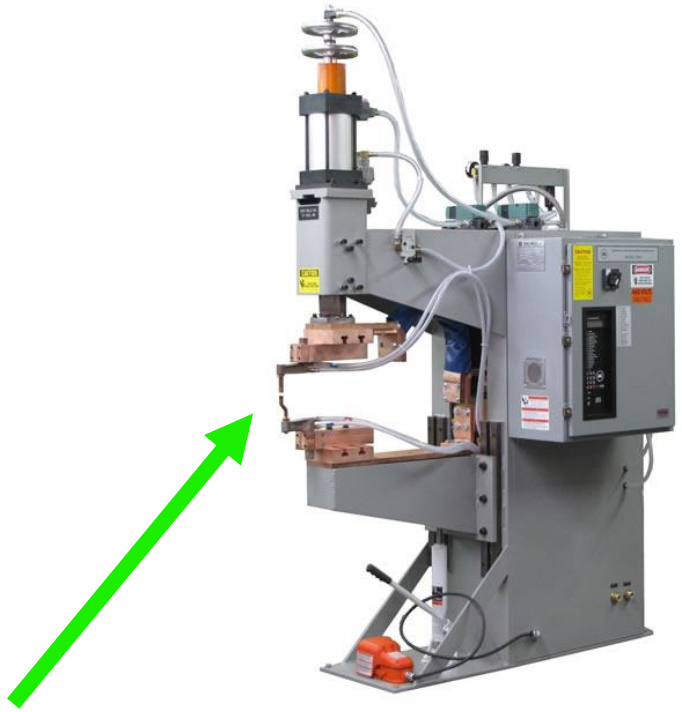


Water Reduction Solutions

Recommendations	Waste/Water Reductions Per Year	Implementation Cost	Net Savings Per Year	Payback Period	Status
Air Heat Exchangers for 12.5 Room	480,000 Gallons of Water	$3,400	$4,600	0.8 years	Implementing
Air Heat Exchanger for Elliot Generator	200,000 Gallons of Water	$1,000	$1,800	0.6 years	Implementing
Other Air Heat Exchangers	270,000 Gallons of Water	$12,600	$2,600	4.8 years	Incremental implementation

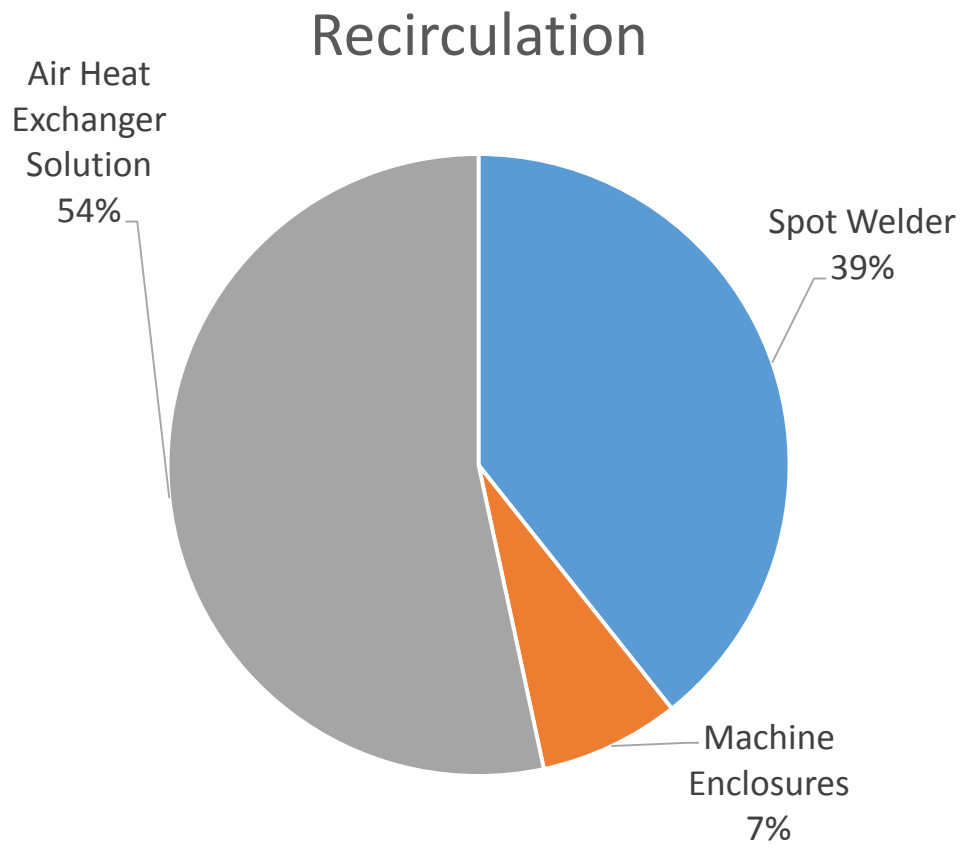
Water Recirculation

- Machine Enclosures
- Spot Welders



Opportunity for Recirculation

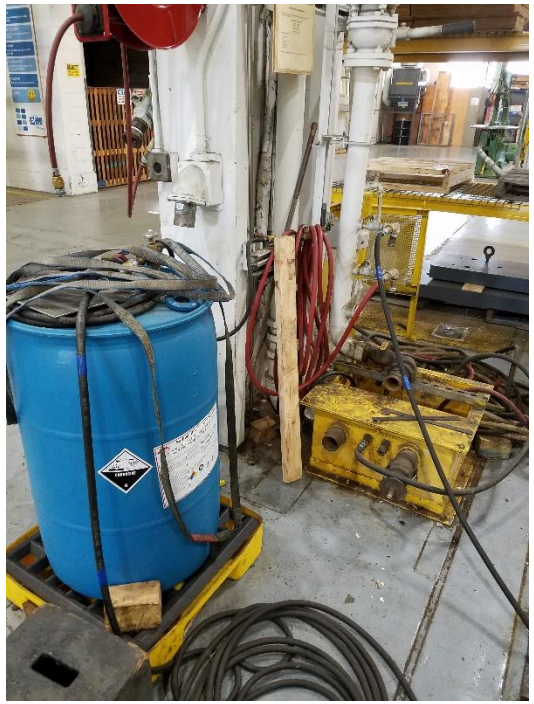
- **Non-Contact Water Users**
  - Spot Welder
    - 700,000 GPY
  - Machine Enclosures
    - 130,000 GPY
  - Air Heat Exchanger Solutions
    - 950,000 GPY



Water Recirculation Solutions

Recommendations	Waste/Water Reductions Per Year	Implementation Cost	Net Savings Per Year	Payback Period	Status
Water Chiller for Spot Welder	700,000 Gallons of Water	$4,900	$6,600	0.7 years	Implementing
Water Recirculation for Machine Enclosures and Turbo Generators	130,000 Gallons of Water	$46,100 ***Update* $14,000**	$1,200 (Water) **$8400** **(Permit + Labor)**	30 years ***Update*** **1.46 Years**	Not Planned ***Update*** **Planned**

Chemical Treatment



- Sodium Bisulfite is used to Remove Chlorine
- Dripped at a consistent rate

Possible Chemical Solutions

- Intermittent Low Drip
- Automated System

Chemical Treatment Savings

Recommendations	Waste/Water Reductions Per Year	Implementation Cost	Net Savings Per Year	Payback Period	Status
Automated Dosing System	390 Gallons of Sodium Bisulfite	$4,400	$4,600	< 1 year	Implementing
Constant Intermittent Slower Drip	390 Gallons of Sodium Bisulfite	$400	$4,600	< 1 year	Not Planned

All Final Solutions

Recommendations	Waste/Water Reductions Per Year	Implementation Cost	Savings Per Year	Payback Period	Status
Automated Chemical Dosing	390 Gallons Sodium Bisulfite	$4,400	$4,600	< 1 year	Implementing
Install Air Cooled Heat Exchangers	950,000 Gallons of Water	$16,500	$9,000	1.9 years	Implementing
Water Chiller for Spot Welder	700,000 Gallons of Water	$4,900	$6,600	< 1 year	Implementing
Water Recirculation for Machine Enclosures	130,000 Gallons of Water, ***Labor and Permit Fees***	$46,100 ***Update* $14,000**	$1,200 ***+$8,400***	30 years ***1.5 years***	Not Planned ***Update* Planned**
Total	1,780,000 Gallons of Water 390 Gallons Sodium Bisulfite	**$39,800**	**$29,800**	1.3 years	Implementing

Complete Water Elimination Savings

Description	Waste Reductions Per Year	Savings Per Year
Total Water Reduction	1.78 Million Gallons of Water	$16,800
Chemical Treatment Reduction	440 Gallons of Sodium Bisulfite	**$5,200**
Permit Elimination	Annual Permit Fee	$1,200
Labor Savings	72 Hours of Labor	$7,200
	Total Potential Savings	**$30,400**

Personal Benefits

Thank you!