

A close-up photograph of a person's hands cupping water flowing from a faucet. The water is clear and cascades into a blue pool below. The background is a blurred green landscape with yellow flowers.

INNOVATION IN PULP & PAPER INDUSTRY

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AGENDA

- ▲ Why Focus on Water?
- ▲ Water use in Pulp & Paper Industry
- ▲ Innovations That Impact Water Use



By 2030 the world will need:



5% MORE ENERGY



Water inventory

Of the earth's water supply:

97.5%
= SALT
WATER

2.5%
= FRESH
WATER

glaciers, ice caps

groundwater

lakes, rivers,
ice/snow

1.72%

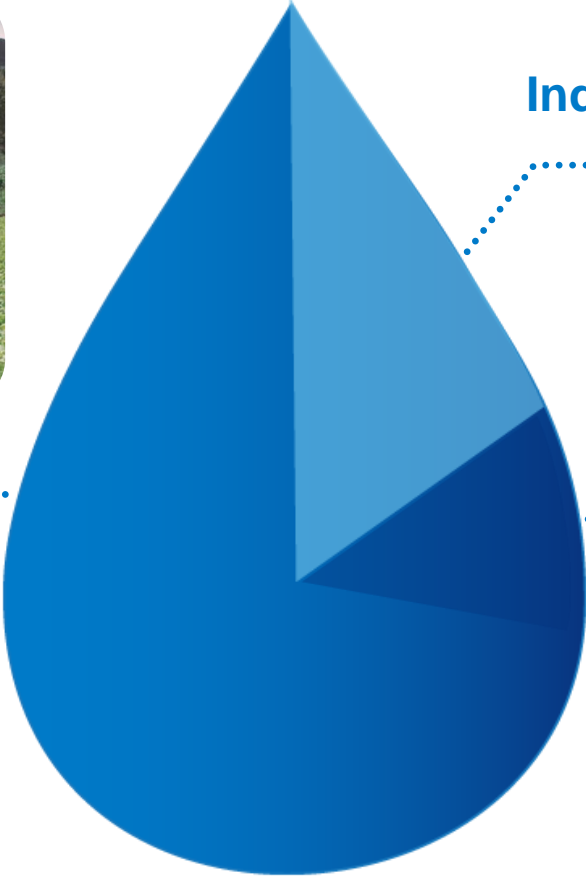
.75%

.03%

Industry is the Second-Largest Fresh Water Consumer



70%
Agriculture



20%
Industry



10%
Domestic



Water Relevance to Pulp & Paper

One of top 3 industrial fresh water users

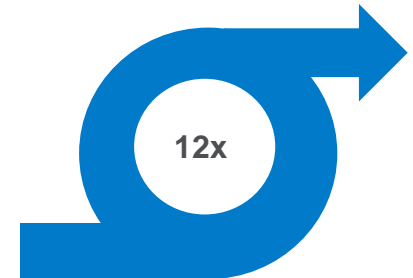


Metals/Mining
Refining, Paper

25m³ of water per paper ton



Up to 85% of water is returned to environment



Water works for paper to ...

Transfer heat



Separate materials



Transport pulp and chemicals



Form product

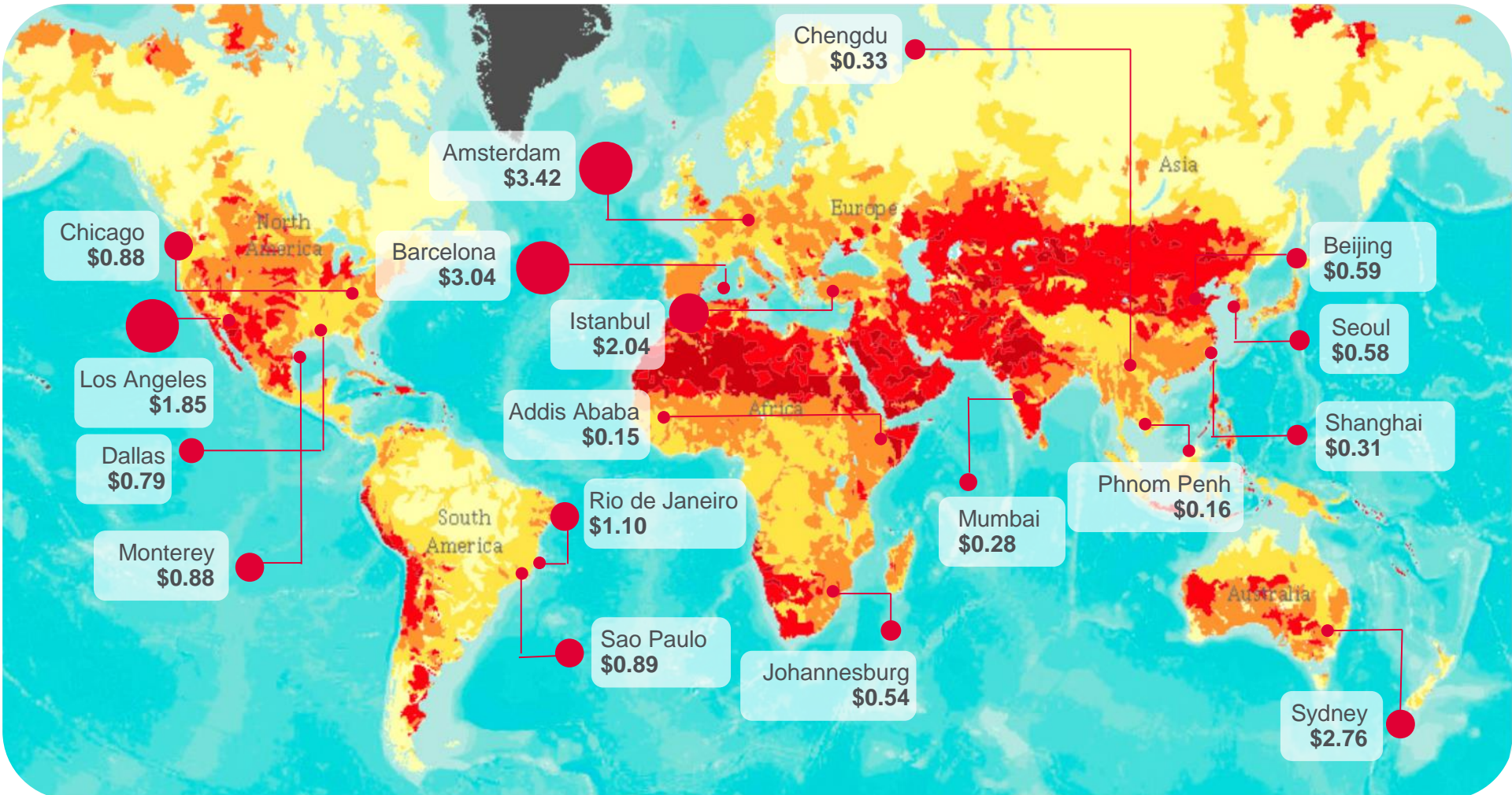


Meet product spec



Water is Undervalued:

Prices inverse to risk



Scarcity Impacts: Financial Implications to Paper

Curtailed Production

Limited availability and quality of water results in **decreased production and loss in revenue.**

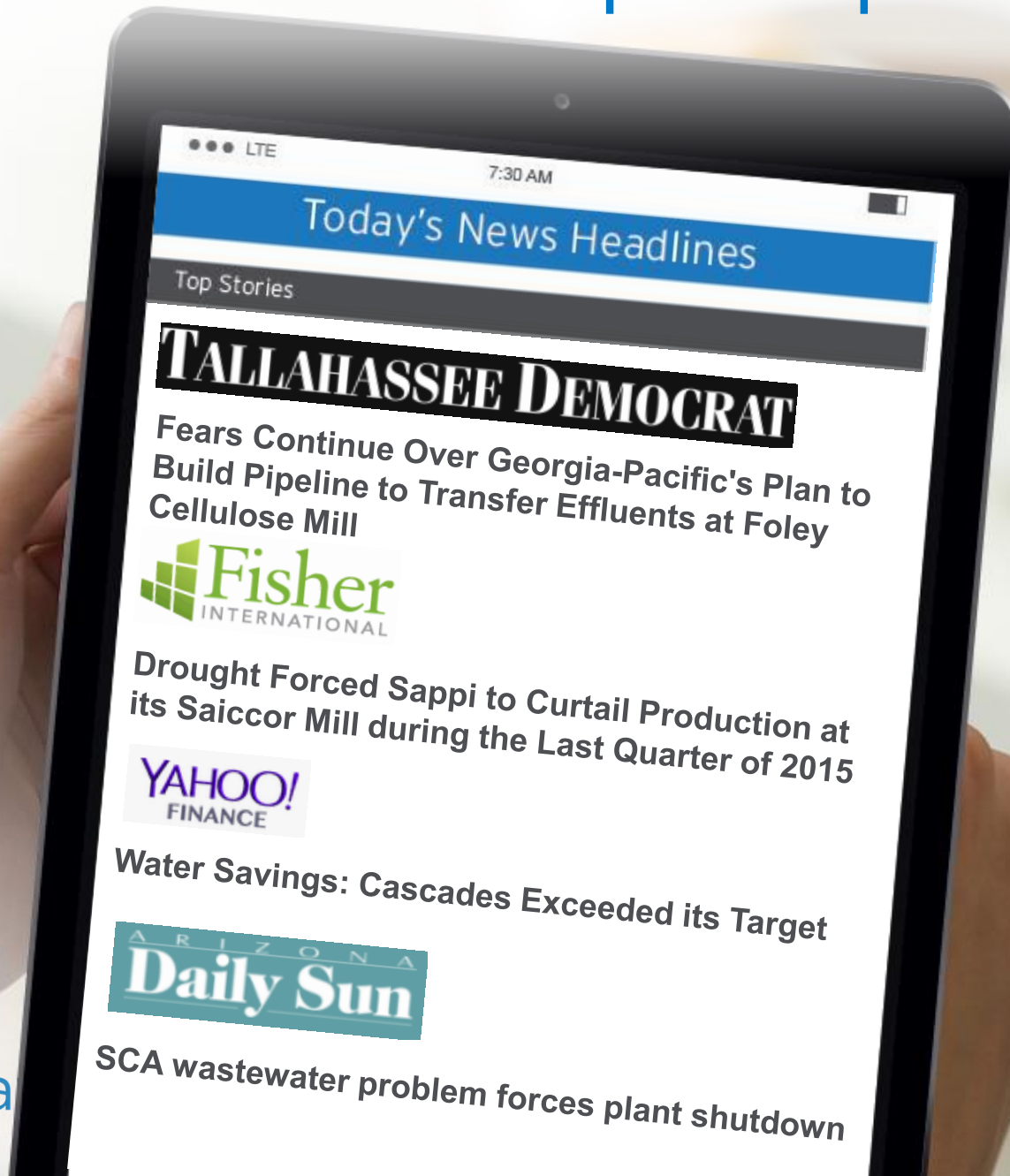
Machine Inefficiency

Water scarcity increases the cost of water, **which reduces profit margins.**

Price Increase & Fines

Revenue	X
Cost of Goods Sold	X
Operating Profit	X
Operating Expenses	X
Depreciation	X
Ebit	X
Interest	X
Tax	X
Profit After Tax	X


Water Headlines in Pulp & Paper



Water Reduction Mandate

Due to California Drought

California has imposed a **25%** statewide water reduction mandate for urban users by February 2016.



WHAT THIS
MEANS FOR
BUSINESSES:

Water suppliers will rely on both **residential and non-residential user reductions** to meet the standard

Water use reporting requirements will expand under the proposed emergency regulation

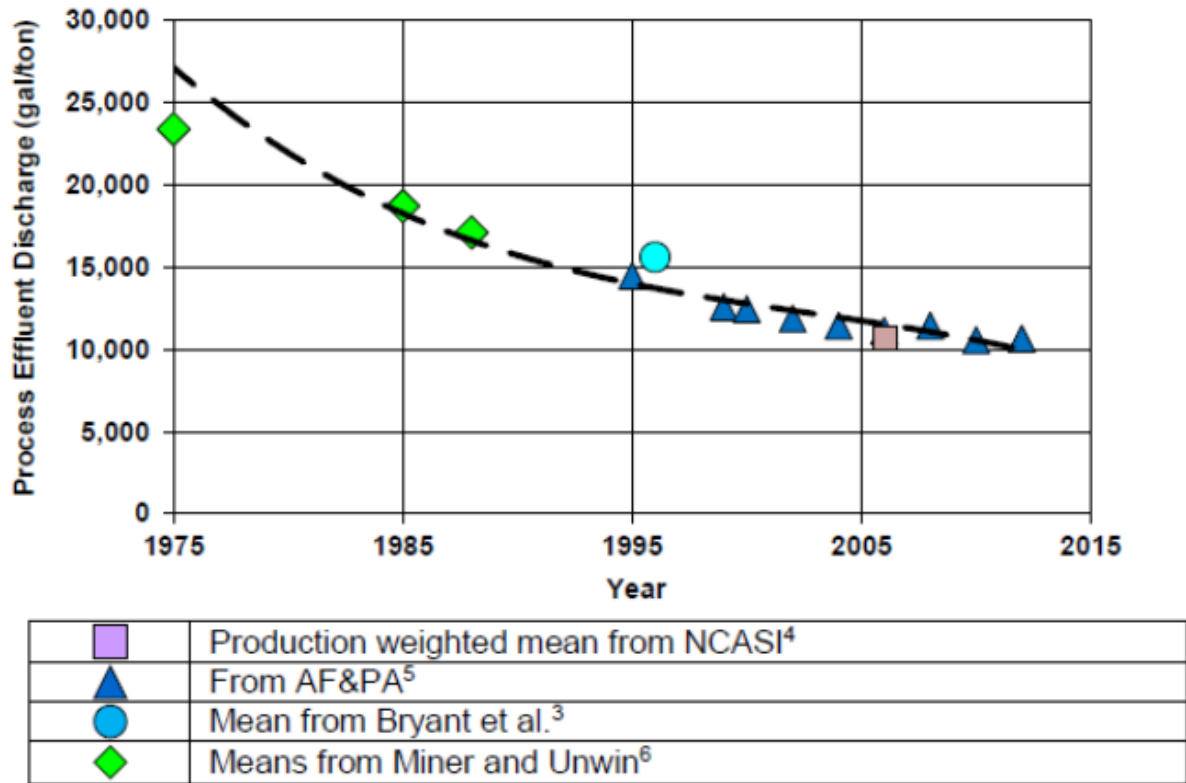
Regulatory and public **pressure to reduce water consumption** will increase

Violations will be costly

Why Water

- ▲ Water is becoming a limited resource. By 2030, the world will need **30% more water** to meet demands (Global Water Intelligence).
- ▲ U.S. pulp and paper producers withdraw more than **one trillion gallons of water annually** from surface and ground sources. This water is repurposed several times in manufacturing before 90% is returned to surface waters.
- ▲ Reducing water usage is an important element to achieve a more sustainable approach for pulp & paper manufacturing.
- ▲ The U.S. pulp and paper industry significantly reduced its water usage over the last 30 years. **The rate of decline of water use has slowed in recent years.**

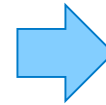
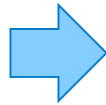
Water Use History



Source: Agenda 2020

Holistic Approach Required

Increased Machine Efficiency & Production of In-Spec Paper

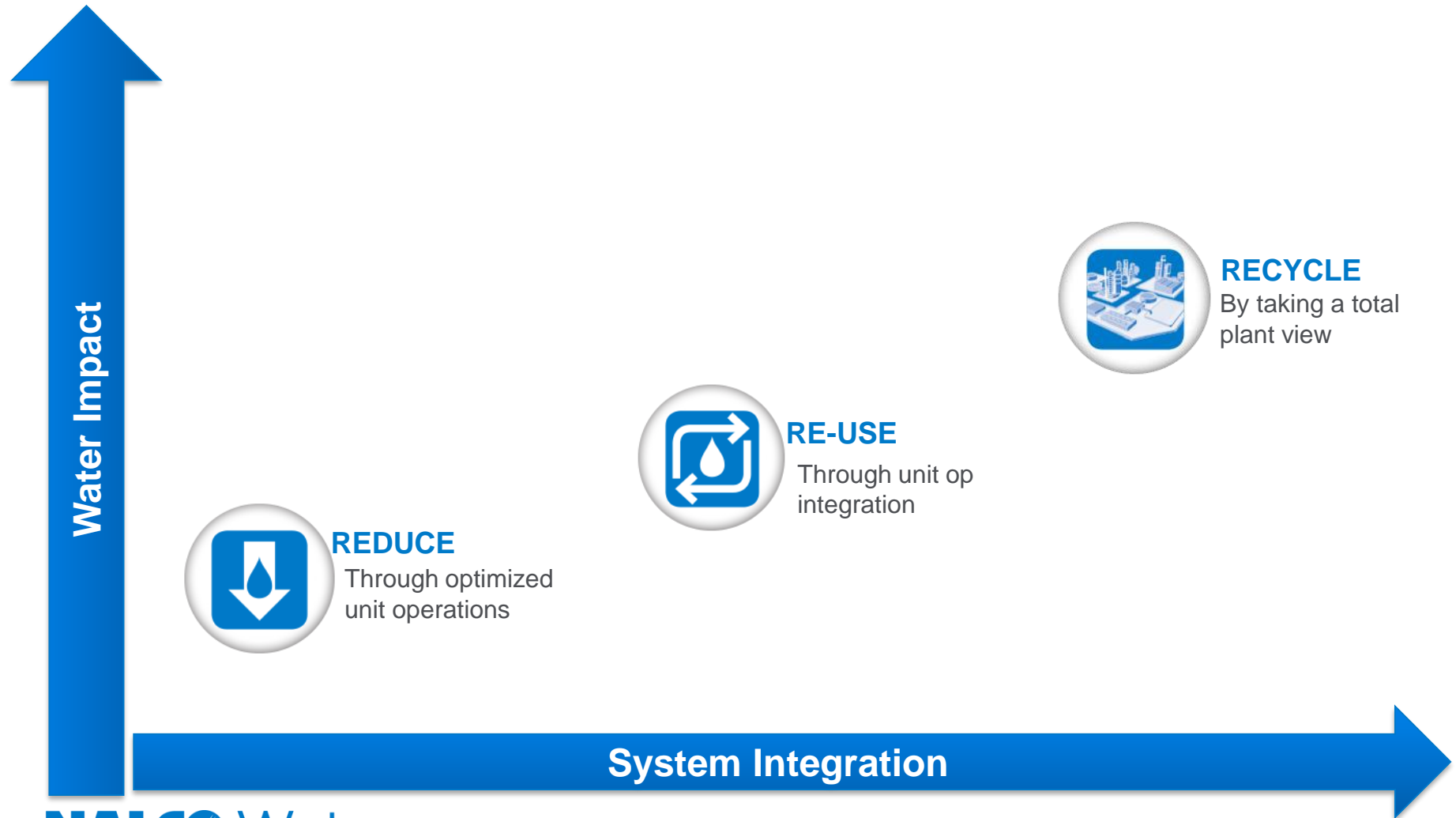


Preparation

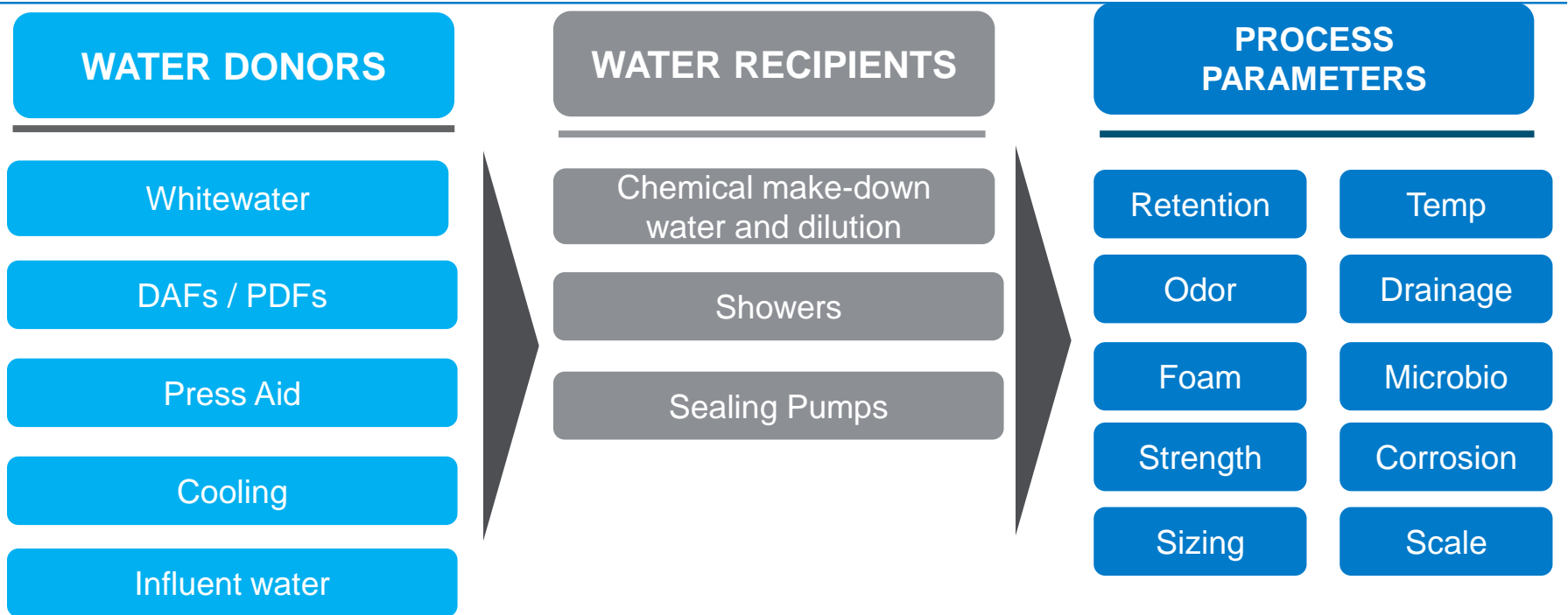
Use

Discharge or
Recycle

Overall Water Use Reduction Approach



Reuse/Recycle Parameters to Consider



GRADE WATER & CHEMISTRY SPECIFICATION

pH	hardness	temperature	ATP / Spore	BOD / COD
conductivity	TSS / TDS	Charge	Chlorine	ions

A photograph of a paper mill's machinery, showing large rolls of paper being processed by rollers. A blue semi-transparent banner is overlaid across the middle of the image, containing text. The background shows industrial equipment, including a yellow overhead crane and various rollers.

INNOVATIONS THAT IMPACT WATER USE

PARETO™ Mixing Technology

FLOCMASTER™ Sludge Dewatering

4D Air Technology for Entrained Air

PARETO™ Mixing Technology

Optimized Chemical Mixing



- ▲ Delivers reduced fresh water consumption, improved operational efficiency and reduced associated energy costs of fresh water heating.
- ▲ **PARETO™** Mixing Technology has saved in ten years of operation nearly **22 billion gallons of fresh water** and nearly **86.5 MM therms of energy**, meaning:
 - ~ 175,000 American homes annual fresh water consumption
 - ~ 40 hrs. of Niagara Falls flow
 - ~ 1,200,000 barrels of crude oil
 - ~ 140,000 cars removed from the road
 - ~650,000 tons of CO₂ prevented from release to the environment

Wrapping up

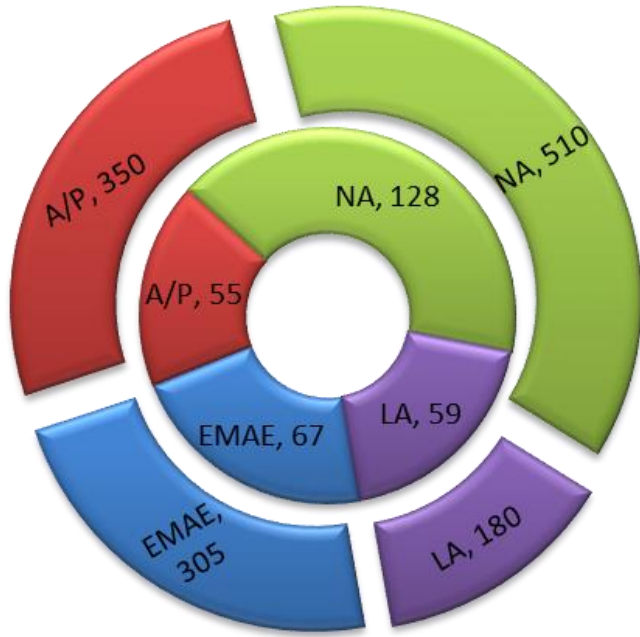
- ▲ A simple, friendly in-line mixing device
- ▲ Provides a differentiated, more efficient method for chemical feed
- ▲ Applications have been able to prove 1 or more of the following benefits:
 1. Increase Runnability
 2. Improve Quality
 3. Reduce Chemical Consumption
 - Minimize Fresh Water usage
 - Fresh Water and Energy Savings

eROI



PARETO™ Mixing Technology

Global Figures



2016

Item

175,579	American Household yearly consumption
3,195,531	Tons of paper manufactured with process water instead of fresh water
645,901	CO2 metric tons prevented to be released
137,426	Cars removed from streets



INNOVATIONS THAT IMPACT WATER USE

PARETO™ Mixing Technology

FLOCMASTER™ Sludge Dewatering

4D Air Technology for Entrained Air

Challenges – Sludge Dewatering



FLOCMASTER™ Mixing Technology

Sludge Dewatering



- ▲ Multicomponent offering that includes equipment, chemistry and service. Delivers a unique superior method for sludge dewatering.
- ▲ **FLOCMASTER™ Technology**
 - Increased cake solids → hauling, disposal, BTU value
 - Improved filtrate quality → potential for re-use
 - Faster dewatering → increased throughput
 - Use increased polymer conc. → fresh water reduction
 - More efficient polymer application → lower usage or better performance

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INNOVATIONS THAT IMPACT WATER USE

PARETO™ Mixing Technology

FLOCMASTER™ Sludge Dewatering

4D Air Technology for Entrained Air

Surface & Entrained Air Control

Automated Antifoam Technology



- ▲ **Nalco 4D Air** is a new antifoam program designed to minimize detrimental effects of entrained air and surface foam in the virgin and recycled carton and container board market.
- ▲ **The 4D Air Program** includes specially formulated chemistries combined with the **PARETO** delivery system, entrained air on-line monitoring and application knowledge to deliver:
 - Enhanced sheet quality
 - Increased productivity
 - Improved wet end stability and cost reduction

Monitoring & Automation

4D Air Entrained Air Monitor

Improve wet end stability and performance with automation through:

- ▲ Reducing wet end variability
- ▲ Monitoring entrained air on-line
- ▲ Controlling antifoam pumps through feedback control
- ▲ Optimizing antifoam usage and subsequent foam control
- ▲ Pareto Mixing Technology
- ▲ Periodic Laboratory Recirculation Testing



Nalco Water Entrained Air Monitor



Energy Cost Savings and Improved Wet End Stability

4D Air Program reduces antifoam costs and increases On Machine Efficiency. savings.



TCO Reduction

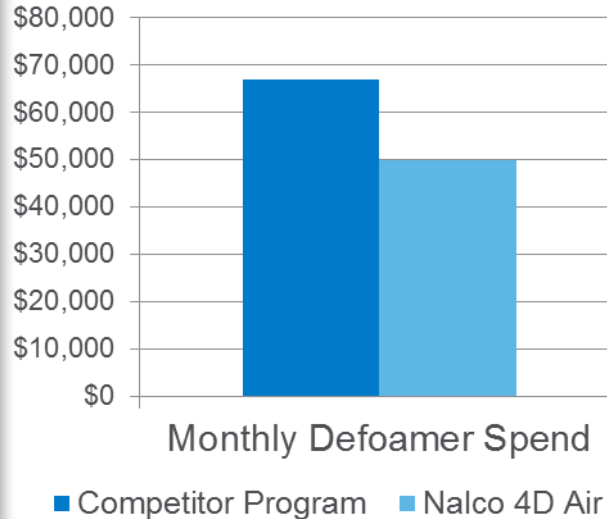
\$215K

Defoamer cost



2%

Reduction in Entrained Air



Improved OME



0.54%

Improved On Machine Efficiency

Conclusions

Total Water Management in Paper

- ▲ Knowledge of Water is Key
 - Process and Utilities
 - Average mill: 25m³ of water per ton
 - Recirculates up to 12x
 - 88% returned to waterways
- ▲ Water influences Key Business Drivers
 - Saleable product
 - Production efficiency
 - Natural resource stewardship
- ▲ Opportunities exist to address water scarcity now
 - Holistic approach to water flow through all operations
 - Development of multifaceted approaches using existing tools
 - Advanced solutions for the future that focus on water reuse and recycling





THANK YOU FOR YOUR TIME