Water and Energy Nexus in Industrial Plants

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Agenda

- Market drivers and trends
- Water and Energy Nexus
- Water treatment fundamentals
- Water Energy Nexus examples
  - Hotel
  - Bottling Plant
  - Energy production (Oil Sands)
- Summary
Market Drivers and Trends

- Trend towards Water conservation
  - Shortage of water (BRIC+)
  - Regulatory pressures
  - Brand image (Sustainability)

- Reuse and recycle and worsening water quality (e.g. Sea Water, municipal waste water)

- More stringent view on chemistries
  - Limits on Specific contaminants (e.g. P)
  - Preference to use “non-chemical solutions” (Europe)
  - Increasing acceptance of “gadgets” (Light markets)

- Lack of qualified labor

- Need for reliable, actionable information
  - Increasing acceptance of the internet and remote monitoring
Water A Key Issue in Fastest-growing Economies

Water quality and quantity are driving important market trends…

- 7 Billion People today, up to 10 Billion by 2050
- Improving quality of life requires more resource-intensive foods
- Today, 1 Billion people lack access to clean water
- Energy demand will rise nearly 40% by 2035
## OUR CUSTOMERS FOCUSING ON SUSTAINABILITY

Public customer data shows demand for solutions to sustainability goals

<table>
<thead>
<tr>
<th>Percent of customers</th>
<th>Has a Sustainability leader</th>
<th>Stated Water Goal</th>
<th>Stated Energy Goal</th>
<th>Stated GHG goal</th>
<th>Stated Safety Goal</th>
<th>Stated Waste Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>87%</td>
<td>53%</td>
<td>55%</td>
<td>40%</td>
<td>9%</td>
<td>34%</td>
<td></td>
</tr>
</tbody>
</table>

Including ambitious Targets:

- **Coca-Cola**: Become Water Neutral
- **Unilever**: Grow business with nearly half the footprint (water, energy, waste)
- **GSK**: > 20% reduction in water or energy
- **Heinz**:
- **Marriott**:
- **Hyatt**:
- **Dairy for Life**:
- **Starwood Hotels and Resorts**:
- **Diageo**:

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*Note: The table and diagram are for illustrative purposes only and may not reflect real data.*
We are the global leader in water, hygiene, and energy technology and services.

We have an exponential impact on the sustainability of our planet.

- **22,500** sales and service professionals
- **delivering innovative programmes and services** (**5,300 patents**) in **171** countries
- **at over 1 million** customers locations
Water & Energy are Interdependent

Water needs for Energy
- Thermoelectric cooling
- Hydropower
- Energy resources extraction
- Fuel production
- Emission management

Energy needs for Water
- Treatment
- Conditioning for use
- Transport & conveyance
- Production (e.g., desalination)
- Pumping
Several major industries are large consumers of both water and energy in the manufacturing sector: Water is the medium of choice for heat transfer in industry.
Water and Energy Flow in a Typical Industrial Plant

1. Cooling Tower
2. Pre-treatment
3. Waste Water Treatment
4. Production Processes
300 Room Hotel Water & Energy Consumption

**Water**
- Chiller: 24%
- Kitchen & Public Areas: 15%
- Laundry: 6%
- Guest Rooms: 9.5%
- Hot Water: 7%
- Other: 6%

**Energy**
- Chiller: 39%
- Kitchen: 6%
- Laundry: 5%
- Air Handling Unit: 3.5%
- Hot Water: 6%
- Lighting: 9.5%
- Pumping: 7%
- Other: 5%
300 Room Hotel Before & After Water Usage Optimization

- Cooling: 20% savings
- Kitchen: 47% savings
- Laundry: 37% savings
- Total: 21% savings
300 Room Hotel Before & After Energy Usage Optimization

- Chiller: 20% savings
- Kitchen: 47% savings
- Laundry: 37% savings
- Air Handling Unit: 40% savings
- Pumping: 5% savings
- Total: 4% savings
New Apex Conveyor Ware Washing Program: Superior Performance with Water and Energy Savings

Products
- Solid products are safe and easy to use
- Non-corrosive chemistry to minimize the risk of chemical injury
- Low phosphate and phosphorus formulas for excellent results

Automation and Reporting
- Reliability and efficiency
- Easily identifies areas to improve operational efficiency
- Delivers best possible at lowest total cost

Product Comparison:
- Traditional vs. Apex Conveyor
  - Better Results
  - 45% Total Savings
  - 24% Electrical Reduction
  - 87% Natural Gas Reduction

World Class On-site service
Aquanomic Laundry Program Delivers Superior Performance with Water and Energy Savings

- Innovative Low Temp Chemistry and Smart Wash Process
- Unique blend of surfactants
- Formulated for the environment

- 40% reduction in water usage
- 50% reduction in energy usage
- Optimized wash formulation

Delivering Results

- Clean, white & soft linens
- Right pH balance
- Does not compromise linen life
3D TRASAR Technology for Cooling Water Enables Water Savings While Delivering Superior, Consistent Cooling Performance

Detect

- Real-time scale and corrosion measurement with fluorescent Tagged Polymer and proprietary Nalco Corrosion Monitor and Nalco Deposit Monitor
- Direct measurement of bio-demand with bio-reporter technology
- Other system conditions monitored through conductivity, pH, ORP, temperature, and turbidity
- Alarm conditions are reported instantly via email

Determine

- Built-in control algorithms determine chemical dosage and blow down response
- Proprietary dynamic algorithms based on Nalco Scale Index and Nalco Bio-Index respond to variable stresses
- Remote monitoring by the Nalco 360 Expert Center enables proactive response to system conditions

Deliver

- Corrosion control
- Fouling prevention maximizes heat transfer efficiency
- Higher cycles minimizes water discharge
- Experts watch your systems 24/7 for your peace of mind
Water and Energy Optimization in a Chemical Plant Using 3D TRASAR

**Water and Energy Cost Savings**

**Plant:** Urea Ammonium Nitrate (UAN) Chemical Plant  
**Region:** North America

**Situation:**
- Large multi-cell cooling towers and several key heat exchangers had heavy scale buildup.  
- Cooling Tower fouled with Nitrifying Bacteria

**Application:** 3D TRASAR® Cooling Water Integrated Solution

**eROI Benefits:**
- $402,785 Energy Savings by Improved Heat Transfer  
- 95,439 MMBtu in Natural Gas Reduction  
- 5,695 Tons of CO2 Emissions Reduced  
- $1.8MM in Increased Production  
- $60,000 in reduced maintenance cost
Some Examples of Opportunities for Water and Energy Savings in Food and Beverage Applications
Ecolab’s Bottle Washing Programs Save Water and Energy While Delivering Superior, Consistent Results

Impact and Savings in a Typical plant

Energy Savings $79,845
Water Savings $14,400
Caustic Savings $28,603
Ecolab’s DryExx™ Lubricants Deliver Superior Performance While Saving Water

**Customer benefits**
- Reduced water consumption
- Cleaner drier safer plant
- Drip pans not required
- Less pressure on water effluent
- Better lubrication – higher production rate
- No phosphorous

**Example Going from wet to dry lubricants**
- 400,000 gal/year water savings
- 50 fold reduction in chemical use

![Diagram](image-url)
Oil Sands: Water and Energy Nexus
Oil Sands—what and where is it?

- Deposits of bitumen found in more than 70 countries

- The bulk of the oil sands is found in northern Alberta and concentrated in 3 Major Reserves:
  - Athabasca-Wabasha
  - Cold Lake
  - Peace River

- Proven Oil Reserves of 175BB barrels, making it second only to Saudi Arabia

- An estimated to 2 trillion bbl still in the ground.

- Oil Sand Content:
  - 10-12% oil
  - 80-85% clay, sand, minerals
  - 4-6% water
  - Bitumen is high in carbon but low in hydrogen and must be upgraded to form a light synthetic crude
Steam Assisted Gravity Drainage (SAGD)

Source: U.S. Department of Energy
0.2-0.5 m³ (50-135 gal) water to produce 1 barrel of bitumen
Water is treated and sent back to the boilers to produce the steam. Water quality is poor.

Cost to produce 1 barrel of oil
- Saudi Arabia/Iraq <$1/barrel
- United States $5-6/barrel
- Canadian Oil Sands: In > $17-22
Nalco Assists Our Customers in Three Main Ways

Emulsion Breaking for efficient separation of oil from water

Water Treatment to remove oils and problem ions for downstream processing in boilers

Reliable Steam Production

Scale Control

Corrosion control
Summary

- Market trends demand innovative solutions for efficient water and energy management

- Water and Energy are intricately intertwined in industrial plants
  - Best practices for water management will result in good energy management

- Opportunity exists for more efficient water and energy management through innovative solutions