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Global Lessons on Water Reuse for Industrial Applications in Alberta

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An Evolving Global Water Market

- Demand for water is on the road to outstrip supply
- Industries are struggling to source sufficient water supply
- Scarcity is raising prices and level of regulation
- Increased scrutiny on environmental and water footprint
- More stringent regulatory standards
  - Water used
  - Quality of wastewater discharge

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Increased Pressure on Water Sources

- Water sources must be sustainable to meet long term demand
  - Continuous reliable sources
  - Cost-effective / economic
  - Minimize environmental impact
- Alternative water supply options:
  - Demand Management
    - Water conservation
    - Water recycle
  - New sources
    - Stormwater
    - Brackish water
    - Seawater
    - Wastewater reuse

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Industry Sustainability Concerns

- Risk to operations
  - Insufficient water supply
  - Decreasing water quality
  - Increasing cost of water sources
  - Increasing water treatment costs
- Downstream constraints
  - Effluent discharge limitations
  - Increasing wastewater treatment costs
  - Contaminants of Emerging Concern
- Cumulative Effects

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Water Management Strategies

- Optimization
- Internal reuse/recycle
- Alternative water sources
- Industrial wastewater recycling
- Regional water solutions vs. individual company solutions

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Water Balance

Why is this important?

- Baseline current water usage
- Identify sources of waste (leakage, compliance, high volumes)
- Encapsulates cost of water and water treatment

Water related costs

- **Direct** – Water use, wastewater discharge, pre-treatment, specialized treatment, energy costs associated with water use, regulatory, water management measures
- **Indirect** – Site location limitations, permitting and license to operate, relationships with stakeholders, environmental liability

How to do it?

- Capture incoming & outgoing flow capacities for every water consuming entity on site
- Classify entity under a category and sum up all entities under category
- Document related costs structure
- Consult a water expert

Elements to consider

- Pretreatment
- Cooling towers
- Boilers
- Processing
- Other
- Wastewater

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Types of Water Reuse

- **Augmentation of supply sources**
  - Groundwater recharge
- **Urban Reuse**
  - Irrigation of parks, highway medians, golf courses, etc.
  - Toilet and urinal flushing
- **Environmental and recreational**
  - Create, restore, and/or enhance wetlands
  - Recreational and aesthetic impoundments
- **Agricultural use and reuse**
- **Industrial Reuse/Recycling**
  - Cooling water
  - Boiler feed and make-up water
  - Industrial process water
  - Commercial uses (e.g. vehicle washing, window washing, etc.)
  - Fire protection
  - Dust control

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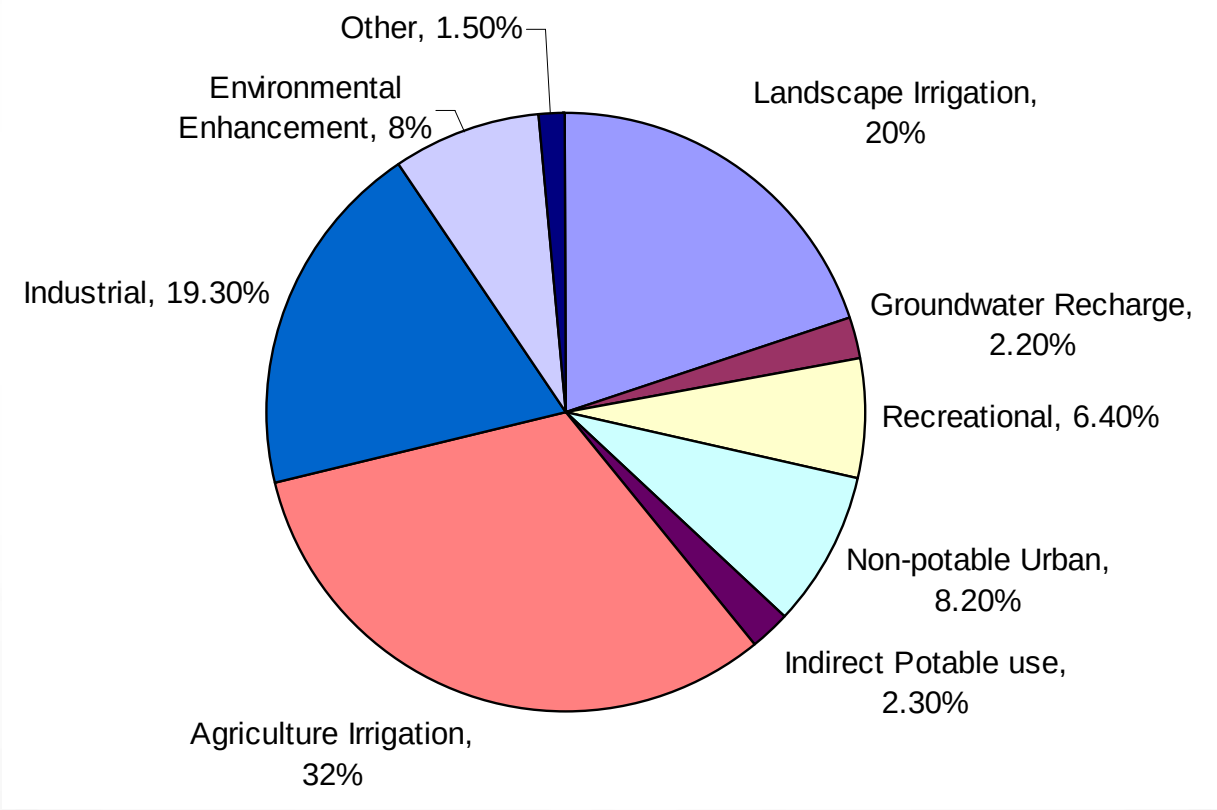
Water Reuse Projects



Source: GWI/PUB Water Reuse Inventory (2009)

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Shifts in Reuse

- Historically, reuse has focused on irrigation
- Recent shift to aquifer recharge and industrial reuse
- Governmental incentives for reuse
- Conservation, efficiency and reuse/recycle are becoming a standard part of industrial water plans
- Regulatory environment is maturing

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Technology Driving Reuse Opportunities

- Advancements in technology driving opportunities for reuse
  - MBR, UF, MF, RO, NF, EDR, IX, Evaporators, ZLD, Advanced Oxidation
  - Often a combination of technologies are required
- Technology costs decreased significantly while improving efficiency and reliability
- Ability to treat high TDS waters (> 35,000 ppm)

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Global Lessons Learned in Reuse

- Regions have been forced to implement reuse for sustainable water management
- Government needs to develop reuse water standards (e.g. California Title 22)
- Public acceptance is paramount
- Reuse must be communicated in a new way
- Wastewater is not waste – it is a valuable product
- More stringent wastewater discharge standards are resulting in increased focus on reuse applications

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Title 22 California Code of Regulations

- Defines water reuse for agricultural irrigation, parks, playgrounds, gold course and school yard irrigation
- Standards of treatment depend on end use
- Four categories of wastewater treatment effluent:
  - **Un-disinfected secondary recycled water –** Oxidized wastewater
  - **Disinfected secondary-23 recycled water** – Oxidized and disinfected (MPN < 23 per 100 ml coliform)
  - **Disinfected secondary-2.2 recycled water** – Oxidized and disinfected (MPN < 2.2 per 100 ml coliform)
  - **Disinfected tertiary recycled water** – Filtered and subsequently disinfected (MPN < 2.2 per 100 ml coliform)

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West Basin Water Recycling Facility

- Built in 1994 and supplies 108ML/d of recycled water
- Industrial customers: El Segundo Power Plant and Chevron Refinery
- Five different qualities of water are produced for diverse uses:
  - **Tertiary Water (Title 22)** – industrial and irrigation uses
  - **Nitrified Water** – industrial cooling towers
  - **Softened Reverse Osmosis Water** – groundwater recharge (MF, RO, disinfection)
  - **Pure Reverse Osmosis Water** – refinery low-pressure boiler feed water
  - **Ultra-Pure Reverse Osmosis Water** – refinery high-pressure boiler feed water

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Benefits of Water Reuse

- Consistent water quantity and quality
- Reduced impacts of seasonal variability in surface water quality
- Reduced demand on raw water sources
- Reduced nutrient discharge to water bodies
- Fulfilling corporate social responsibility commitments

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Potential Reuse/Recycling Opportunities in Alberta

- Alternate water sources:
  - Municipal wastewater to industrial process
  - Cooling and boiler blowdown
  - RO reject
- Potential industrial uses:
  - Cooling water
  - Boiler feed
  - Process water
  - Fire protection
  - Washing
  - Dust suppression

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The Future of Reuse In Alberta

- Water scarcity in South Saskatchewan River Basin
- Water quality concerns in North Saskatchewan River Basin
- Regulatory drivers exist today, more are coming:
  - Water for Life – 30% reduction in water use intensity by 2015 (from 2005 levels)
  - Oilfield Injection Policy – non-saline water conservation and exploration of alternate water sources
  - CCME Wastewater Standards
- Reuse projects implemented in Alberta
- Next steps for Alberta

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Q&A

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