

**WATER & ENERGY
CONSERVATION IN SANITATION**



Northwest Food, Safety, and Sanitation
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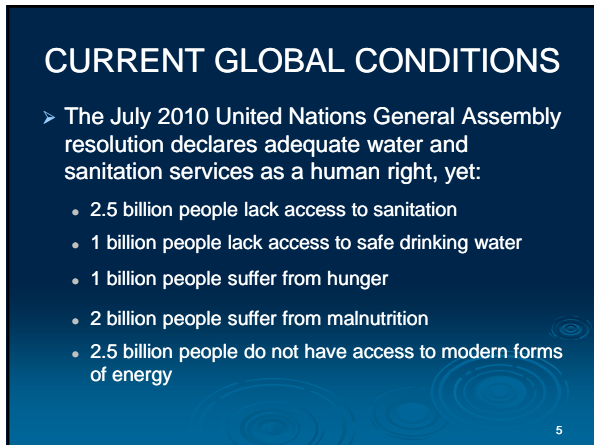
RECENT HEADLINES

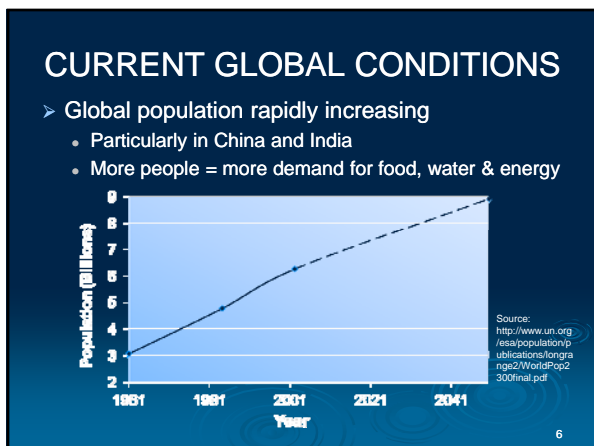
- *Global Water Shortage Looms in New Century*
- *Water is Overtaking Oil as Our Scarcest Natural Resource in the World*
- *Americans Are the World's Biggest Water Consumers but Only 5% of the World's Population*
- *Thirty-Six U.S. States to Face Water Shortages in the Next Five Years*
- *Cost of Water in Nipomo, CA Going Up: Residents Will See an Average Increase of 9.5% on Their Bills*

OUTLINE

- What's Happening on a Global Basis
- What it Means for the U.S.
- What the Costs Are
- Benefits of Conservation Efforts
- Current Water and Energy Usage in Sanitation Programs
- Conservation Opportunities
- Government Incentives
- Other Available Resources








POPULATION EFFECT ON WATER

➤ Water scarcity & mega-cities converge in 2025



Over 65% of megacities will be in high or severe water stressed regions.

Source: http://icds.org/files/attachments/100419_Freedman_Slides.pdf

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CURRENT GLOBAL CONDITIONS

➤ There is a finite amount of land, freshwater and fossil fuels available and we're destroying what we have

- Greenhouse gas emissions increased **70%** between 1970 and 2004

➤ Humanity's usage of Earth's biocapacity:

- 1961: 50%
- 2002: **120%**
- 2050 Estimate: **200%**



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CURRENT GLOBAL CONDITIONS

➤ Standard of living increasing in many countries

- Increase in water quality and sanitation
- Increased demand of Western-world foods

➤ Global demand for water expected to exceed supply by **40%** by 2030

➤ Global energy needs will increase **50%** by 2030

➤ Global need for food will increase **70%** by 2050

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STOCKHOLM STATEMENT

- Stockholm International Water Institute issued the “Stockholm Statement” to 2012 UN Conference on Sustainable Development
- Calls for universal provisioning of safe drinking water, adequate sanitation & modern energy services by 2030
- Asks for commitment to following by 2020:
 - 20% increase in total food supply-chain efficiency; reduce losses and waste from field to fork
 - 20% increase in water efficiency in agriculture; more nutrition and crop per drop
 - 20% increase in water use efficiency in energy production; more kWh per drop
 - 20% increase in the quantity of water reused
 - 20% decrease in water pollution

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WHAT IT MEANS FOR THE UNITED STATES

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WHAT DOES IT ALL MEAN

- The world is a global economy
 - Water, energy and food are interlinked and inter-dependent globally
- Energy costs are skyrocketing
 - Portion of U.S. annual energy use created by the combustion of fossil fuels: **86 percent**
 - 2008 – Food manufacturers experienced as much as 50% rise in energy costs -> impacts bottom line
- Widespread droughts occurring in U.S.
 - U.S. municipalities increasing water costs
 - Risk of water shortage moderate to extreme in 2/3 of U.S. by 2050

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WATER SHORTAGE RISKS

- USA Today, 7/2010: *Global warming raises moderate to extreme water shortage risks in two-thirds of U.S. counties*



Source: <http://content.usatoday.com/communities/greenhouse/post/2010/07/global-warming-raises-water-shortage-risks-in-one-third-of-us-counties/1>

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BOTTOM LINE

- More people will exist with less total resources
 - Particularly in mega-city areas: increased population will stress already scarce resources
- Industrial sprawl contributes to pollution and reduced freshwater
- Climatic changes increasing droughts and natural disasters that threaten water and energy sources
- Failure to implement water and energy conservation means:
 - We ALL may run out of water, energy and/or food
 - Only resource-efficient businesses will survive

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WHAT ARE THE COSTS

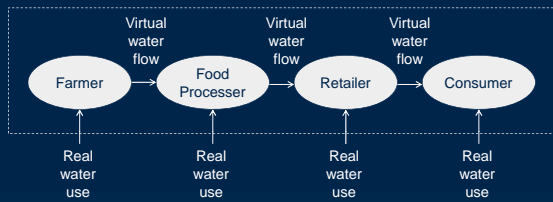
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WATER FOOTPRINT OF FOOD

- Water footprint: volume of freshwater used to produce the product
 - Measures external and internal water used from “farm to fork”
 - Blue water footprint: volume of freshwater evaporated from global blue water resources (surface and ground water) to produce the good.
 - Green water footprint: volume of water evaporated from global green water resources (rainwater stored in soil)
 - Grey water footprint: volume of water required to dilute pollutants to extent that quality of ambient water remains above agreed water quality standards

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THE VIRTUAL WATER CHAIN



Adapted from: Hoekstra et al. Water For Food, p.55

- There is a lot more water "in a product" than simply the raw ingredient
- Many opportunities exist "farm to fork" to improve conservation efforts
- Retailers like Wal-Mart are demanding it with their sustainability index and end use companies are pushing backwards on their suppliers (i.e. coffee growers, farmers, etc) to improve their water and energy conservation efforts

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WATER FOOTPRINT EXAMPLES

As reported by www.cnbc.com:

- Global average water footprint for ONE 8.8oz glass of beer = **20 gallons of water**
 - Most of the water involved is in producing the barley
- For ONE cup of coffee: ~ **37 gallons of water**
 - Majority of the water is for growing the coffee plant
- For ONE hamburger: ~ **634 gallons of water**
 - Majority of the water is for the production of the beef including feed



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THE COST OF WATER

- Companies often unaware of true cost of water
 - True cost of water may be more than 3 times total amount charged for supply and disposal
- Charged for cost of supply and:
 - Water treatment;
 - Effluent treatment and discharge;
 - The value of lost raw materials and product;
 - Heating;
 - Pumping;
 - Maintenance;
 - Capital depreciation of equipment.

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BENEFITS OF CONSERVATION EFFORTS

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BUSINESS OPPORTUNITIES

- Water and energy conservation programs, *done properly*, can bring big savings to a company's bottom line
- Environmental sustainability is a trendy and competitive strategy
 - Customers want to know companies care
 - Many companies have a sustainability statement on company webpage
 - Facebook comments on a company's FB page reflect consumer concerns
 - Companies at the end of the "food chain" are looking for suppliers to be more sustainable
 - Wal-Mart requires it; has sustainability index

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MARKETING OPPORTUNITIES

- Marketing value from Certifications:
 - Energy Star
 - U.S. Green Building Council's LEED
 - Other third-party/nonprofit organizations:
 - Fairtrade, Rainforest Alliance, 4C
 - Certifications address 3 Pillars of Sustainability: Social, Economic and Environmental
- Hubert Weber, President, Coffee, Kraft Foods Europe
 - "Our consumers and customers care about the benefits that certification delivers. That's good for business. As a result, we're making a positive impact across our supply chain – from crop to cup."

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POLICY OPPORTUNITIES

- U.S. in midst of transformational policy-making for industry re: energy and environmental issues
- Companies can seize opportunities to help shape policies
- Nonprofit organizations, with companies, forming U.S. and global policies
 - Example: Fair Trade USA
 - Fair Trade USA audits and certifies transactions between U.S. companies and their international suppliers
 - Guarantee that the farmers and workers producing Fair Trade Certified goods are paid fair prices and wages, work in safe conditions, protect the environment and receive community development funds to empower and uplift their communities

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WATER AND ENERGY USAGE IN SANITATION PROGRAMS

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TOTAL COST OF CLEANING

- Total cost of cleaning is much more than just water and a little soap
- Costs include:
 - Fresh Water
 - Discharge Water
 - BOD and Suspended Solids
 - pH Adjustment
 - Alkaline Chemical
 - Acid Chemical
 - Sanitizing Chemical
 - Heating BTU's
 - Labor
 - Equipment- repair and maintenance

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WATER USED FOR CLEANING

Water Use by Major Food-Processing Types	
Type of Process	Percent of Water for Cleaning
Bakery	70
Soft Drink	48
Brewery	45
Jam	22

Adapted from: EBMUD_WaterSmart_Guide_Process_Water.pdf

- Many municipalities seeking to raise water and energy rates and institute higher use fees for food plant wastewater
- Important to understand cleaning applications and areas for improvement in resource utilization

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CONSERVATION OPPORTUNITIES

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GENERAL STARTING POINTS

- Contact your local utility company and/or your sanitation supplier to assist with an energy and water audit
- Develop an action plan
 - Determine a baseline
 - Evaluate current practices/demand
 - Develop an improvement/savings strategy

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GENERAL STARTING POINTS

- Name a coordinator to develop, implement and oversee a conservation program(s).
 - A conservation program must have buy-in from the top down and bottom up in an organization
 - Foster a culture of conservation and rewards for such activities
 - Initiate a "If you see something, say something" policy
 - Encourage employees to report potential areas for improvement no matter how small or big, directly to manager or via a "drop box" system
 - Consider a "conservation day" with games, information tables, etc to get motivation going

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GENERAL STARTING POINTS

- Reduce water needed for cleaning
 - Dry cleanup
 - Prevent spills by controlling processing equipment and leaks
- Metering and submetering water important to understand how much water is used in each process or type of equipment
- Proper process controls essential to managing water and energy use
- Look at the Major Cleaning Applications for areas of improvement

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MAJOR CLEANING APPLICATIONS

- Transportation and Cleaning of Food Products
 - Flume use to transport and clean produce common
 - Cleaning of meat, poultry and fish
- Equipment Cleaning
 - Clean-in-place (CIP)
 - Conveyor belts
 - Closed vessels, pipes and delivery tubs
 - Clean-out of-place (COP)
 - Utensils
 - Equipment that can be disassembled
- Cleaning Containers (Bottles, Cans, Cartons, etc)
- Opportunities exist in most applications for improvements in water and energy usage

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TRANSPORTATION & CLEANING OF FOOD PRODUCTS

- Recycle transport water
- Adjust flume design to minimize water use
- Use flumes with parabolic cross sections
- Provide surge tanks to avoid water loss
- Use float control valves on makeup lines
- Use solenoid valves to shut off water when equipment stops
- Control sprays on belts
- Control process equipment to reduce waste
- Install sprays to wash food
- Use mechanical disks and brushes

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EQUIPMENT CLEANING

- Dry cleaning as a first step is essential for saving water and energy
 - Remove as much otherwise-wasted product by pouring and storing for future use
 - Scrape equipment and vessels to remove as much waste as possible
 - Use dry brushes, clothes, wet towels and paper towels to remove waste
- Dry cleaning labor costs offset by potential to recover product, reduce pollution loading and clean equipment more thoroughly
 - Allows employees to discover possible mechanical problems at an early stage

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EQUIPMENT CLEANING

- Upgrade to real-time, concentration-based CIP monitoring and controls
- Conductivity measurements
 - Provides detergent at proper concentration
- Vessels
 - Replace spray balls with a high-pressure, low volume rotating spray
 - Hot pre-pasteurization water in dairy tanks can be captured and reused as wash water for other CIP needs

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CONTAINER CLEANING

- Cleaning bottles, can and containers prior to filling is common
 - Use air burst to remove loose debris and materials
 - Reuse water from can warming and other operations to reduce water use
 - Use pressure sprays and steam instead of high-volumes of hot water
 - Water and energy savings
- One brewery recovered bottle wash water and used it for washing crates where bottles are placed
 - Save more than 4,500 gallons of water a day

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WASTEWATER PRETREATMENT

- Food-manufacturing wastewater streams often have high amounts of solids, fats, oils and grease
 - Makes direct reuse a challenge
 - Cost-prohibitive in many cases
 - Several pretreatment options before discharge
 - Systems focusing on reducing biological (or biochemical) demand (BOD)
 - Live bacteria metered into waste water at specified intervals
 - Consume organic carbons sources (sugars, fats, oils, grease)
 - Systems focused on reducing BOD, COD and overall solid waste
 - Microbial enzymes with complement of non-enzymatic biocatalysts/cofactors
 - Accelerates digestion of organic waste
 - Lessens need for chemical additives
 - Lowers aeration requirements for energy savings
 - Decreases BOD of wastewater to municipalities

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ZERO DISCHARGE

- The original principle of “zero discharge” is recycling of all industrial wastewater
 - This means that wastewater will be treated and used again in the process. Because of the water reuse, wastewater will not be released to the sewer system or surface water.
 - Has changed from a “technical description” in most cases to a “goal”
- The term “zero discharge” is sometimes used interchangeably, and incorrectly, with “indirect water reuse”, “reduced usage of waste materials” and/or “zero landfill”

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INDIRECT WATER REUSE

- Water recapture and reuse
 - Proper pretreatment key to success
- Examples
 - Kettle Foods in Salem, OR – Foodprocessing.com 2010 Green Plant of the Year Recipient
 - System to recapture the water used for washing potatoes
 - Used wash water is filtered and reused for applications such as lavatory plumbing
 - Fabiano Brothers – Wholesale Distributor in Michigan
 - Water reclamation system for truck-washing bays
 - Estimated 70% less water usage
 - Less water leaves site = lower processing and treating costs

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REDUCED DISCHARGE

- Kettle Foods - Recycles 100% of its cooking oil into biodiesel fuel
 - Collects sunflower and safflower oil and sends to biodiesel production company for processing
 - 1 gallon of waste vegetable oil produced for every 7600 bags of potato chips manufactured
 - Biodiesel company transforms each gallon of waste oil into 1 gallon of fuel
 - Also use biodiesel to fuel their company cars

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REDUCED DISCHARGE

- Tyson
 - Captures biogas at several company wastewater treatment facilities and converts to fuel for operating hot water boilers in meat processing plants
 - Dynamic Fuels = 50/50 joint venture with Syntroleum
 - Produces renewable diesel and jet fuels using Syntroleum's technology from Tyson's animal fats, greases and vegetable oils
- General Mills
 - Burn oat hulls from milling process to provide 90% of the steam to operate its Fridley, MN plant
 - Saves ~\$390K/year
 - Oat hulls burned by a biomass plant in MN generate enough electricity, on average, to power about 17,000 homes

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ANAEROBIC DIGESTERS / BIOGAS PLANTS

- Anaerobic bacteria break down or "digest" organic material in the absence of oxygen and produce "biogas" as a waste product
- When burned, a cubic foot of biogas yields about 10 Btu of heat energy per percentage of methane composition
 - Ex: Biogas composed of 65% methane yields 650 Btu per cubic foot
- Material drawn from digester called sludge
 - Rich in nutrients – excellent soil conditioner
 - Can be used as feed additive when dried

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ANAEROBIC DIGESTERS / BIOGAS PLANTS

- ConAgra Foods in Louisiana – sweet potato waste product sent to digester
 - Biogas burned and reused in facility
 - Natural gas needs cut ~20%
- Cargill built and operated anaerobic digester on Bettencourt Dairy in Idaho
 - Converts manure from farm's 6,000 cows into 1 million kilowatt-hours of electricity per month
 - Electricity is sold to local power grid – enough to power ~1,100 homes per month

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GOVERNMENT INCENTIVES



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STATE PROGRAMS


- Incentives, grants, rebates, tax credits and/or services available through State Departments of Energy
- Visit your state's website for more information
- Contact the state BEFORE initiating any project to determine eligibility and requirements
- Most rebates are available on a first come, first serve basis through a specific time period and while funding is available



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STATE INCENTIVE CASE STUDY

- MillerCoors – Irwindale, CA brewery
 - Employs ~ 600 people
 - Produces ~ 7 million barrels of beer annually
- Challenge:
 - Implement a clean, renewable source of energy for plant while:
 - Minimizing emissions
 - Curtailing cost associated with disposal of waste byproduct from beer manufacturing process



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STATE INCENTIVE CASE STUDY

- Plant-wide energy usage analysis determined best opportunity for savings and emissions reductions:
 - Build a biogas fired cogeneration plant using the biogas recovered from beer waste utilizing an anaerobic digester
- Biogas fuels cogeneration plant, providing the brewery with 1 MW of power per hour
 - Thermal energy produced by cogeneration plant heats the digester and offsets high-quality steam/hot water used in various beer manufacturing processes
 - Allows plant to use recycled by-products as fuel


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STATE INCENTIVE CASE STUDY

- Project cost: \$1.5 million
 - \$1 million rebate received from California Public Utilities Commission Self-Generation Incentive Program
- Simple payback on project = 6 months
 - Net project cost was \$474K
- **Annual Savings Amount: \$936K**

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FEDERAL PROGRAMS – ENERGY STAR



- Joint program of U.S. EPA and U.S. Department of Energy helping to save money and protect the environment through energy efficient products and practices
- Companies that reduce energy consumption 10% over 5 years of less can become an Energy Star Partner
 - Earns certification and rights to promote the Energy Star logo in company materials
- Manufacturers can increase sales and customer loyalty by promoting the energy-saving and environmental benefits associated with ENERGY STAR.
- http://www.energystar.gov/index.cfm?c=manuf_res_pt_manuf

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FEDERAL PROGRAMS

- U.S. Department of Energy (DOE)
 - Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR)
 - Gov't programs in which federal agencies with large R&D programs set aside a fraction of funding for competitions among small businesses only
 - See www.sbir.gov for more information
 - Industrial Technologies Program (ITP)
 - Lead gov't program working to increase the energy efficiency of U.S. industry
 - Together partners, ITP helps research, develop, and deploy innovative technologies that companies can use to improve their energy productivity, reduce carbon emissions, and gain a competitive edge.
 - <http://www1.eere.energy.gov/industry/>

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OTHER RESOURCES

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OTHER RESOURCES

- Your chemical sanitation supplier
 - www.shepardbros.com
- Local utility company
 - Many offer free classes and preliminary walk-throughs
- U.S. Green Building Council (USGBC)
 - Non-profit organization
 - Leadership in Energy and Environmental Design (LEED) is an internationally-recognized green building certification system
 - Reference guides, education programs and registration for a project with LEED available at www.usgbc.org

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OTHER RESOURCES

The Tax Incentives Assistance Project (TIAP)

- www.energytaxincentives.org/business/

- Sponsored by a coalition of public interest nonprofit groups, government agencies, and other organizations in the energy efficiency field
- Designed to give consumers and businesses information needed to make use of federal income tax incentives for energy efficient products and technologies

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HELP YOUR PLANT...
AND YOUR PLANET



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