

# Getting to Water Security

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# What is water security?

The ability to safeguard an availability of water sufficient to sustain lives and livelihoods and protect against threats to and from water.

# Nexuses

National Security

Energy Production and Use

Natural and Manmade Disasters

Agriculture

Peace and Conflict

Sanitation, Health and Hygiene

Global Markets

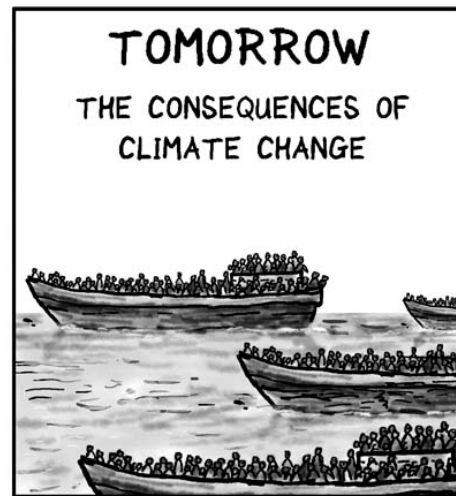
Natural Resources and Services

Infrastructure

Governance and Institutions

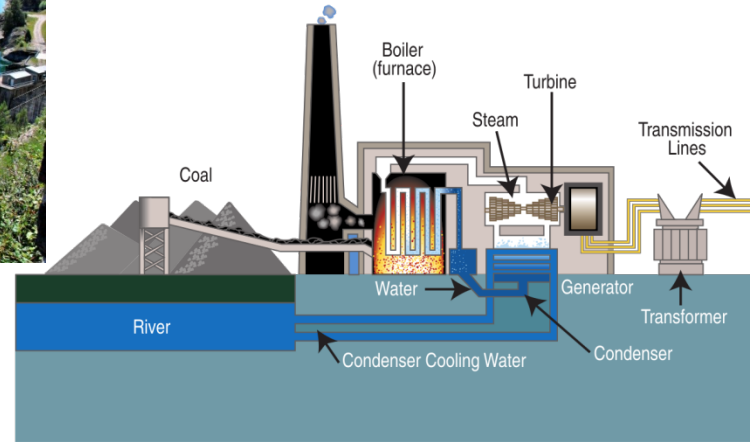


# National Security

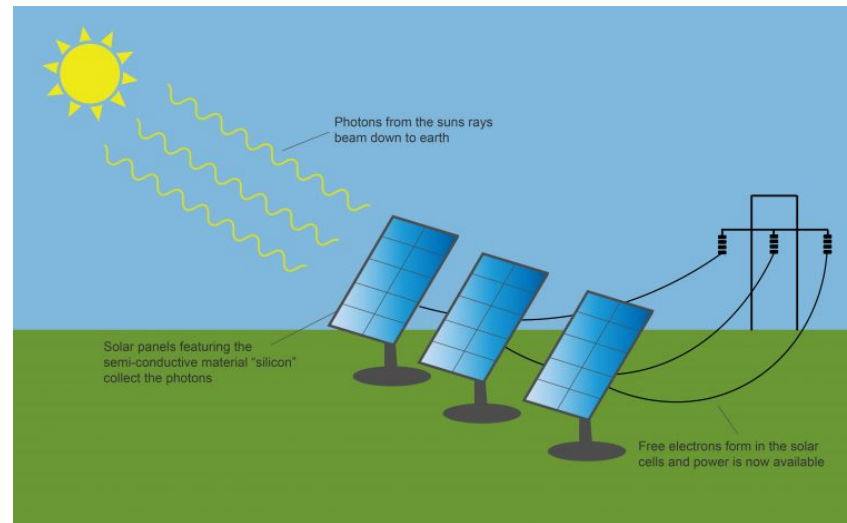
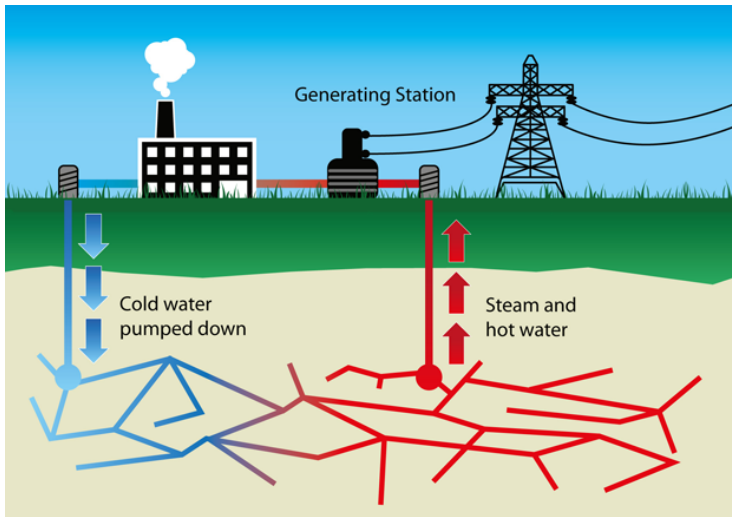


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# Energy Production and Use



<b>Fuel type</b>	<b>Water use for refining and processing (gal/MMBtu)</b>	<b>Method of transportation</b>
Coal	1-2	Rail and barge
Coal gasification	11-26	
Natural gas	0-2	Pipeline
Liquefied natural gas	50	
Gas-to-Liquids	19-86	
Oil	7.2-32	Rail, truck, tanker and pipeline
Biofuels: Corn Ethanol, wet mills	62	Truck
Biofuels: Corn Ethanol, dry mills	40	
Biofuels: Cellulosic Ethanol, biochemical conversion	78-130	
Biofuels: Cellulosic Ethanol, thermochemical conversion	25-30	
Biofuels: Biodiesel	4.2	
Uranium: Diffusion	12-13	Truck, barge
Uranium: Centrifugation	10-11	





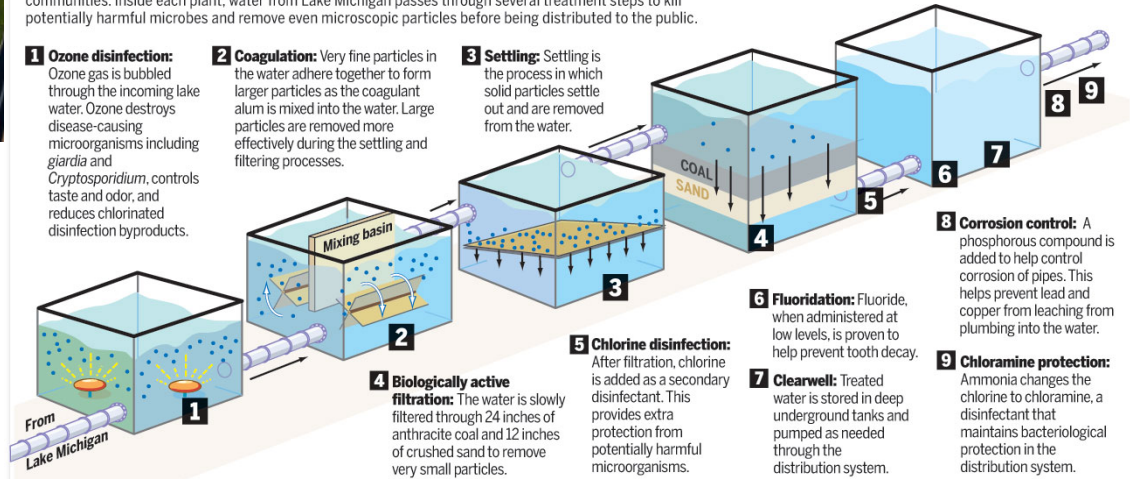
## Drinking water treatment process

The Milwaukee Water Works provides drinking water from two treatment plants to Milwaukee and 15 suburban communities. Inside each plant, water from Lake Michigan passes through several treatment steps to kill potentially harmful microbes and remove even microscopic particles before being distributed to the public.

**1 Ozone disinfection:** Ozone gas is bubbled through the incoming lake water. Ozone destroys disease-causing microorganisms including *giardia* and *Cryptosporidium*, controls taste and odor, and reduces chlorinated disinfection byproducts.

**2 Coagulation:** Very fine particles in the water adhere together to form larger particles as the coagulant alum is mixed into the water. Large particles are removed more effectively during the settling and filtering processes.

**3 Settling:** Settling is the process in which solid particles settle out and are removed from the water.



**4 Biologically active filtration:** The water is slowly filtered through 24 inches of anthracite coal and 12 inches of crushed sand to remove very small particles.

**5 Chlorine disinfection:** After filtration, chlorine is added as a secondary disinfectant. This provides extra protection from potentially harmful microorganisms.

**6 Fluoridation:** Fluoride, when administered at low levels, is proven to help prevent tooth decay.

**7 Clearwell:** Treated water is stored in deep underground tanks and pumped as needed through the distribution system.

**8 Corrosion control:** A phosphorous compound is added to help control corrosion of pipes. This helps prevent lead and copper from leaching from plumbing into the water.

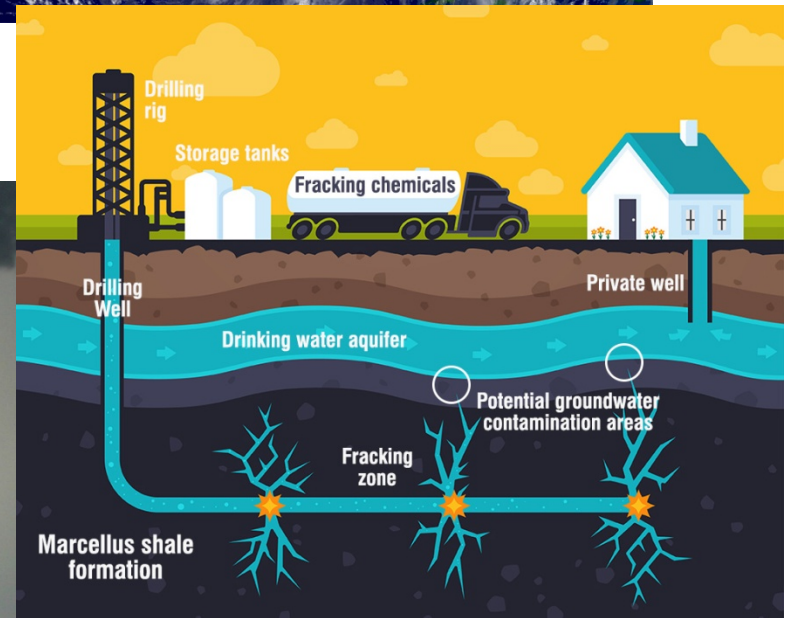
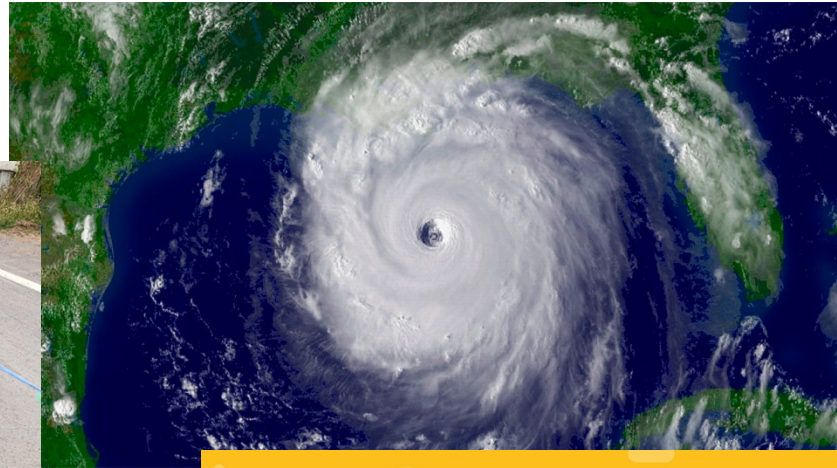
**9 Chloramine protection:** Ammonia changes the chlorine to chloramine, a disinfectant that maintains bacteriological protection in the distribution system.

Source: Milwaukee Water Works

Journal Sentinel graphic: ENRIQUE RODRIGUEZ/erodrigu@jrn.com



# Natural and Manmade Disasters







# Agriculture



# Peace and Conflict





# Sanitation, Health and Hygiene



# Global Markets

<b>Sector (in the United States)</b>	<b>Revenue Generated (2007, USD)</b>
Public water supply systems	\$53 billion
Agricultural production	\$297 billion
Livestock	\$154 billion
Mining and energy resource extraction	\$418 billion
Manufacturing	\$2.4 trillion
Sale of electricity	\$197 billion
Commercial fishing	\$4.5 billion
Travel and tourism	\$379 billion
<b>TOTAL</b>	<b>\$3.9025 trillion</b>

<b>River Basin</b>	<b>Revenue Generated</b>	<b>Jobs Generated</b>
Mississippi River	\$400 billion	1.3 million
Chesapeake Bay	\$107.2 billion	600,000 (tourism); 41,000 (commercial seafood industry)
Nile River	\$304 billion	Unavailable
Ganges River	\$690 billion	Unavailable
Danube River	\$1305 billion	Unavailable



**Table: Average virtual water content (m<sup>3</sup>/ton) (adapted from Chapagain/Hoekstra)**

<b>Crop</b>	<b>United States</b>	<b>China</b>	<b>Mexico</b>	<b>Australia</b>	<b>World (average)</b>
Rice (paddy)	1275	1321	2182	1022	2291
Wheat	849	690	1066	1588	1334
Maize	489	801	1744	744	909
Soybeans	1869	2617	3177	2106	1789
Sugar cane	103	117	171	141	175
Cotton seed	2535	1419	2127	4268	3644
Sorghum	782	863	1212	1081	2853
Coffee (roasted)	5790	7488	33475	N/A	20682
Beef	13193	12560	37762	17112	15497
Pork	3946	2211	6559	5909	4856
Chicken	2389	3652	5013	2914	3918
Eggs	1510	3550	4277	1844	3340
Milk	695	1000	2382	915	990

**Table: Industrial water withdrawals, virtual water exports and virtual water imports (1997-2001)**

<b>Country</b>	<b>Average industrial water withdrawal (10<sup>5</sup>m<sup>3</sup>/year)</b>	<b>Virtual water export of exported industrial products (average)</b>	<b>Virtual water import of imported industrial products (average)</b>
Brazil	10293	2211	3694
Cambodia	14	N/A	89
Denmark	324	38658	2693
Germany	31926	25416	29757
Mexico	4128	3790	9710
Morocco	261	123	599
Nigeria	678	531	542
Saudi Arabia	195	136	1703
South Africa	1527	912	1924
Spain	7298	3753	8520
Thailand	1789	1655	3596
United States	215495	59195	69763
World	716764	361838	361838

# Natural Resources and Services



The need for  
WASTEWATER INFRASTRUCTURE  
**EXCEEDS**  
**\$271 Billion**

Every day nearly

**6 Billion Gallons**  
of treated water is **LOST**  
due to leaking pipes

Funding for **RECYCLED**  
WATER DISTRIBUTION  
has increased by **21%**  
since 2008

## Infrastructure

An estimated  
**240,000 water**  
**main BREAKS**  
occur each year

**18%** of dams in the  
National Inventory of Dams  
**SERVE FLOOD**  
**CONTROL**

**76% OF THE POPULATION**  
rely on  
**14,748 TREATMENT PLANTS**  
for wastewater sanitation

**\$1 Trillion**  
**IN INVESTMENT IS NEEDED**  
to maintain and expand service to  
meet demands over the next  
**25 years**

**4.4 pounds**  
**OF SOLID WASTE**  
is generated per person per day



# Governance and Institutions

