

A Utility Perspective on Energy and Water Conservation

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KeySpan Generation

- 6 Steam Electric Plants
 - 4262 Megawatts
- 12 Internal Combustion Sites
 - 2115 Megawatts
- 1 Combined Cycle
 - 250 Megawatts
- Total 6627 Megawatts

An Example of Energy and Water Conservation

As Demonstrated by the U.S. Navy

USS Constitution (Old Ironsides)

July 27, 1798 48,600 gallons

February 20, 1799 38,600 gallons

Electric Energy Delivery

- Generation
- Transmission
- Distribution

Electric Generation and Distribution

Generator

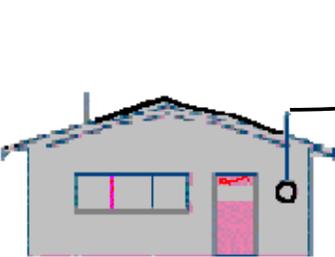
Load Serving Entity



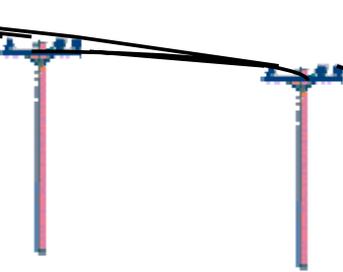
Power Station



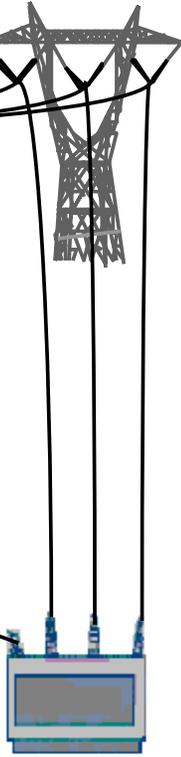
Transmission System



Pole Top Transformer



Distribution System



Substation

Electric Energy Sources-Plants

- Traditional
 - Steam electric plants
 - Fossil fuel
 - Nuclear
 - Co-Generation
 - Internal Combustion
 - Combined Cycle
 - Hydro

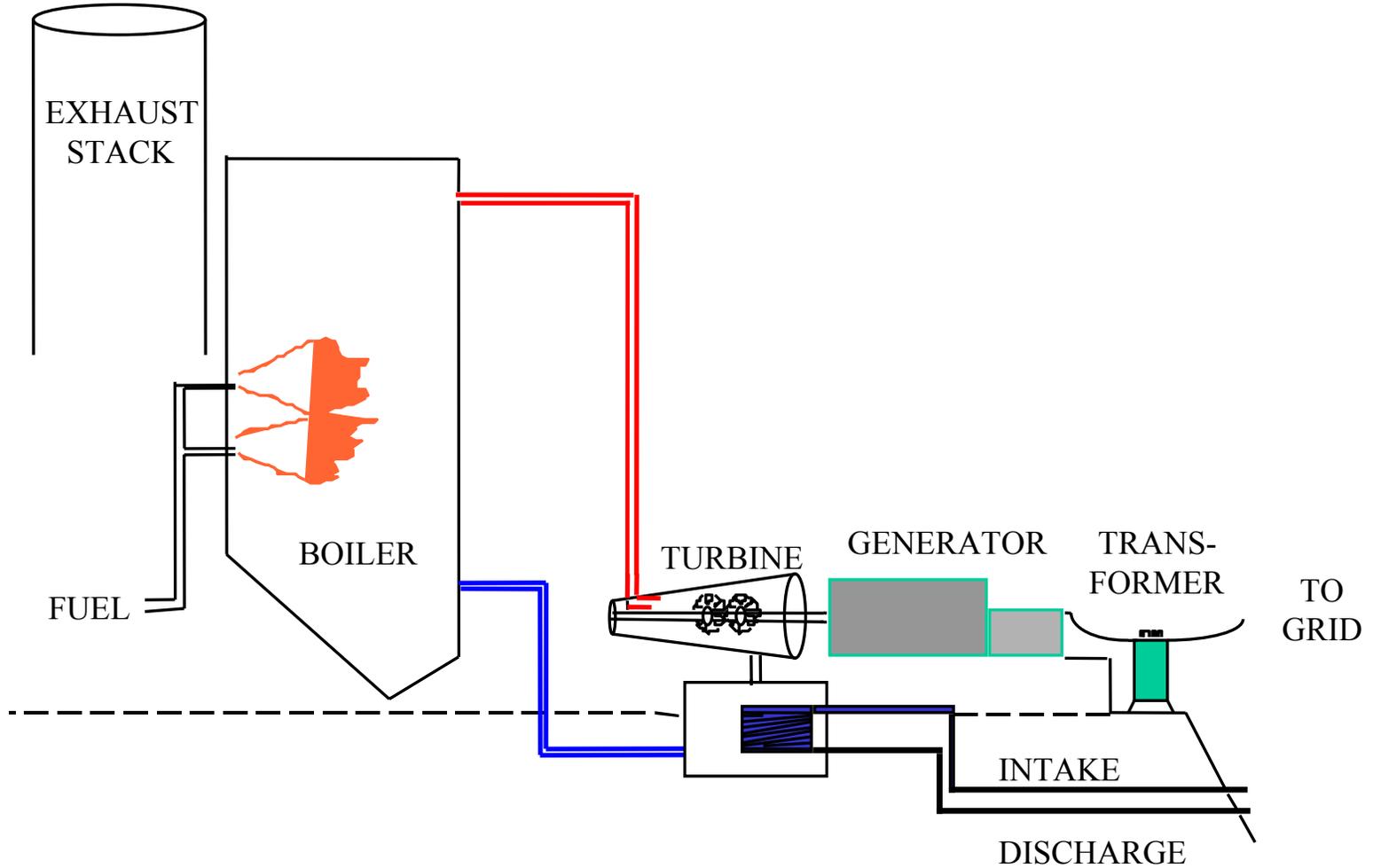
Electric Energy Sources

- Non-Traditional
 - Wind
 - Solar
 - Tidal
 - Wave
 - Fuel Cell

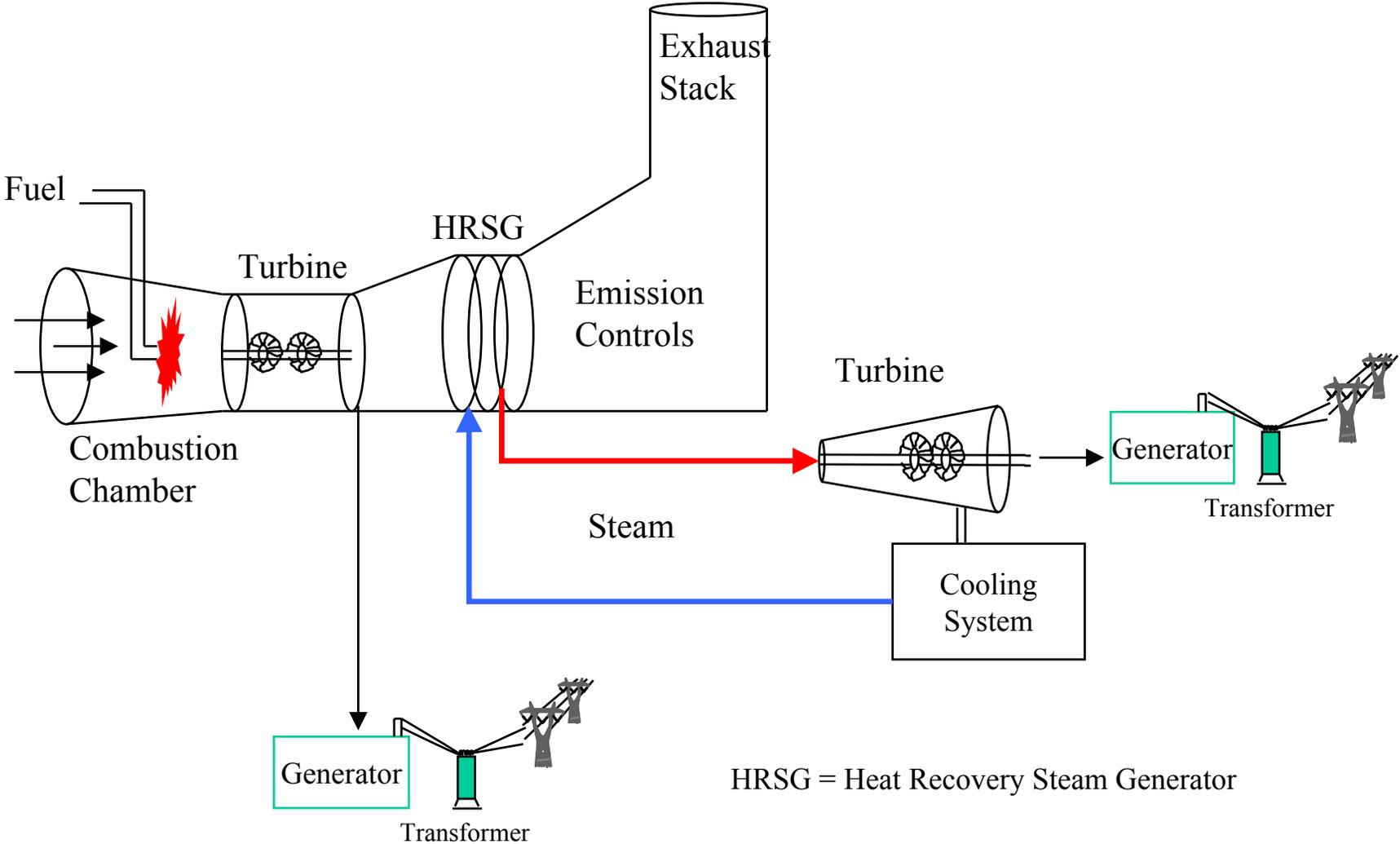
Fuel Sources

- Steam Electric
 - Fossil fuels (oil, gas, coal)
 - Nuclear (fission, fusion?)
 - Miscellaneous (refuse, biomass)
- All require water for mining, production and transportation of fuels

STEAM ELECTRIC POWER PLANT



Combined Cycle Electric Generating Unit



Generation Water Requirements

- Cooling (non-consumptive), FW/SW
 - Condensers
 - Heat exchangers
 - Mechanical (bearings)
- Plant Processes (consumptive), FW
 - Boiler makeup water, wash water
 - Aux cooling
 - Ash handling
 - Sanitary

Cooling Systems

- Once-Through (open cycle), FW/SW
- Off-Stream (closed cycle), most FW
 - Natural Draft Cooling Towers
 - Mechanical Draft
 - Helper Towers
 - Spray Ponds
 - Cooling Ponds/Lakes
 - Air Cooling

Cooling System Impacts

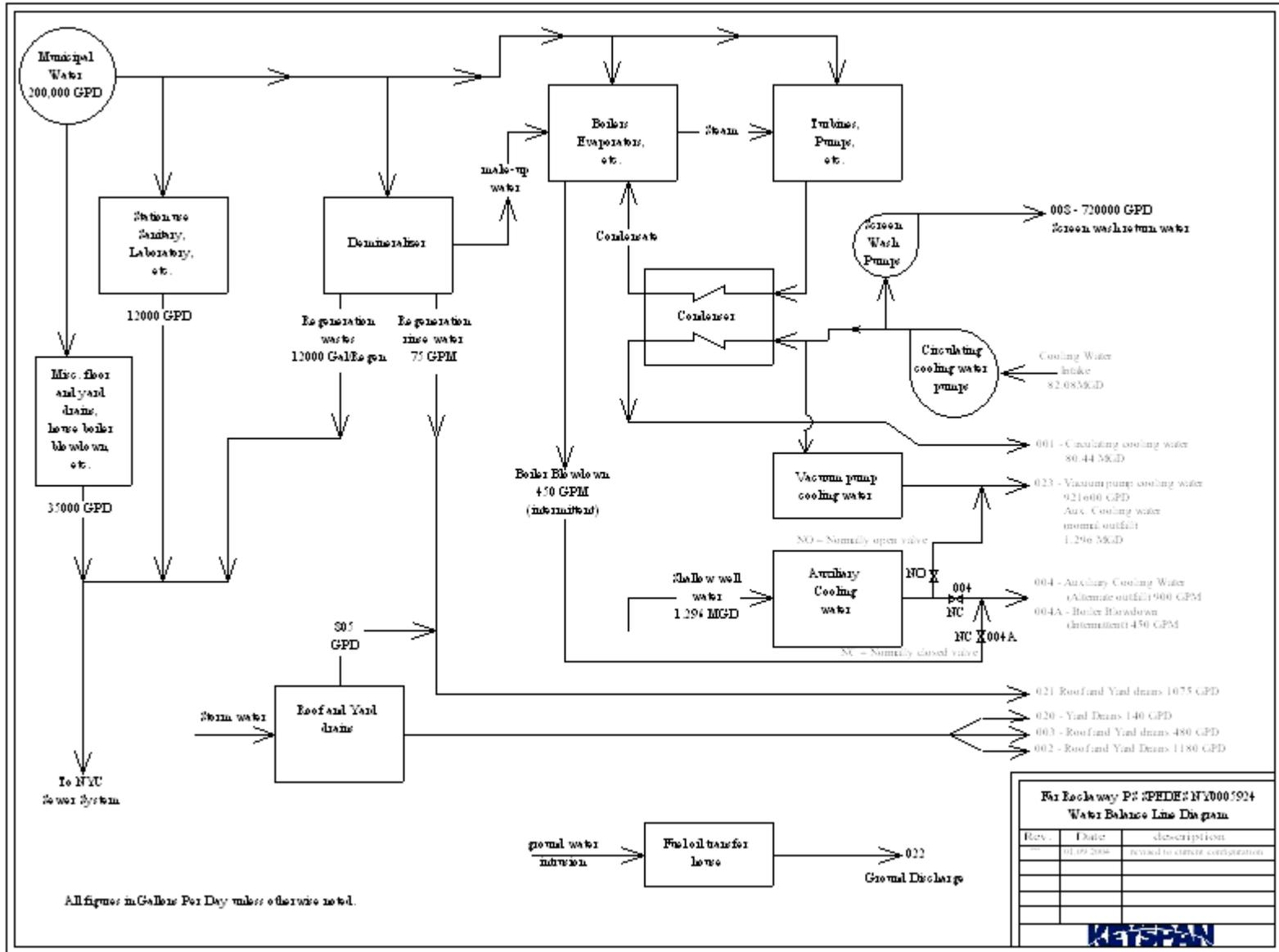
- Once-Through
 - Impingement
 - Entrainment
 - Thermal
 - DO/Chemical
 - Mitigation possible
 - Minimal water consumption
 - Low cost, most efficient

Off Steam Cooling Impacts-1

- Wet Towers
 - Large, visual structures
 - Visual plumes, fogging, drift (salt)
 - Water consumption through evaporation, blowdown
 - Reduced I&E
 - Reduced efficiency, higher cost

Off Stream Cooling Impacts-2

- Dry Cooling
 - Large Structure
 - Fan Noise
 - Insect and bird I&E
 - Reduction in efficiency, particularly in hot weather (need replacement generation)
 - Least water use
 - Highest cost



All figures in Gallons Per Day unless otherwise noted.

Table 7.1: Facility Water Use

Water Demand	Typical ¹			Peak ²			Annual Average ³		
	gpm	gph	gpd	gpm	gph	gpd	gpm	gph	gpd
Potable Water	2	120	2,880	2	120	2,880	2	120	2,880
Miscellaneous Service Water	15	900	21,600	15	900	21,600	15	900	21,600
HRSO Makeup	36	2,160	51,840	36	2,160	51,840	36	2,160	51,840
Recycled Blowdown	(24)	(1,440)	(34,560)	(24)	(1,440)	(34,560)	(24)	(1,440)	(34,560)
Inlet Air Cooling Makeup	0	0	0	25	1,500	36,000	5.5	330	7,920
Total Water Demand ⁴	29	1,740	41,760	54	3,240	77,760	34.5	2,070	49,680

Notes

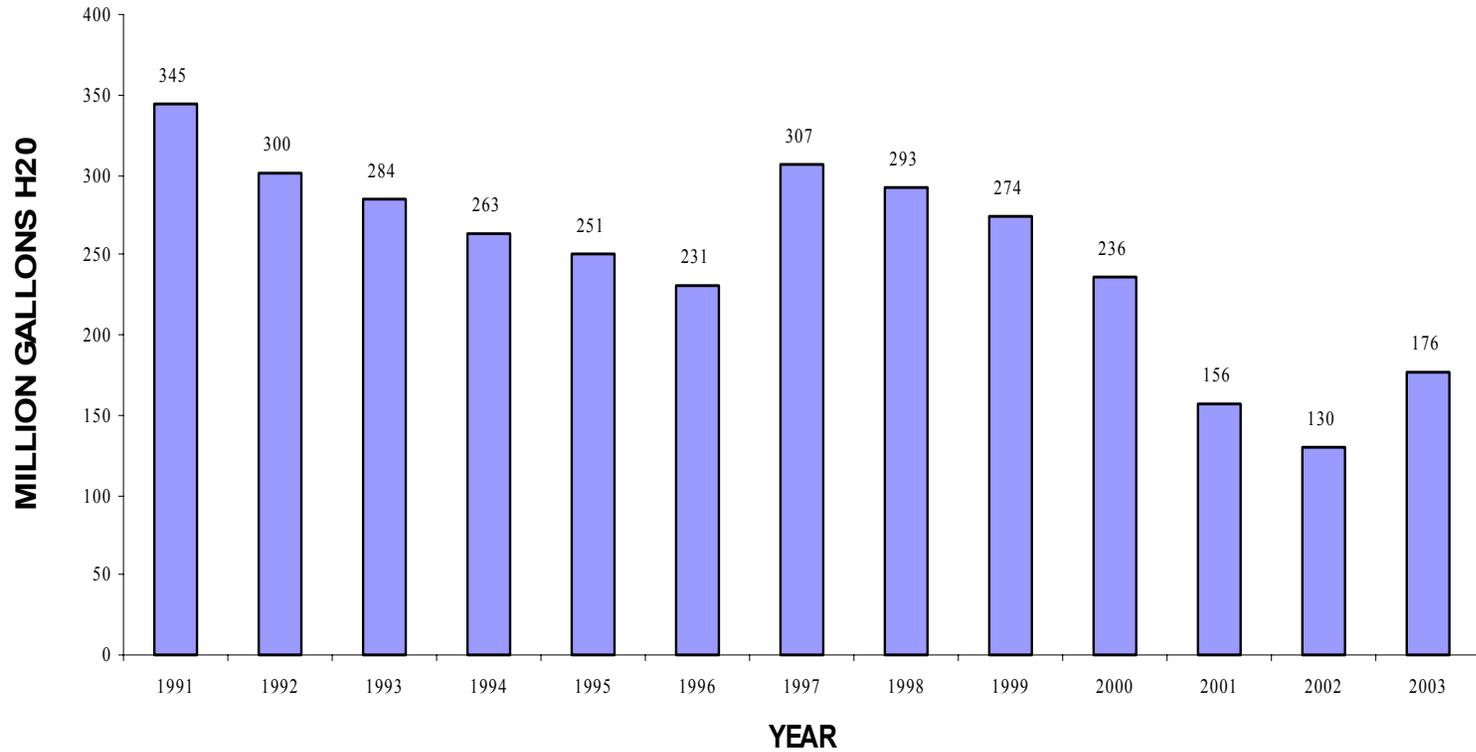
¹ Fall, Winter, Spring Operations Inlet Air Cooler Off (Temp < 60°F)

² Summer Operations Inlet Air Cooler On (Temp > 60°F)

³ Based on projected annual water use divided by 365 days per year (based on temperature data).

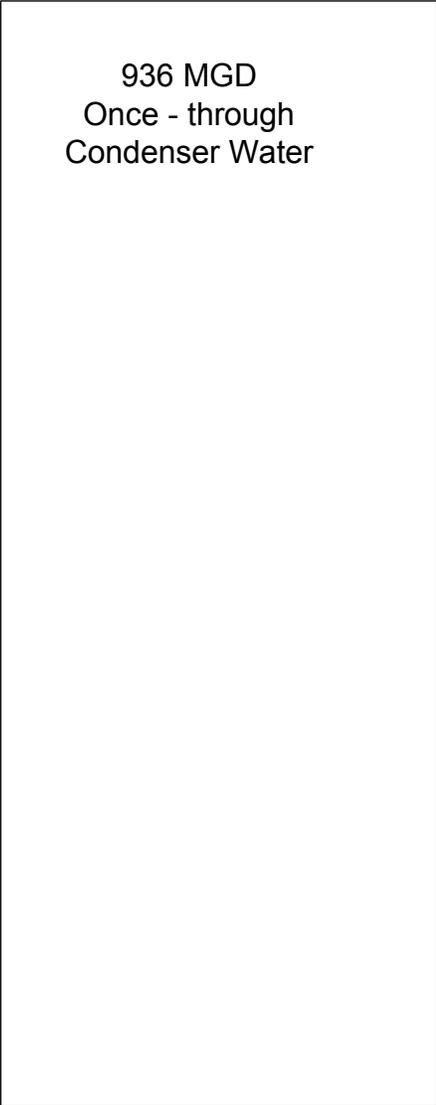
⁴ Recycled Blowdown was subtracted to calculate total water demand.

NORTHPORT P.S. WATER CONSUMPTION 1991 - 2003

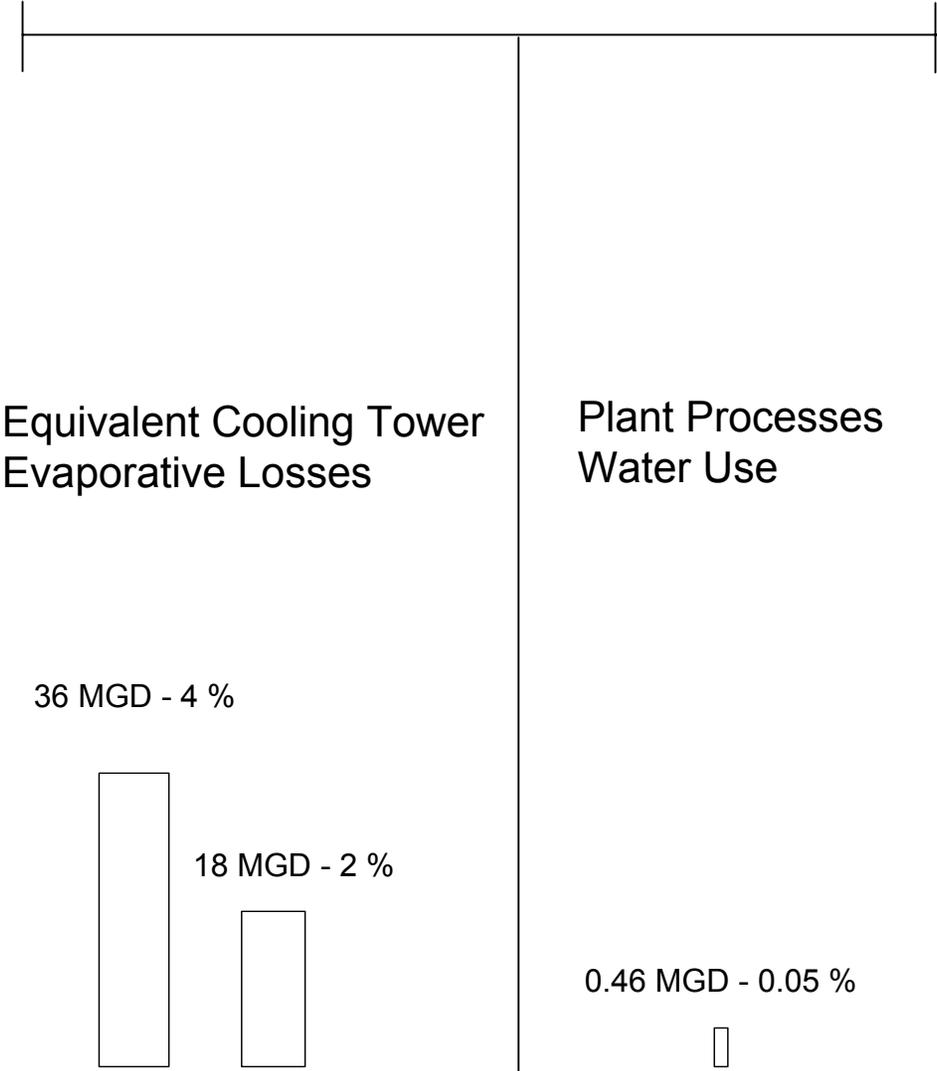


Relative Water Use 1500 MWe Steam Electric Plant

Non - Consumptive Use



Consumptive Use



Water Rules of Thumb

- Cooling water requirements:
 - 400 to 700 gpm per megawatt
- Plant process water requirements:
 - 0.14 to 0.69 gpm per megawatt
 - (200 to 1000 gpd)

NYS Water Use - 1992

- Withdrawals (of 16,289 mgd State total)
 - Fossil Fuel Power: 10,408 64%
 - Nuclear Power: 1,558 10%
 - Total: 11,966 74%
- Consumption (of 522 mgd State total)
 - Fossil Fuel Power: 37 7%
 - Nuclear Power: 10 2%
 - Total: 47 9%

NY Electric Load Growth

(NYSERDA)

	2000	2006	2021
• MW	30,200	32,319	36,568
• % (annual)		1.14	0.92
• % (total)			21.09

Conclusions - 1

- Growth in demand will require more generation, about 1% to 2% per year
- More generation requires more water
- Most water use is for non-contact cooling
- Wet cooling towers are consumptive
- Process water is consumptive

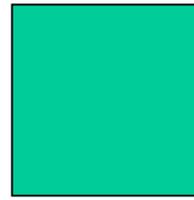
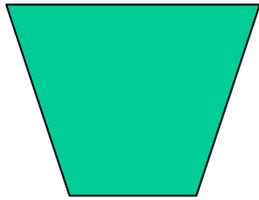
Conclusions - 2

- Technology improvements or alternatives are needed to check or reduce growth in water consumption for energy production
- Or, embrace and develop the Navy's substitution alternative ...

Turn Wine into Water



Cooling Towers



Test

- First Bullett
- Second Bullett
- Third bullet
- fourth bullett