True Cost of Water

* UIUC goal to reduce potable water consumption by 20% by 2015 and by 40% by 2025
* Project goal benchmark water use in cooling towers and Abbott
* Ideas to improve waster use efficiency
* Abbott cooling tower uses 5% and all campus cooling towers use 25% in 2011
* Cooling tower- cools water through evaporation primary use to remove heat from buildings in the summer
* Consumption from evaporated water and blowdown water
* Cooling tower consumption measured in Kgals
	+ 2010- 216448 Kgals
	+ 2011- 278684 Kgals
* Slide 14 break down of water consumption of cooling towers in 2011
* COC- Cycles of Concentration- measure of water efficiency target 4-5 bigger number better
* COC depends on water quality, higher quality higher target COC but more $$$
* Largest water consumption at larger plants running at 3+ cycles
* Lower efficiencies = more money
* Small towers at vet med chiller plant make more blowdown than the larger plants
	+ Good place to improve
* RO process at Abbott was analyzed for 2 years and it was determined there was limited opportunities for optimization
* Way to reduce water consumption:
	+ R1-Increase COC by using higher quality water
	+ R2-Improve monitoring at CT
	+ R3-Reduce cooling load- retrocommision buildings & inc CT efficiency
	+ R4-Use water from another source for CT makeup
		- Abbott RO reject
		- Oak St Seepage
		- Reprocessed blowdown
	+ R5-Use blowdown somewhere else
* Thermal Energy Storage is 6.5 million gallons
* R1- reduce cooling tower numbers during operations to 7
* Save 57.3 million gals- 20% of CT water use and 5% campus
* Cost broken down to chemical treatmeant, water makeup cost, and sewage (25% assumed of makeup becomes sewage)
* Treating water cost money but the money can be saved from incoming water and sewer fees
* Inc COC to 5 from 3.5
* Abbott COC is 2 should be 7 but okay if can get to 5
* Issues with R!- Need sulfuric acid brings up safety concerns and environmental policies
* Non chemical CT available but very little data
* Slide 45 to 64 hoe cavitation works in the VRTX non chemical treatment water cooling
* R2 make monitoring continuous and automated
* Pilot used was TRASAR 3D at north campus chiller plant
* First year saw 14% reduction in water consumption
* Additional units bought for oak st and vet med chiller plants
* Closer monitoring in equipment making sure there are no malfunctions
* R3 reduce cooling load with more efficient buildings and energy efficient uses at the chiller plants
* Current retrocommission projects saved 21 million gallons
* R4 using seepage needs to be treated and is excessive
* Explore option more could reduce city water for makeup
* R5- not the best route

Abbott

* CHP- combined heat and power
* Reduces CO2 emissions by 101,000 tons per day
* Serves 19.4 million square ft of building space
* Uses natural gas boilers, coal boilers, and gas turbines
* Steam send to buildings and when it is condensed it returns to the plant to reboil
* Mercury levels in emissions only 7% of EPA limit
* 90% of sulfur dioxide removed
* 58% less water in 2016 than 2008
* Cut emissions of CO2 by 21% from 2010 to 2016
* 77% natural gas 23% coal
* HRSG- heat recovery steam generator

Chiller Plants

* Regional chilled water plants using central piping loop connecting campus buildings
* 5 regional plants
	+ Oak St Chiller Plant
	+ North Campus Chiller Plant
	+ Library Air Conditioning Center
	+ Animal Sciences Air Conditioning Center
	+ Chemistry and Life Science Chiller Plant
	+ Vet med
* 26 miles of underground piping to 90 main campus buildings
* New system increased efficiency, reliability, energy conservation, and reduced maintenance cost
* Using the 6.5 million gallon thermal energy storage tank water is cooled at night at market low and demand low and chillers turned off during the day

Cogeneration Plants

* IEA Bioenergy did a report on Stockholm’s CHP and converted all units to MW, MWh, or GWh
* “The plant has a production capacity of 280 MW heat and 130 MW electricity, making it one of the largest biomass fired CHP plants in the world. The plant will produce 750 GWh of electricity and 1,700 GWh of heat each year”
* \*\*\*Water is lost from blowdown, transport in pipes, steam trap/ leak and vent loss, deaerator vent loss, direct steam injection
* Makeup water is used to refill the consumed water
* Trend amounts of makeup water to see how much water is being lost each cycle
* \*\*\*Recommendations- reduce direct injection, leak/excess vent prevention program, water treatment for less blowdown, or optimize steam for deaerator vents
* “A record amount, over 40 000 MWh of renewable district heat was collected from the sun in the summer of 2014 (in only three months) through the system and the total amount of renewable district heat gathered from the system grew to 90 000 MWh in 2014”
* \*\*Water m3/a a=pay-back period

Meeting Notes

Municipal water losses

Distribution loses difference from output meter to input meters at all buildings

Check top buildings of water use to see if they have new fixtures

Annual quality water reports

25% lose to sewage for chiller towers 75% for tower

Half of the chiller cooling towers are metered- oak st plant metered

Intake meter but not discharge

Intake for chiller loop and cooling tower metered

Energy used per unit water output

In chiller plant steam cooler and cooling tower

\*\*\*what data we need for chiller plant to find efficiency

Not all plant have electricity meter for plants

 Vet med is glycol system that’s why no water consumption

Mike will show metering standard

Tracking water use for production

Find national standards for line loses for potable water

Ashlyn stillwill study of water consumption on house, ask her about finding comparisons

Check BIF in EBS for grey water use