

Water-Energy Nexus Survey Pilot Project

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**Illinois Section
American Water Works Association**

Water Efficiency Committee

- Formed in 2009
- Over 30 members
 - Utility, non-profit, consultants, and government
- Active volunteer committee
 - Meetings, webinars, presentations, etc.
- Project focused

Water-Energy Nexus Survey

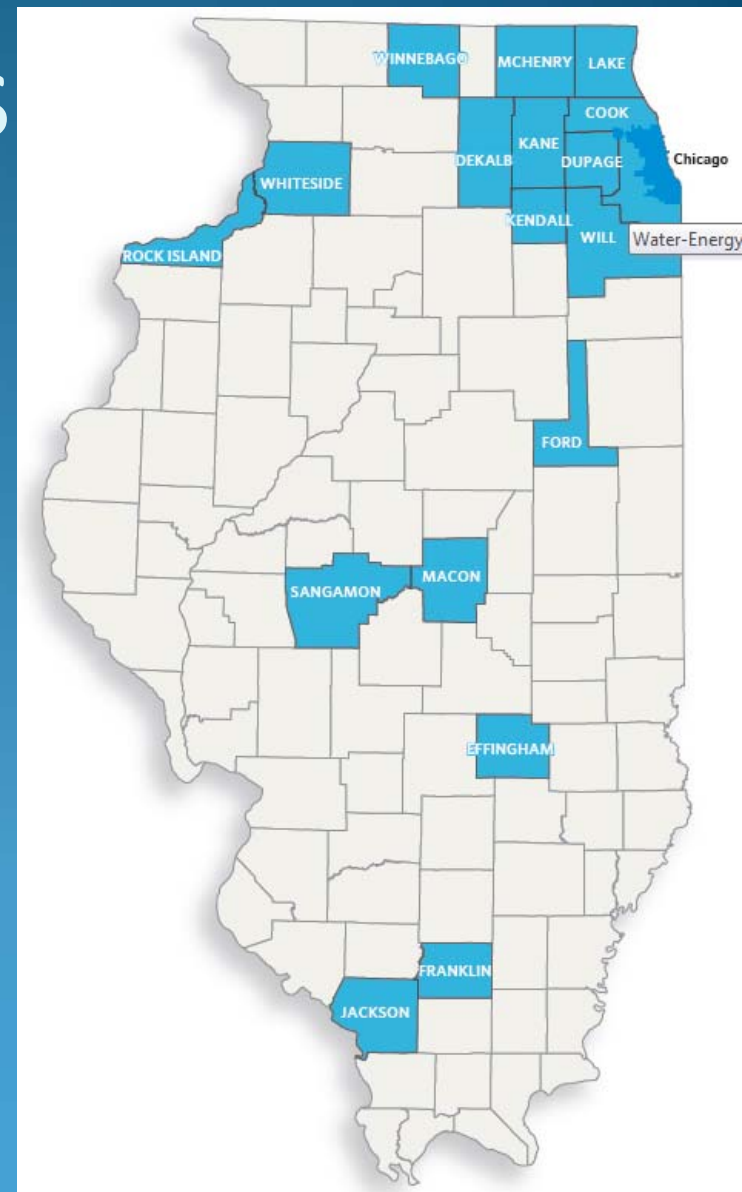
- Why:
 - To better understand the relationship between water and energy in Illinois
 - Energy intensity and cost
 - Educational tool
 - Short- and long-term planning
- Who: Water supply utilities in IL
- What: 2010 data

Survey Components

- Connections/population served
- Water supply
 - Water source
 - Production, billed/metered/accounted for water
- Energy
 - Annual energy consumption (electricity and gas) and cost
- Total annual operating expenses
- Treatment

Survey Respondents

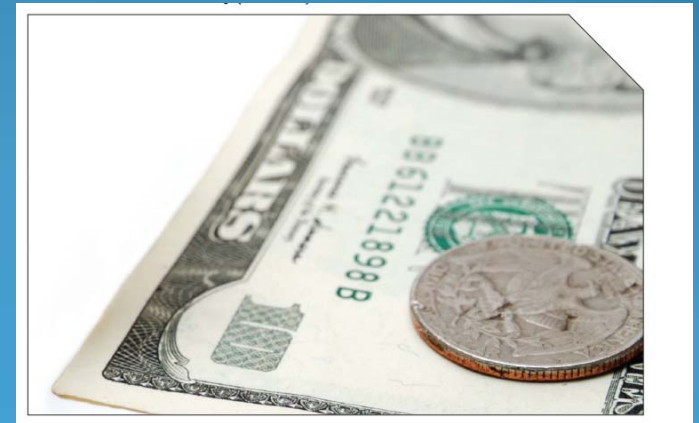
- 52 total
- 44 with usable data
- 5.4 million people, 42%¹
- 17 counties
- Size
 - Small (18)
 - Medium (15)
 - Large (7)
 - Wholesaler (4)



¹ Includes Chicago pop. around 2.7 people.

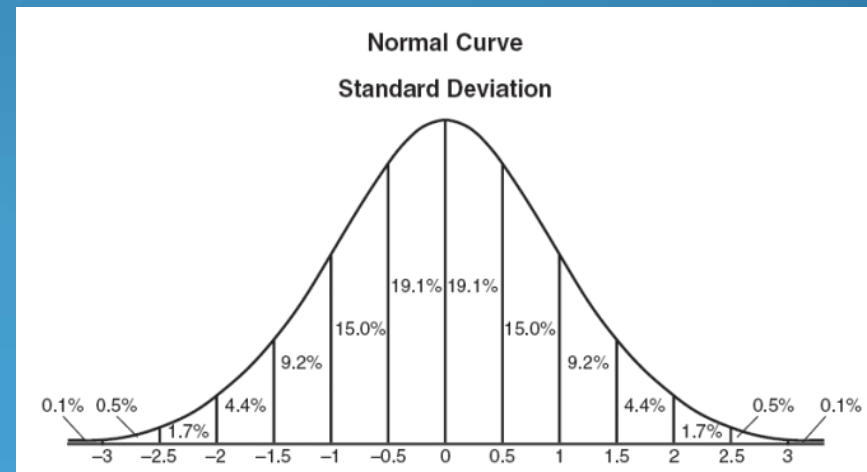
Survey Metrics

- Annual electricity cost
- Electricity cost as % of annual operating budget
- Energy intensity in kWh per MG produced
- Energy production cost in \$/MG produced
- Average cost per kWh
- Estimated water loss as %
- Energy cost of water loss



Data Analysis

- Self-reported data
- Outliers removed
 - For normally distributed sample, 99.7% of normally distributed data are within three standard deviations of the mean.
 - Individual outlier data points (i.e., errors) excluded instead of entire data set
- Statistics on remaining data
 - Mean
 - Min
 - Max
- Utility size and source



Energy Intensity (kWh/MG)

Illinois
AWWA

Utility Size	# of respondents	Mean	Minimum	Maximum
Wholesaler	3	1,946	1,308	2,554
Large (>15,000 connections)	7	1,621	218	3,171
Medium (5,000-15,000 connections)	15	1,560	75	6,361
Small (<5,000 connections)	17	2,912	110	12,890

WI Public
Services
Commission

Customers Served	# of utilities	Mean	Minimum	Maximum
Over 4,000	98	1,810	21	6,503
1,000-4,000	145	2,036	185	6,401
Fewer than 1,000	317	2,157	1	15,560

USEPA, Region 5 & Indiana
Dept. of Environmental
Management

Indiana Utility	MGD	kWh/MG
Bloomington Utilities	14	2,198
Mishawaka City Utilities	8	1,653
Valparaiso Flint Lake Plant	4	1,981

Summary
of mean
and actual
data

	# of utilities surveyed	Range of kWh/MG
Illinois	41	1,637-2,912
Wisconsin	560	1,809-2,157
Indiana	3	1,653-2,198

2010 Electricity cost

Utility Size	# of respondents	Mean	Minimum	Maximum
Wholesaler	3	\$1,647,705	\$190,922	\$3,262,345
Large	7	\$983,510	\$133,015	\$1,793,293
Medium	15	\$247,732	\$1,455	\$829,181
Small	17	\$37,633	\$1,335	\$262,156

- Utilities grouped by size
- High cost for larger utilities

Electricity cost % of annual total operating expenses (%)

Utility Size	# of respondents	Mean	Minimum	Maximum
Wholesaler	3	13.2%	3.9%	25.0%
Large	7	8.0%	1.9%	15.7%
Medium	10	9.0%	1.9%	18.3%
Small	16	7.5%	1.0%	23.7%

- Cost as % of total operation expenses is roughly independent of utility size

Energy cost per unit

Per MG				
Utility Size	# of respondents	Mean	Minimum	Maximum
Wholesaler	3	\$174	\$114	\$218
Large	7	\$178	\$84	\$285
Medium	15	\$140	\$6	\$462
Small	17	\$314	\$44	\$1,272

Per kWh				
Utility Size	# of respondents	Mean	Minimum	Maximum
Wholesaler	3	\$0.09	\$0.08	\$0.10
Large	6	\$0.09	\$0.05	\$0.13
Medium	14	\$0.09	\$0.06	\$0.15
Small	17	\$0.10	\$0.01	\$0.16

- Small utilities have higher water production cost from energy

- Similar cost per unit independent of size

Comparing water sources

Total annual cost of electricity (\$)				
Utility Water Source	# of respondents	Mean	Minimum	Maximum
Groundwater	17	\$92,037	\$1,335	\$430,435
Lake Michigan	16	\$254,421	\$1,455	\$1,489,847
Surface	8	\$845,405	\$183,040	\$1,622,072
Electricity cost percent of annual total operating expenses (%)				
Utility Water Source	# of respondents	Mean	Minimum	Maximum
Groundwater	17	7.6%	3.3%	14.8%
Lake Michigan	12	8.2%	1.0%	25.0%
Surface	8	14.6%	2.6%	38.0%
Energy intensity of water production, electricity only (kWh/MG)				
Utility Water Source	# of respondents	Mean	Minimum	Maximum
Groundwater	17	2,844	1,014	6,361
Lake Michigan	17	866	75	2,554
Surface	7	2,019	218	3,538
Water production cost from energy, gas+electricity (\$/MG)				
Utility Water Source	# of respondents	Mean	Minimum	Maximum
Groundwater	17	\$293	\$105	\$725
Lake Michigan	17	\$94	\$6	\$218
Surface	8	\$586	\$151	\$3,336

- Non-Lake MI surface water utilities tend to dedicate a higher % of budget to energy & pay more for energy per unit of water.
- Groundwater utilities have the highest average energy intensity.

Water Loss

Utility Size				
Gallons/billed/metered/accounted for per gallons produced				
	# of respondents	Mean	Minimum	Maximum
Wholesaler	3	3.1%	1.9%	5.5%
Large	7	17.3%	3.9%	29.4%
Medium	15	11.4%	2.4%	20.9%
Small	18	7.6%	1.7%	17.7%

Water Source				
Gallons/billed/metered/accounted for per gallons produced				
	# of respondents	Mean	Minimum	Maximum
Groundwater	18	9.6%	1.7%	19.8%
Lake Michigan	17	8.2%	1.9%	20.9%
Surface	8	16.5%	3.8%	29.4%

Energy Summary

- Energy intensity estimates are comparable to other regional studies.
- Energy cost percentage generally consistent regardless of utility size.
- Small utilities use and pay more for energy per MG than larger sized utilities.
- Surface water utilities tend to dedicate a higher percentage of budget towards electricity and have higher water production cost per unit than groundwater and Lake Michigan utilities.
- Groundwater utilities have the highest average energy intensity.

Water Loss Summary

- Survey respondents reported 22.5 billion gallons of water loss in 2010, equating to a loss of \$2 million in energy costs alone.
- On average, large utilities tend to have higher percentages of water loss and have the highest associated energy costs of water loss.



Lessons Learned

- No consistent data collection and tracking
- Energy and water data in different places
- Energy use data breakdown by steps
- Short and sweet survey instrument
- Need more!
 - Education/outreach
 - Incentives
 - Staff time and budget



Next Steps

- Include total distribution energy use and treatment
- Phase II?
- Distribute individualized utility reports
- Promote survey report as case study
- Coordinate with similar efforts/organizations



Thank you!

Visit www.isawwa.org for the full report.

http://www.isawwa.org/resource/collection/82A33FB3-E26F-4EA1-932D-866A9E8E264A/FY12-0077_ISAWWA_SURVEY_REPORT_final.pdf

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