#12 Siouxland Energy Cooperatives Ethanol Plant Energy and Water Usage vs. Cities within a 10 mile radius

Ethanol Plant without CO_2 Capture						
No.	**Ethanol Plant/ Town**	**Population**	****Water Permit Value MGY**	****2023 Water Usage MGY**		**Comments**
Ethanol Plant - Near Sioux Center, Iowa			-	-		
	Siouxland Energy Cooperatives - Sioux Center Plant		425.0	195.0		Without CO_2 capture water requirement
	Combined Towns All Water Usage		441.9	441.9		City residential use assumes 70 gal./person/day
1	Perkins	50	1.3	1.3		Water usage too small to require a permit
2	Carmel	50	1.3	1.3		Water usage too small to require a permit
3	Newkirk	50	1.3	1.3		Water usage too small to require a permit
4	Maurice	265	6.8	6.8		Water usage too small to require a permit
5	Hull	2,384	60.9	60.9		Water usage too small to require a permit
6	Orange City	6,267	160.1	160.1		
7	Sioux Center	8,229	210.3	210.3		
	Percentage of ethanol plant usage of total water usage	17,295	49.0%	30.6%		
Conclusion: Without CO2 Capture						
	This ethanol plant consumes 31% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles).					

#12 Siouxland Energy Cooperatives Ethanol Plant Energy and Water Usage vs. Cities within a 10 mile radius

Ethanol Plant with CO_2 Capture						
No.	**Ethanol Plant/ Town**	**Population**	****Water Permit Value MGY**	****2023 Water Usage MGY**	**2023 Water Usage % of Total**	**Comments**
Ethanol Plant - Near Sioux Center, Iowa		-	-	-	-	City residential use assumes 70 gal./person/day
1	Perkins	50	1.3	1.3		Water usage too small to require a permit
2	Carmel	50	1.3	1.3		Water usage too small to require a permit
3	Newkirk	50	1.3	1.3		Water usage too small to require a permit
4	Maurice	265	6.8	6.8		Water usage too small to require a permit
5	Hull	2384	60.9	60.9		Water usage too small to require a permit
	No Permit	2799	71.5	71.5	10.1%	
6	Orange City	6267	160.1	160.1	22.7%	
7	Sioux Center	8229	210.3	210.3	29.8%	
8	Ethanol plant water for Ethanol Production		425	195	27.7%	Without CO2 Capture water requirement
9	Ethanol Plant water for CO_2 Capture		68.3	68.3	9.7%	Additional CO_2 Capture water requirement
	Total Plant and Towns	17,295	935.1	705.1	100.0%	
	Percentage of ethanol plant usage of total water usage		52.7%	37.3%		
Conclusion: With CO2 Capture						
	This ethanol plant consumes 37% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles)					

***Ethanol Production Capacity of Plant - MGY**	**65**
Factor: Water required to cool and compress the CO_2 for capture - MGY Water/ MGY Ethanol	1.05
Calculate additional water required for CO_2 Capture - MGY	68.25
Calculate ratio of gallons of water/ gallons of Ethanol	3.0
Total water requirement of towns and Ethanol plant - MGY	776.7
Total water requirement of towns - MGY	513.4
Total water requirement for ethanol plant - MGY	263.3
Ratio of ethanol plant water use vs. surrounding area	0.51
Percentage of ethanol plant usage of total water usage	33.9%
Total Population within the 10 mile radius	17,295

#12 Siouxland Energy Cooperatives Ethanol Plant Energy and Water Usage vs. Cities within a 10 mile radius

Water Use	
Typical water use per person per day - Gallons/ person/ day	70
Equivalent # of people ethanol plant water use w/o CO2 capture	7,632
Equivalent # of people ethanol plant water use w/ CO2 capture	**10,303**
Electricity Use	
Electricity to produce Ethanol - kWh/ gallon EtOH for production	0.6
Total Electricity used to produce ethanol - kWh	39,000,000
Electrical use to capture CO2 - kWh/ gallon EtOH	0.377
Total Electricity used to capture CO2 - kWh	24,505,000
Total electricity to produce ethanol and capture CO2 - kWh	6.351E+07
Typical electrical use/ residence - kWh/year	10,476.0
Equivalent number of residences	6,062.0
Number of people / residence	2.4
Equivalent number of people	**14,549**
Natural Gas Use	
Natural gas use per gallon of ethanol for production - BTU's/ gal.	26,000
Natural gas use for ethanol plant - BTU's	1.690E+12
Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal.	0
Typical Natural Gas use/ residence - BTU's/ year	96,000,000
Equivalent number of residences	17,604
Number of people / residence	2.4
Equivalent number of people	**42,250**
* Ethanol Capacity per Iowa Renewable Fuels Association	** Water usage per the greater of DNR WACOP Permit or 3 times ethanol capacity.

#12 Siouxland Energy Cooperatives Ethanol Plant (65 MGY) near Sioux Center