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

Ethan	ol Plant without CO ₂ Capture							
No.	Ethanol Plant/ Town	Population	**Water Permit Value MGY	**2023 Water Usage MGY		Comments		
Ethan	ol Plant - Near Sioux Center, Iowa		-	-				
	Siouxland Energy Cooperatives - Sioux Center Plant		425.0	195.0	٧	Vithout 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	\	Nater usage too small to require a permit		
2	Carmel	50	1.3	1.3	\	Nater usage too small to require a permit		
3	Newkirk	50	1.3	1.3	\	Nater usage too small to require a permit		
4	Maurice	265	6.8	6.8	\	Nater usage too small to require a permit		
5	Hull	2,384	60.9	60.9	\	Nater 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%				
Concl	usion: 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).							

Page 8 of 11 Print Date: 5/20/2024

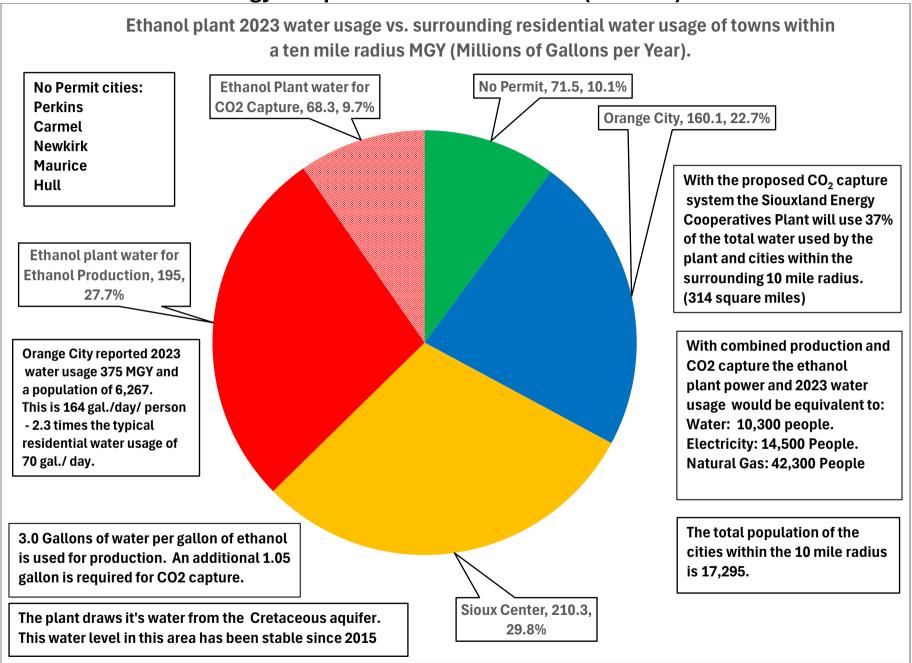
#12 Siouxland Energy Cooperatives Ethanol Plant Energy and Water Usage vs. Cities within a 10 mile radius

Ethar	nol Plant with CO ₂ Capture					
No.	Ethanol Plant/ Town	Population	**Water Permit Value MGY	**2023 Water Usage MGY	2023 Water Usage % of Total	Comments
Ethar	nol 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%	200.070	
Conc	lusion: With CO2 Capture					
	This ethanol plant consumes 37% of the water used by th within the surrounding 10 mile radius (314 square miles)	e cities and plant				
*Etha	anol Production Capacity of Plant - MGY	65				
	or: Water required to cool and compress the CO ₂ for are - MGY Water/ MGY Ethanol	1.05				
Calculate additional water required for CO ₂ Capture - MGY		60 OF				
Calcu	late additional water required for CO ₂ Capture - MGY	68.25				
	late additional water required for CO ₂ Capture - MGY late ratio of gallons of water/ gallons of Ethanol	3.0				
Calcu Total	late ratio of gallons of water/ gallons of Ethanol water requirement of towns and Ethanol plant - MGY	3.0 776.7				
Calcu Total Total	late ratio of gallons of water/ gallons of Ethanol water requirement of towns and Ethanol plant - MGY water requirement of towns - MGY	3.0 776.7 513.4				
Calcu Total Total Total	late ratio of gallons of water/ gallons of Ethanol water requirement of towns and Ethanol plant - MGY water requirement of towns - MGY water requirement for ethanol plant - MGY	3.0 776.7 513.4 263.3				
Calcu Total Total Total Ratio	late ratio of gallons of water/ gallons of Ethanol water requirement of towns and Ethanol plant - MGY water requirement of towns - MGY water requirement for ethanol plant - MGY of ethanol plant water use vs. surrounding area	3.0 776.7 513.4 263.3 0.51				
Calcu Total Total Total Ratio Perce	late ratio of gallons of water/ gallons of Ethanol water requirement of towns and Ethanol plant - MGY water requirement of towns - MGY water requirement for ethanol plant - MGY	3.0 776.7 513.4 263.3				

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

Equivalent # of people ethanol plant water use w/o CO2 capture Equivalent # of people ethanol plant water use w/ CO2 capture Electricity Use Electricity to produce Ethanol - kWh/ gallon EtOH for production Total Electricity used to produce ethanol - kWh Electricid use to capture CO2 - kWh/ gallon EtOH Total Electricity used to capture CO2 - kWh Total Electricity used to capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total electrical use/ residence - kWh/year Equivalent number of residences Equivalent number of people / residence Equivalent number of people / 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gall of ethanol for CO2 capture - BTU's/ gal. Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4 Puppical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Water Use				
Electricity Use Electricity to produce Ethanol - kWh/ gallon EtOH for production Total Electricity used to produce ethanol - kWh Blectricity used to produce ethanol - kWh Blectricity used to produce ethanol - kWh Blectricity used to capture CO2 - kWh Blectricity used to capture CO2 - kWh Total Electricity used to capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Bquivalent number of residences Bquivalent number of people / residence Bquivalent number of people / residence Bquivalent number of people Batural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use per gall of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Bqho00,000 Equivalent number of residences 17,604 Number of people / residence 2.4	Typical water use per person per day - Gallons/ person/ day	70			
Electricity Use Electricity to produce Ethanol - kWh/ gallon EtOH for production Total Electricity used to produce ethanol - kWh Electrical use to capture CO2 - kWh/ gallon EtOH Total Electricity used to capture CO2 - kWh Total Electricity used to capture CO2 - kWh Total Electricity used to capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Equivalent number of residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence	Equivalent # of people ethanol plant water use w/o CO2 capture	7,632			
Electricity to produce Ethanol - kWh/ gallon EtOH for production Total Electricity used to produce ethanol - kWh Electrical use to capture CO2 - kWh/ gallon EtOH Total Electricity used to capture CO2 - kWh Total Electricity used to capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Equivalent # of people ethanol plant water use w/ CO2 capture	10,303			
Electricity to produce Ethanol - kWh/ gallon EtOH for production Total Electricity used to produce ethanol - kWh Electrical use to capture CO2 - kWh/ gallon EtOH Total Electricity used to capture CO2 - kWh Total Electricity used to capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4					
Total Electricity used to produce ethanol - kWh Electrical use to capture CO2 - kWh/ gallon EtOH Total Electricity used to capture CO2 - kWh Total Electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence Equivalent number of residences 17,604 Number of people / residence 2.4	Electricity Use				
Electrical use to capture CO2 - kWh/ gallon EtOH Total Electricity used to capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence	Electricity to produce Ethanol - kWh/ gallon EtOH for production	0.6			
Total Electricity used to capture CO2 - kWh Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of people / residences 17,604 Number of people / residence 24 Equivalent number of residences 17,604 Number of people / residence 24 Equivalent number of residence 25,000 10 10 10 10 10 10 10 10 10	Total Electricity used to produce ethanol - kWh	39,000,000			
Total electricity to produce ethanol and capture CO2 - kWh Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. O Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Electrical use to capture CO2 - kWh/ gallon EtOH	0.377			
Typical electrical use/ residence - kWh/year Equivalent number of residences Number of people / residence Equivalent number of people Equivalent number of people Equivalent number of people 14,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Total Electricity used to capture CO2 - kWh	24,505,000			
Equivalent number of residences Number of people / residence Equivalent number of people Equivalent number of people Id,549 Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. O Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Total electricity to produce ethanol and capture CO2 - kWh	6.351E+07			
Number of people / residence Equivalent number of people Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences Number of people / residence 2.4	Typical electrical use/ residence - kWh/year	10,476.0			
Equivalent number of people Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences Number of people / residence 14,549 26,000 1.690E+12 0 96,000,000 17,604 17,604	Equivalent number of residences	6,062.0			
Natural Gas Use Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences Number of people / residence 2.4	Number of people / residence	2.4			
Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences Number of people / residence 2.4	Equivalent number of people	14,549			
Natural gas use per gallon of ethanol for production - BTU's/ gal. Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences Number of people / residence 2.4					
Natural gas use for ethanol plant - BTU's Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Natural Gas Use				
Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal. Typical Natural Gas use/ residence - BTU's/ year Equivalent number of residences 17,604 Number of people / residence 2.4	Natural gas use per gallon of ethanol for production - BTU's/ gal.	26,000			
Typical Natural Gas use/ residence - BTU's/ year 96,000,000 Equivalent number of residences 17,604 Number of people / residence 2.4	Natural gas use for ethanol plant - BTU's	1.690E+12			
Equivalent number of residences 17,604 Number of people / residence 2.4	Natural gas use per gal. of ethanol for CO2 capture - BTU's/ gal.	0			
Number of people / residence 2.4	Typical Natural Gas use/ residence - BTU's/ year	96,000,000			
	Equivalent number of residences	17,604			
Equivalent number of people 42,250	Number of people / residence	2.4			
	Equivalent number of people	42,250			
	* Ethanol Capacity per Iowa Renewable Fuels Association	** Water usage pe	r the greater of D	NR WACOP Pe	rmit or 3 times et

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



May 2024 Page 11 of 11 Print Date:5/20/2024