

#2 Green Plains Inc. Shenandoah 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 Shenandoah Iowa						
	Green Plains Inc. Shenandoah Plant		240.0	240.0		Without CO ₂ capture water requirement
	Combined Towns All Water Usage		164.1	164.1		City residential use assumes 70 gal./person/day
1	Imogene	39	1.0	1.0		Water usage too small to require a permit
2	Riverton	245	6.3	6.3		
3	Farragut	490	12.5	12.5		
4	Essex	722	18.4	18.4		
5	Shenandoah	4,925	125.8	125.8		
	Percentage of ethanol plant usage of total water usage	6,421	59.4%	59.4%		
Conclusion: Without CO₂ Capture						
	This ethanol plant consumes 59% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles).					

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No.	Ethanol Plant/ Town	Population	**Water Permit Value MGY	**2023 Water Usage MGY	2023 Water Usage % of Total	Comments
Ethanol Plant - Near Shenandoah Iowa		-	-	-	-	City residential use assumes 70 gal./person/day
1	Imogene	39	1.0	1.0	0.2%	Water usage too small to require a permit
2	Riverton	245	6.3	6.3	1.3%	
3	Farragut	490	12.5	12.5	2.6%	
4	Essex	722	18.4	18.4	3.8%	
5	Shenandoah	4925	125.8	125.8	25.8%	
6	Ethanol plant water for Ethanol Production		240	240	49.2%	Without CO ₂ Capture water requirement
7	Ethanol Plant water for CO ₂ Capture		84.0	84.0	17.2%	Additional CO ₂ Capture water requirement
Total Plant and Towns		6,421	488.1	488.1	100.0%	
Percentage of ethanol plant usage of total water usage			66.4%	66.4%		
Conclusion: With CO₂ Capture						
This ethanol plant consumes 66% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles)						
*Ethanol Production Capacity of Plant - MGY		80				
Factor: Water required to cool and compress the CO₂ for capture - MGY Water/ MGY Ethanol		1.05				
Calculate additional water required for CO₂ Capture - MGY		84				
Calculate ratio of gallons of water/ gallons of Ethanol		3.0				
Total water requirement of towns and Ethanol plant - MGY		488.1				
Total water requirement of towns - MGY		164.1				
Total water requirement for ethanol plant - MGY		324.0				
Ratio of ethanol plant water use vs. surrounding area		1.97				
Percentage of ethanol plant usage of total water usage		66.4%				
Total Population within the 10 mile radius		6,421				

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Water Use					
Typical water use per person per day - Gallons/ person/ day	70				
Equivalent # of people ethanol plant water use w/o CO2 capture	9,393				
Equivalent # of people ethanol plant water use w/ CO2 capture	12,681				
Electricity Use					
Electricity to produce Ethanol - kWh/ gallon EtOH for production	0.6				
Total Electricity used to produce ethanol - kWh	48,000,000				
Electrical use to capture CO2 - kWh/ gallon EtOH	0.377				
Total Electricity used to capture CO2 - kWh	30,160,000				
Total electricity to produce ethanol and capture CO2 - kWh	78,160,000				
Typical electrical use/ residence - kWh/year	10,476.0				
Equivalent number of residences	7,460.9				
Number of people / residence	2.4				
Equivalent number of people	17,906				
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	2.080E+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	21,667				
Number of people / residence	2.4				
Equivalent number of people	52,000				
* Ethanol Capacity per Iowa Renewable Fuels Association		** Water usage per the greater of DNR WACOP Permit or 3 times ethanol capacity.			

#2 Green Plains Inc. Ethanol Plant (80 MGY) near Shenandoah

Ethanol plant 2023 water usage vs. surrounding residential water usage of towns within a ten mile radius MGY (Millions of Gallons per Year).

