

#15 POET Biorefining - Arthur 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 Arthur, Iowa		-	-		
	POET Biorefining - Arthur Plant		761	396		Without CO ₂ capture water requirement
	Combined Towns All Water Usage		318.966	318.97		City residential use assumes 70 gal./person/day
1	Arthur	222	5.7	5.7		Water usage too small to require a permit
2	Kiron	267	6.8	6.8		Water usage too small to require a permit
3	Ida Grove	2,051	52.4	52.4		
4	Odebolt	9,944	254.1	254.1		
	Percentage of ethanol plant usage of total water usage	12,484	70.5%	55.4%		
Conclusion: Without CO₂ Capture						
This ethanol plant consumes 55% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles).						

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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 Arthur, Iowa		-	-	-	-	City residential use assumes 70 gal./person/day
1	Arthur	222	5.7	5.7	0.7%	Water usage too small to require a permit
2	Kiron	267	6.8	6.8	0.8%	Water usage too small to require a permit
3	Ida Grove	2051	52.4	52.4	6.1%	
4	Odebolt	9944	254.1	254.1	29.8%	
5	Ethanol plant water for Ethanol Production		761.0	396.0	46.4%	Without CO ₂ Capture water requirement
6	Ethanol Plant water for CO ₂ Capture		138.6	138.6	16.2%	Additional CO ₂ Capture water requirement
Total Plant and Towns		12,484	1218.6	853.6	100.0%	
Percentage of ethanol plant usage of total water usage			73.8%	62.63%		
Conclusion: With CO₂ Capture						
This ethanol plant consumes 63% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles)						
*Ethanol Production Capacity of Plant - MGY		132				
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		138.6				
Calculate ratio of gallons of water/ gallons of Ethanol		3.0				
Total water requirement of towns and Ethanol plant - MGY		853.6				
Total water requirement of towns - MGY		319.0				
Total water requirement for ethanol plant - MGY		534.6				
Ratio of ethanol plant water use vs. surrounding area		1.68				
Percentage of ethanol plant usage of total water usage		62.6%				
Total Population within the 10 mile radius		12,484				

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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	15,499				
Equivalent # of people ethanol plant water use w/ CO2 capture	20,924				
Electricity Use					
Electricity to produce Ethanol - kWh/ gallon EtOH for production	0.6				
Total Electricity used to produce ethanol - kWh	79,200,000				
Electrical use to capture CO2 - kWh/ gallon EtOH	0.377				
Total Electricity used to capture CO2 - kWh	49,764,000				
Total electricity to produce ethanol and capture CO2 - kWh	1.290E+08				
Typical electrical use/ residence - kWh/year	10,476.0				
Equivalent number of residences	12,310.4				
Number of people / residence	2.4				
Equivalent number of people	29,545				
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	3.432E+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	35,750				
Number of people / residence	2.4				
Equivalent number of people	85,800				
* Ethanol Capacity per Iowa Renewable Fuels Association		** Water usage per the greater of DNR WACOP Permit or 3 times ethanol capacity.			

#15 POET Biorefining Ethanol Plant (132 MGY) near Arthur

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

