#25 Valero Renewable Fuels - Hartley 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 Hartley, Iowa			-	-		
	Valero Renewable Fuels - Hartley Plant		570	420		Without CO_2 capture water requirement
	Combined Towns All Water Usage		121.8	121.8		City residential use assumes 70 gal./person/day
1	May City	50	1.28	1.28		Water usage too small to require a permit
2	Moneta	50	1.28	1.28		Water usage too small to require a permit
3	Melvin	199	5.08	5.08		Water usage too small to require a permit
4	Everly	575	14.69	14.69		
5	Primghar	896	22.89	22.89		
6	Sanborn	1,392	35.57	35.57		
7	Hartley	1,605	41.01	41.01		
	Percentage of ethanol plant usage of total water usage	4767	82.4%	77.5%		
Conclusion: Without CO2 Capture						
	This ethanol plant consumes 78% 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 Hartley, Iowa		-	-	-	-	City residential use assumes 70 gal./person/day
1	May City	50	1.3	1.3		Water usage too small to require a permit
2	Moneta	50	1.3	1.3		Water usage too small to require a permit
3	Melvin	199	5.1	5.1		Water usage too small to require a permit
	No Permit	299	7.6	7.6	1.1%	
4	Everly	575	14.7	14.7	2.1%	
5	Primghar	896	22.9	22.9	3.3%	
6	Sanborn	1392	35.6	35.6	5.2%	
7	Hartley	1605	41.0	41.0	6.0%	
8	Ethanol plant water for Ethanol Production		570	420	61.0%	Without CO2 Capture water requirement
9	Ethanol Plant water for CO_2 Capture		147.0	147.0	21.3%	Additional CO_2 Capture water requirement
	Total Plant and Towns	4,767	838.8	688.8	100.00%	
	Percentage of ethanol plant usage of total water usage		85.5%	82.3%		

Conclusion: With CO2 Capture

This ethanol plant consumes 82% of the water used by the cities and plant within the surrounding 10 mile radius (314 square miles)

***Ethanol Production Capacity of Plant - MGY**	**140**
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	147
Calculate ratio of gallons of water/ gallons of Ethanol	3.0
Total water requirement of towns and Ethanol plant - MGY	696.4
Total water requirement of towns - MGY	129.4
Total water requirement for ethanol plant - MGY	567.0
Ratio of ethanol plant water use vs. surrounding area	4.38
Percentage of ethanol plant usage of total water usage	81.4%
Total Population within the 10 mile radius	4,767

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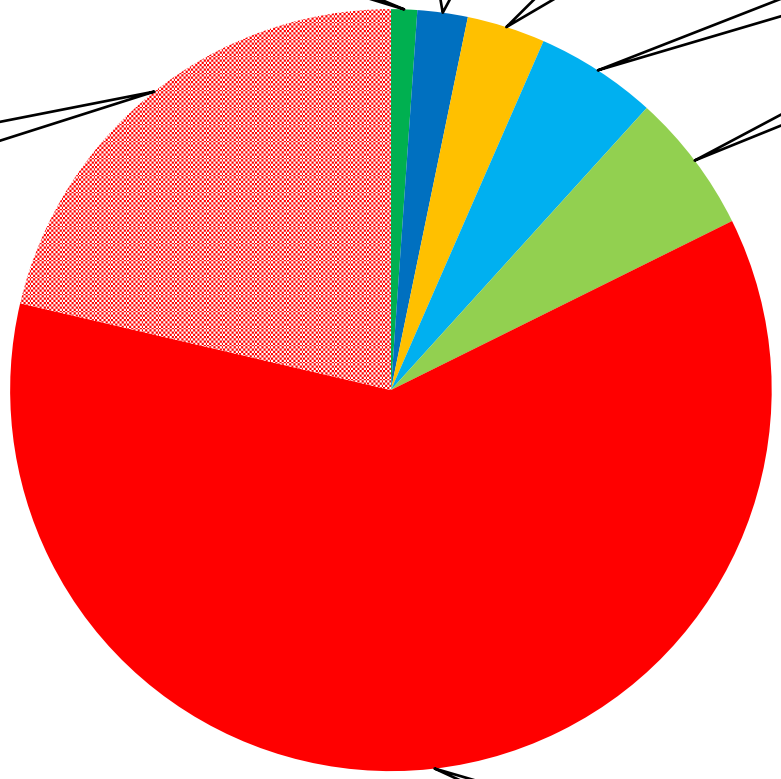
Water Use	
Typical water use per person per day - Gallons/ person/ day	70
Equivalent # of people ethanol plant water use w/o CO2 capture	16,438
Equivalent # of people ethanol plant water use w/ CO2 capture	**22,192**
Electricity Use	
Electricity to produce Ethanol - kWh/ gallon EtOH for production	0.6
Total Electricity used to produce ethanol - kWh	84,000,000
Electrical use to capture CO2 - kWh/ gallon EtOH	0.377
Total Electricity used to capture CO2 - kWh	52,780,000
Total electricity to produce ethanol and capture CO2 - kWh	1.368E+08
Typical electrical use/ residence - kWh/year	10,476.0
Equivalent number of residences	13,056.5
Number of people / residence	2.4
Equivalent number of people	**31,336**
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	3.640E+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	37,917
Number of people / residence	2.4
Equivalent number of people	**91,000**
* Ethanol Capacity per Iowa Renewable Fuels Association	** Water usage per the greater of DNR WACOP Permit or 3 times ethanol capacity.

#25 Valero Renewable Fuels Ethanol Plant (140 MGY) near Hartley

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



No Permit cities:
May City
Moneta
Melvin

This plant uses four times as much water as all the surrounding cities within a 10 mile radius.

With the proposed CO_2 capture system the Valero Renewable Fuels Hartley Plant will use 82% of the total water used by the plant and cities within the surrounding 10 mile radius. (314 square miles)

With combined production and CO2 capture the ethanol plant power and 2023 water usage would be equivalent to:
Water: 22,200 people.
Electricity: 31,300 People.
Natural Gas: 91,000 People

3.0 gallons of water per gallon of ethanol used for production.
An additional 1.05 gallon is required for CO2 capture.

The plant draws it's water from the Cretaceous aquifer.
This water level in this area has been stable since 2015

The total population of the cities within the 10 mile radius is 4,767.