

Covers for Long-Term Dairy Manure Storages Part 2: Estimating Your Farm's Annual Cost and Benefit

Annual Costs of Storage Covers

With the wide variety of storage cover options, a cost-benefit analysis is an important part of evaluating whether to install a cover, and if so, what type. Table 1 provides estimates of the average annual cost of covers for different storage structures. This analysis assumes a lost opportunity cost of capital at 8% (excluding gas handling equipment), and includes depreciation, maintenance, repairs, and disposal costs. Maintenance and repair costs vary depending upon the cover material chosen and are typically covered by the installer or an associated service provider. For remote locations, a one-time repair cost can be as high as \$5,000.

Annual Benefits of Storage Covers

While permeable and impermeable covers both reduce odor emissions and may reduce nitrogen loss to the atmosphere, an impermeable cover can provide further operational benefits that can help offset higher capital costs. Benefits include the avoidance of handling rainwater mixed with stored manure and the potential to sell carbon credits (CO₂ eq) if methane is captured and destroyed. (For information on Carbon Credits, see Fact Sheet GHG-1: Overview of Carbon Trading in Agriculture.)

Rainwater can be isolated from the manure storage with an impermeable cover. The benefit to excluding rainwater is realized in the reduced cost during land application, the increased storage capacity of the manure storage system or the reduction of the required storage size. The total impact of rainwater avoidance depends upon the surface area of the storage system, whether adjacent areas contribute runoff to the storage, and the net annual precipitation (rainfall-evaporation) of the specific site. Annual avoidance can range from 300,000-700,000 gallons per acre of surface area in NY. The accompanying Cover Cost Calculator allows for the estimation of on-farm savings based on rainwater avoidance and specific manure handling costs.



Impermeable cover installed on an existing earthen dairy manure storage in New York State

Table 1. Average annual cost of manure storage covers based on storage size. Annual cost is the summation of lost opportunity cost of capital at 8% (based on installed price per square foot over the expected operational life of the cover, excluding gas handling equipment), depreciation, maintenance and repair, and disposal at the end of useful life.

Storage Size	Permeable Geotextile Cover – Installed Cost and Expected Life			Impermeable Cover – Installed Cost and Expected Life	
	\$0.35/square foot 5 years	\$1/square foot 5 years	\$1/square foot 10 years	\$3/square foot 20 years	\$5/square foot 20 years
100' Diameter (0.18 Acre)	\$ 1,500	\$ 2,800	\$ 1,500	\$ 2,400	\$ 3,900
120' Diameter (0.26 Acre)	\$ 2,200	\$ 4,000	\$ 2,200	\$ 3,500	\$ 5,600
200' Diameter (0.72 Acre)	\$ 5,900	\$ 11,100	\$ 6,200	\$ 9,700	\$ 15,700
1 Acre	\$ 8,200	\$ 15,400	\$ 8,600	\$ 13,500	\$ 21,800
2 Acres	\$ 16,400	\$ 30,700	\$ 17,200	\$ 27,000	\$ 43,600

Biogas collection and combustion from an impermeable storage cover can qualify as a greenhouse gas mitigation technology because methane (a potent greenhouse gas) is destroyed in the combustion process. Public and private exchanges have been developed for the allocation and trading of carbon credits (CO₂ eq) generated from greenhouse gas mitigation projects. The Chicago Climate Exchange (CCX) and the Regional Greenhouse Gas Initiative (RGGI) are potential carbon credit markets for northeast dairy farmers.

The CCX estimates carbon credit allocations for manure storage covers based on the number of cows and heifers and the classification of the manure storage system. The CCX defines two types of manure storage systems: liquid slurry or anaerobic lagoon.

The method used by CCX estimates the highest amount of carbon credits that can be allocated per year (measured in metric tons of CO₂ eq per animal). The actual payment will be based on the lower of the metered or calculated volume of gas. Table 2 provides an estimate of the yearly carbon credits per animal a producer in NY could receive for implementing an impermeable cover, gas collection, and flare system. Table 2 also depicts the yearly value of the carbon credits based on various market values. The price of one metric ton of CO₂ eq between January and August of 2008 ranged from \$1.90 to \$7.40.

For more information on Carbon Credits, see Fact Sheet GHG-1: Overview of Carbon Trading in Agriculture.

Table 2: Estimated annual amount and market value of Carbon Credits (metric tons CO₂ eq) received from implementing an impermeable storage cover and flaring collected biogas based on CCX regulations.

	Annual Metric Ton CO ₂ eq	\$2/Metric Ton	\$5/Metric Ton	\$20/Metric Ton
Liquid Slurry Storage (per cow)	1.36	\$2.72	\$6.80	\$27.20
Liquid Slurry Storage (per heifer)	0.55	\$1.10	\$2.75	\$11.00
Anaerobic Lagoon (per cow)	4.17	\$8.34	\$20.85	\$83.40
Anaerobic Lagoon (per heifer)	1.70	\$3.40	\$8.50	\$34.00

Estimate Your Annual Cost and Benefit with the Cover Cost Calculator

The MS Excel[®] Spread Sheet: Cover Cost Calculator has been developed to estimate the annual cost and benefit of implementing an impermeable manure storage cover based on your specific inputs, shown in Figure 1. To use the Cover Cost Calculator open the Excel file and select “Enable Macros”, then follow directions provided in the program. The Cover Cost Calculator does not account for benefits associated with odor control or nitrogen retention.

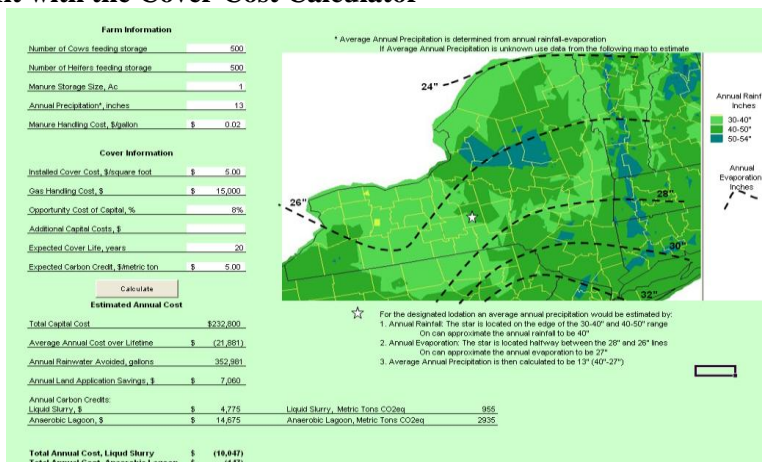


Figure 1: Picture of Cover Cost Calculator

Fact Sheet Series

Covers for Long-Term Dairy Manure Storages

SC1: Odor Control and More	SC4: Design Considerations for Impermeable Geomembrane Covers
SC2: Estimating Annual Cost and Benefit	SC5: Design Considerations for Permeable Geotextile Covers
SC3: Flares and Gas Handling	SC6: Design Considerations for Pump-out of New and Existing Storages

Authors	Tim Shepherd tas229@cornell.edu 607-225-1236	Curt Gooch, P.E. cag26@cornell.edu 607-255-2088	Karl Czymmek kjc12@cornell.edu 607-255-4890	Jason Karszes jk57@cornell.edu 607-225-3809
----------------	---	---	---	--

References: General information within this document was gathered from the 2008 Conference Proceedings of Liners and Covers for Agricultural Waste Storage, Robert Burns, Iowa State University. Cover cost information reflects personal correspondence with Andrew Mills of Layfield Group, Richmond BC, Canada, November 2008. Carbon credit information and estimates were based on protocols from Chapter 9 of the CCX Rule Book, available online at http://www.chicagoclimatex.com/docs/offsets/CCX_Rulebook_Chapter09_OffsetsAndEarlyActionCredits.pdf#page=53

Acknowledgement: Development of this fact sheet was supported by funds from the New York Farm Viability Institute: Center for Dairy Excellence.