

Industry Standard Emissions

Open Anaerobic Lagoon EF¹: 6.3 lb-VOC/yr-cow
Dairy requiring permits: minimum of 1,954 cows

$$\text{VOC} = 1,954 \text{ cow} \times 6.3 \text{ lb-VOC/yr-cow} \times \text{ton}/2,000 \text{ lb} = 6.2 \text{ ton-VOC/year}$$

VOC Reductions

Anaerobic Digester System w/IC engine control²: 46%

$$\text{VOC Reductions} = 6.2 \text{ ton-VOC/year} \times 0.46 = 2.9 \text{ ton-VOC/year}$$

Annualized Costs of Digester System

Annualized purchase/installation cost:

- A = $[P(i)(1+i)^n] \div [(1+i)^n - 1]$ where:
A: Equivalent annual capital cost of the control equipment
P: Present value of the control equipment, including installation
I: Interest rate (District policy is to use 10%)
n: Equipment life (District policy is to use 10 years)

$$P = \$600/\text{cow}^3 \times 1,954 \text{ cow} = \$1,172,400$$

$$A = [\$1,172,400 (0.1)(1+0.1)^{10}] \div [(1+0.1)^{10} - 1]$$
$$A = \$190,803/\text{yr}$$

Ongoing Costs:

$$\text{O\&M}^4 = \$0.01/\text{kWh}$$

$$\text{Generator Size}^5 = 0.1 \text{ kW/cow} \times 1,954 \text{ cow} = 195 \text{ kW}$$

$$\text{Annual O\&M} = \$0.01/\text{kWh} \times 195 \text{ kW} \times 8,760 \text{ hr/yr} = \$17,082/\text{yr}$$

¹ "Emissions from Animal Feeding Operations - Draft", U.S. EPA, August 15, 2001, chpt. 9, table 2. EF has been scaled to account for a cow of 1,400 lb.

² District Dairy Draft BACT determination, page 45.

³ Maximum covered lagoon digester installed cost from "Dairy Power Production Program Progress Report", by CEC and WURD, May, 2003.

⁴ EPA AgSTAR estimate for ongoing O&M cost of dairy digester system is \$0.01/kW-hr.

⁵ Industry sizing estimate for dairy digester power generating equipment is 0.1 kW/cow.

Annual costs: \$190,803/yr + \$17,082/yr = \$207,885/yr

Annualized Benefit of Digester System

Power Delivery Service Rates			
Name	Winter (\$/kW-hr)	Summer (\$/kW-hr)	Average (\$/kW-hr)
SCE	0.1027	0.1580	0.1304
PG&E	0.1577	0.1577	0.1577
TID	0.0873	0.0934	0.0904
MID	0.0799	0.0931	0.0865
Total			0.1163

Ongoing benefit of on-site power generation:

Annual Savings = 195 kW × 8,760 hr/yr × \$0.1163/kW-hr = \$198,664/yr

Overall Annual Cost of Digester System

Total Annual Cost = \$207,885/yr - \$198,664/yr = \$9,221/yr

Cost of VOC Emission Reduction:

Cost of reductions = \$9,221/year ÷ 2.9 ton/year
= \$3,180/ton