

Saving Energy In Rodent Vivaria

The Problem

The high energy consumption of Individually Ventilated Caging (IVC) housing research mice and rats in the United States is a huge part of a facility's operating budget. In 2007, approximately 30 million mice were used in biomedical research, testing and education in this country. With an average of 3 mice per cage and an 8-month lifespan, it is conservatively estimated that 6.7 million cages are currently in use, and that number is constantly rising. More than 75% of these are IVC cages. At an average of 125 cages per rack, there are more than 40,000 IVC racks in constant use housing mice. At an estimated 1.25 blower motors per rack, that is about 50,000 blowers in constant use. With each blower consuming 300 watts of power, IVC racks in the USA are consuming 15 megawatts of power every minute of every day.

The facility must also consume power to remove the room heat loads of 30 million mice and 50,000 blowers. At 0.49 watts per mouse and 300 watts per blower, another 16.47 megawatts of heat is generated. This is 56.2 million BTU/hr, or 4,687 tons, of cooling (1 ton = 12,000 BTU/hr). At an assumed average efficiency of 0.6 KW power consumption per ton of cooling, 2.81 megawatts of constant electrical power is required to remove the heat loads associated with IVC housing of rodents.

Put it all together, and in one year, that is 156 Gigawatt-Hours per year. According to the most recent figures from the Energy Information Administration (EIA) of the United States government, the average cost of commercial electricity in the United States for January and February of 2008 is 9.52 cents per KWH. At this energy cost, \$14.85 million dollars per year are spent just on the electricity to run IVC racks in this country. With energy costs skyrocketing further in 2008, expect that figure to be significantly higher, and continue to rise.

A growing number of facilities are focusing attention on the carbon footprint of energy consumption. According to the EIA, 1.34 pounds of CO₂ are created and added to the atmosphere for each KWH of electricity produced. Therefore, the annual use of IVC racks in the United States is responsible for about 104,500 TONS of CO₂ dumped into the environment each year. Each average IVC rack in the country is consuming \$362.50 of electricity per year, and contributing more than 2.5 tons of CO₂ air pollution.

One Solution

Replace motorized IVC racks with Animal Care Systems' Exhaust Ventilated Cage racks (EVC) that use no motors or blowers. EVC exhaust hoses connect directly to the building's HVAC exhaust system, using animal room ventilation to purge air from each cage on a rack. Because EVC racks are negative pressure, animal heat loads are eliminated at the source. A 100-cage EVC rack requires 40-60 CFM of HVAC room exhaust ventilation to ventilate the cages.

Based on the average energy consumption of typical large air-handling systems, 14 watts of blower power are required to move 50 CFM of air in an EVC rack. Since all animal heat loads are exhausted directly from the room, and there are no heat loads from rack-mounted motors, a 100-cage EVC rack uses a total of only 14 watts. Using the same cost of electricity, and adjusting for 125-cage equivalence, that's an electricity cost of \$14.59 per year. Carbon dioxide air pollution is only 205 lbs per year per 125-cage

rack. EVC rodent racks can save more than 95% of the electricity usage of an IVC rack; and the carbon footprint is 95% smaller.

Summary

EVC racks improve energy efficiency, offer a better environment for housing and breeding, and greatly reduce the carbon footprint of a facility. Below are summary tables of annual total and individual IVC rack energy costs and carbon footprints in the United States compared to equivalent quantity of cages in EVC racks.

Total EVC vs IVC Energy Consumption/Carbon Footprint

	Tons CO2/year	KWH/year	Energy Cost/year
50,000 EVC Racks (100 cages)	4,108	6,132,000	\$583,766
40,000 IVC Racks (125 cages)	104,520	156,000,000	\$14,850,000

Tons CO2/year KWH/year Energy Cost/year

Individual EVC vs IVC Energy Consumption/Carbon Footprint*

	Lbs CO2/year	KWH/year	Energy Cost/year
One EVC Rack	205	153	\$14.59
One IVC Rack	5,225	3,900	\$362.50

*Corrected to 125-cage equivalence for both racks