



SAVING ENERGY in the MOUSE HOUSE

The problem: In 2007, there were approximately 30 millions mice used in United States, with an average of 3 mice per cage and an 8-month lifespan in animal facilities that support biomedical research, testing, and education. We estimate 6.7 million cages were used to house these mice. Approximately 75% or 5 million cages are on individually ventilated caging (IVC) racks. We estimate an average of 125 cages and 1.25 blowers per rack for a total of 40,000 IVC racks and 50,000 blowers currently in use. Each IVC rack draws power for the supply and/or exhaust blowers to forcing air in the cages, is a heat sink for animal heat loads, and generates heat loads from the blower(s).

Each blower is a plug-in that draws about 315 watts (W) so that an average IVC rack needs 393.75W (315 W X 1.25 blowers) of plug load. IVC racks run 24 hours/7 days that equals to 8,760 hours per year for about 3,449.25 kilowatts (kWh) per IVC rack. This, times 40,000 IVC racks equal to 138 gigawatt-hour (GWh) of yearly IVC's plug-in energy consumption in the United States.

Each IVC rack is a heat sink and produces equipment heat loads. That necessitates the support of high HVAC (heating, ventilation, air conditioning) requirements to maintaining animal room environmental conditions. There is a consensus that every cage of five (5) mice and every blower on an IVC rack generate on average 8 BTU/hour (2.34W) and 761 BTU/h (223W) of heat loads respectively. The heat gain of an IVC rack is 571.25W (125x2.34W = 292.5W+1.25x 223W = 278.75W). To cooling 571.25W, the HVAC has to provide ~66 cubic feet per minute (cfm) at supply temperature of 55 °F (it takes ~ 1W of power for each cfm). The annual energy cost to cooling the heat gain from each rack is 578.16 kW (66 W X 8,760 hours = 578.16 kWh). This, times 40,000 racks equal to 23 GWh of yearly HVAC energy consumption.

The estimated yearly energy consumption for each IVC rack/cage is about 4,027.41/32.2 kWh and for all the 40,000 IVC racks in the United States alone is about 161 GWh (138 GWh plug load + 23 GWh HVAC). According to EPA, each 1,316 kW produced by a coal-plant generates 1 ton of carbon dioxide emissions. Therefore, the annual use of 40,000 IVC racks (125-cage each) in this country is responsible for about 121,580 tons of CO₂ (6,079 lbs. per 125-cage rack or 49 lbs. per cage) dumped into the environment.

A mouse house can leave a hefty carbon footprint from using plug-ins and heat sink-designed IVC racks!

One Solution: Non motorized exhaust ventilated cage racks (EVC) do not have blower and eliminate animal heat loads. EVC exhaust vent hose connects directly to the building's exhaust HVAC system to purging air from each cage on a rack and exhausting cages air through a central 'chimney' plenum by direct exhaust ventilation. Each 100-cage EVC rack (OptiMICE, Animal Care Systems, CO) requires 40-60 cfm of HVAC exhaust ventilation to purging the cages off room-air. To draw 0.6 cfm at supply temperature of 65 °F from each cage it takes 0.6 W of HVAC energy.

The estimated annual energy consumption for each EVC rack/cage is about 525.6/5.25 kWh (60 W X 8,760 h = 525.6 kWh) and for all 5 million cages on 50,000 non-motorized EVC racks (100-cage each) equal to about 26.3 GWh (50,000 times 525.6 kWh). Therefore, the annual use of 50,000 EVC racks in this country would be responsible for the production of 19,970 tons of CO₂ (~800 lbs. CO₂ per rack or 8 lbs. per cage).

A mouse house and the environment can benefit a lot from the use of non-motorized EVC racks!

Conclusion: The 40,000 IVC racks are using 6 times or 134.7 GWh more energy (equivalent to 12,472 households) and are responsible for 101,610 tons more CO₂ in the environment than the 50,000 EVC racks.

A "typical" IVC rack (120-cage) would consume 3,864 kWh per year. Therefore, three (3) IVC racks (120-cage) would consume as much electricity per year as 1 household. It would take 21 EVC racks (100-cage) to consume as much electricity as one (1) household.

Typical annual CO₂ emissions are three (3) tons per IVC rack (120-cage). In comparison, annual CO₂ emissions are 792 pounds (0.396 tons) per EVC rack (100-cage).

EVC racks improve energy efficiency, operate environmentally friendlier housing and breeding, and help offset the carbon footprints of institutions.

	IVC	EVC	SAVINGS per year
Yearly Energy consumption: US/Cage	161 GWh / 32.2 kWh	26.3 GWh / 5.25 kWh	134.7 GWh / 27 kWh
Yearly CO₂ Emissions: US/Cage	121,580 tons / 49 lbs.	19,970 tons / 8 lbs.	101,610 tons / 41 lbs.

Source: EPA

