Energy Efficient No-Kill Animal Shelter

Animal and Environmentally friendly shelter design

Tag words: no-kill shelter, energy-efficient

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Summary

The well being of domestic animals is often endangered in today’s society because of the lack of resources to care for abused or abandoned animals. Caring for animals while at the same time remaining environmentally conscientious was the goal of the community service. As such, we designed a green animal shelter that took into consideration everything from the laws regarding animal shelters, to the acoustics in the facility, to the directionality of the building itself, and, of course, to environmentally friendly energy options like solar power and incorporating a green roof. In doing this we learned a tremendous amount about the intricacies of designing a facility. Particularly with regards to the amenities that all animals must have like kennel space, exercise, and veterinary care. Also, in making it a green facility we also learned an extraordinary amount about alternative energy solutions that can be used in just about any working building.

Video Link

Energy Efficient No-Kill Animal Shelter: http://www.youtube.com/watch?v=1vUkJfaXXw
The Issue: Animal/Pet Care

With the current state of the economy, the government, states, businesses, and families are making cutbacks. Unfortunately, some of these cutbacks are affecting the care for pets and animals. For example, families’ spending is cutback in order to pay bills for their shelter, food, education, transportation, etc., and their pet(s) may just be looked as another bill. Owning an animal is costly due to providing food, shelter, vet examinations, medical care, etc. Therefore, the pet may be considered as a cutback where an owner may not provide the proper food and medical care they need. Some families may also have to foreclose their homes due to the economy and end up leaving their homes as well as their pet(s) because of the costly burden. Another example why they might also abandon their pet is when their pet gets injured and they cannot afford the medical procedures to restore the animal’s health. The list can go on yet now there is an abundance of abandoned animals wandering the streets. With the help of animal control, these abandoned animals are brought to shelters which are now overcrowding due the high rate of abandonment. Some shelters are forced to euthanize these animals due to limited space. No-kill shelters, on the other hand, do not euthanize due to lack of space but are filling up and can no longer take in more animals. These no-kill shelters are generally non-profit organizations that rely on private donations and fundraising for funds to keep the shelter running with the proper care for the animals they house. Unfortunately, funding is harder to get now, again, due to the economy. Therefore, there is a need for an energy-efficient no-kill shelter to not only provide abandoned animals the loving care and support they need, but this shelter will also be self sufficient due to its energy-efficient design.

Pet Laws

(Laws were adapted from Animal Legal and Historical Center
http://www.animallaw.info/statutes/stuspa3ps459_502.htm#s207)

Facility Laws

- Housing facilities must be equipped with fire extinguishers on the premises. An indoor housing facility may have a sprinkler system also.
- Housing facilities for dogs must be sufficiently heated and cooled to protect the dogs from temperature or humidity extremes and to provide for their health and well-being. If dogs are present, the ambient temperature in the facility must not fall below 50 degrees F. Conversely, the ambient temperature must not rise above 85 degrees F when dogs are present
- Housing facilities for dogs must be sufficiently ventilated at all times when dogs are present to provide for their health and well-being and to minimize odors, drafts, ammonia levels and to prevent moisture condensation. That is, the relative humidity must be maintained at a level that ensures the health and well-being of the dogs housed therein. The appropriate ventilation, humidity and ammonia ranges are determined by the Canine Health Board.
- Housing facilities for dogs must be lighted well enough to permit routine inspection and cleaning of the facility and observation of the dogs. Animal areas must be provided a regular diurnal lighting cycle of either natural or artificial light. Lighting must be uniformly diffused throughout housing facilities and provide sufficient illumination to aid in maintaining good housekeeping practices, adequate cleaning and observation of animals at any time and for the well-being of the animals. Primary enclosures must be
placed so as to protect the dogs from excessive light. The appropriate lighting ranges are determined by the Canine Health Board.

- The floors and walls of primary enclosures must be impervious to moisture. The ceilings of indoor housing facilities must be impervious to moisture or must be replaceable.

**Kennel Laws**

- All kennels for dogs must be equipped with smoke alarms or fire extinguishers
- Primary enclosures must be designed and constructed so that they are structurally sound and must be kept in good repair.
- Primary enclosures must meet the following requirements:
  - Have no sharp points or edges that could injure the dogs.
  - Be maintained in a manner to protect the dogs from injury.
  - The height of a primary enclosure that is not fully enclosed on the top must be sufficient to prevent the dog from climbing over the walls.
  - Keep animals other than dogs from entering the enclosure.
  - Enable the dogs to remain dry and clean.
  - Provide shelter and protection from temperatures and weather conditions that may be uncomfortable or hazardous to any dog.
  - Provide sufficient space to shelter all the dogs housed in the primary enclosure at one time.
  - Provide potable water at all times, unless otherwise directed by a veterinarian in a writing that must be kept in the kennel records.
  - Enable all surfaces in contact with the dogs to be readily cleaned and sanitized or be replaceable when worn or soiled.
  - Have floors that are constructed in a manner that protects the dogs' feet and legs from injury. The floor must not permit the feet of a dog housed in the primary enclosure to pass through any opening.
  - Provide space to allow each dog to turn about freely and to stand, sit and lie in a normal position. The dog must be able to lie down while fully extended without the dog's head, tail, legs, face or feet touching any side of the enclosure.
  - The interior height of a primary enclosure must be at least six inches higher than the head of the tallest dog in the enclosure when it is in a normal standing position.
- Each mother with nursing puppies will be provided with an additional amount of floor space based on her breed and behavioral characteristics and in accordance with generally accepted husbandry practices as determined by the attending veterinarian. If the additional amount of floor space for each nursing puppy is less than 5% of the minimum requirement for the mother, the amount of floor space must be approved in writing by the attending veterinarian and will be kept in the kennel records.
- All dogs housed in the same primary enclosure must be compatible, as determined by observation. Not more than six adult dogs may be housed in the same primary enclosure. Females in heat may not be housed in the same primary enclosure with sexually mature males, except for breeding. Females with litters may not be housed in the same primary enclosure with other adult dogs, and puppies under 12 weeks of age may not be housed in the same primary enclosure with adult dogs, other than the dam or foster dam. Dogs displaying vicious or aggressive behavior toward other dogs must be housed separately.
All kennels must be equipped with a smoke alarm and must have a means of fire suppression, such as fire extinguishers or a sprinkler system on the premises.

A dog housed in a primary enclosure must be provided a minimum amount of floor space in the primary enclosure, calculated as provided under this subparagraph: Find the mathematical square of the sum of the length of the dog in inches, measured in a straight line from the tip of its nose to the base of its tail, plus six inches, then divide the product by 144, then multiply by 2. The calculation is: \((\text{length of dog in inches} + 6)(\text{length of dog in inches} + 6) \div 144 \times 2 = \text{required floor space in square feet}\). For the second dog placed in the primary enclosure the minimum floor space must be doubled. The floor space must be calculated using the longest dog. For each dog above two, the minimum floor space must be multiplied by 1.5 per additional dog.

Primary enclosures must be placed no higher than 30 inches above the floor of the housing facility and may not be placed over or stacked on top of another cage or primary enclosure.

The floor of the primary enclosure must be strong enough so that the floor does not sag or bend between the structural supports, must not be able to be destroyed through digging or chewing by the dogs housed in the primary enclosure, must not permit the feet of any dog housed in the primary enclosure to pass through any opening, must not be metal strand whether or not it is coated, must allow for moderate drainage of fluids and must not be sloped more than 0.25 inches per foot.

Cleanliness Laws

The following must apply:

- Excreta, feces, hair, dirt, debris and food waste must be removed from primary enclosures at least daily or more often if necessary to prevent an accumulation of excreta, feces, hair, dirt, debris and food waste to prevent soiling of dogs contained in the primary enclosures and to reduce disease hazards, insects, pests and odors.
- Used primary enclosures and food and water receptacles must be cleaned and sanitized in accordance with this section before they can be used to house, feed or water another dog or grouping of dogs.
- Used primary enclosures and food and water receptacles for dogs must be sanitized at least once every two weeks and more often if necessary to prevent an accumulation of excreta, feces, hair, dirt, debris, food waste and other disease hazards.
- Hard surfaces of primary enclosures and food and water receptacles must be sanitized using one of the following methods:
  - Live steam under pressure.
  - Washing with water with a temperature of at least 180 degrees F and soap or detergent, as with a mechanical cage washer.
  - Washing all soiled surfaces with appropriate detergent solutions and disinfectant or by using a combination detergent or disinfection product that accomplishes the same purpose with a thorough cleaning of the surfaces to remove excreta, feces, hair, dirt, debris and food waste so as to
remove all organic material and mineral buildup and to provide sanitization followed by a clean water rinse.

- Primary enclosures, exercise areas and housing facilities using material that cannot be sanitized using the methods under subparagraph must be made sanitary by removing the contaminated material as necessary to prevent odors, diseases, pests, insects and vermin infestation.
- Premises where primary enclosures are located, including buildings and surrounding grounds, must be kept clean and in good repair to protect the animals from injury, to facilitate the husbandry practices required in this act and to reduce or eliminate breeding and living areas for rodents and other pests and vermin. Premises must be kept free of accumulations of trash, junk, waste products and discarded matter. Weeds, grasses and bushes must be controlled so as to facilitate cleaning of the premises and pest control and to protect the health and well-being of the animals.
- An effective program for the control of insects, external parasites affecting dogs or pests must be established and maintained so as to promote the health and well-being of the dogs and reduce contamination by pests in housing facilities.

**Exercise Laws**

- An appropriate plan must be developed and followed to provide dogs with the opportunity for exercise. The plan needs to be approved by a veterinarian.
- Each primary enclosure needs to have an entryway that will allow the dog unfettered clearance out of the enclosure to an exercise area unless the enclosure is closed for active cleaning, under subsection, or by order of a veterinarian.
- The Canine Health Board may, upon a request from a shelter owner, provide on a case-by-case basis for an alternative means of allowing clearance from a primary enclosure to the exercise area if the shelter owner presents the board with a plan that the board determines is verifiable, enforceable and provides for exercise equal to or greater than that which the dogs would receive otherwise. The board would meet within 60 days of a request submitted or sooner if necessary.
- Exercise requirements must be as follows:
  - Unless otherwise approved by the Canine Health Board, the exercise area must allow for unfettered clearance for dogs from their primary enclosure.
  - The exercise area must be at least twice the size of the primary enclosure.
  - The exercise area must have adequate means to prevent dogs from escaping.
  - The exercise area fencing must be kept in good repair and be free of rust, jagged edges or other defects that could cause injury to the dogs.
  - The exercise area needs to be cleaned in accordance with the requirements present in cleanliness laws.
  - Dogs must not be placed in the area in a manner that would cause injury to the dogs.
  - Compatible dogs may be exercised together.
  - Nursing mothers and their puppies need to be exercised separately from other dogs.
- The exercise area must be on ground level and the ground of the exercise area must be solid and maintainable. Surfaces such as gravel, packed earth and grass which are solid and maintainable may be utilized.
- The exercise area must be outdoors, unless otherwise approved.
- It is prohibited to further expand the shelter to include the required outdoor exercise area. Unless, the shelter owner applies to the department within 180 days after the effective date of this clause for approval to construct the required exercise area indoors. The department will notify the applicant by certified mail of approval or disapproval within 30 days of receipt of the application. The department will not require that the licensed shelter appeal the decision of a zoning hearing board or other municipal body with jurisdiction to interpret a local ordinance as a condition of application or approval. Denial by the department of an application for an indoor exercise area will be appealable. While an appeal is pending and until final conclusion of the appeal, the kennel will not be considered in violation of this act for failure to have the required exercise area. The required exercise area will be constructed within 90 days of the final conclusion of an appeal under this clause or within one year of the effective date of this clause, whichever is later.
- If, in the opinion of the veterinarian, it is inappropriate for a dog to exercise because of its health, condition or well-being, these rules will not apply with respect to that dog. Such a determination must be documented by the veterinarian and, unless the basis for determination is a permanent condition, must be reviewed at least every 30 days by the veterinarian and updated as necessary. Records of determinations will be maintained by the shelter.
- Forced exercise methods or devices such as swimming, treadmills or carousel-type devices do not meet the exercise requirements of this paragraph.

**Animal Care Laws**

- The kennel in which the primary enclosure is located must establish a written program of veterinary care, which must include a physical examination and vaccination schedule, a protocol for disease control and prevention, pest and parasite control, nutrition and euthanasia. A copy of the program must be kept in the kennel records.
- All dogs must be provided with adequate food that is clean and free from contaminants.
- All dogs must be removed from the primary enclosure when the primary enclosure is cleaned.
- Rabies vaccinations may only be administered by or under the supervision of a veterinarian.

**Record Keeping Laws**

- The first thing that needs to be done is obtain from the state a license for the class of shelter that is going to be built. This expires every June so it will need to be renewed yearly. Records of every animal kept at the shelter also will need to be thoroughly kept so that any authorized personnel can easily find information if necessary.
- For each dog in a kennel, a permanent record must be kept and made readily available for inspection. The record must contain all of the following information:
  - The date of birth of the dog.
The date of the last rabies vaccination.
- The date of the dog's last veterinarian check.
- All veterinarian records must be kept for two years after the dog has left the care of the facility.
- Notwithstanding any law, a dog may not be euthanized except by a veterinarian.

**Shelter Considerations and Guidelines**

When designing a shelter, there are many considerations that need to meet the Pet laws, mentioned above, as well as the board of Health’s regulations. Many of the considerations below have been adapted from the Humane Society of the United States website (www.animalsheltering.org).

- **Acoustics**
  
  Acoustics refers to the placement of animals. It is obvious that different animals, such as cats and dogs, cannot be put into the same kennel however even if they are in separate kennels, they must be in separate rooms. This is because animal hearing is very sensitive. Noise created by either animal can have an effect on animal behavior, such as create anxiety which can lead to health problems. When looking at the placement of canines in relation to each other, to reduce over stimulation from seeing one another, the dog kennels are placed in an apartment style setting, where the kennels are facing outward instead of facing each other. Also, each kennel is separated with a divider that is at a height taller than the dog but not as high as the ceiling. This is because of ventilation purposes as well as to not complete isolate the dogs within the kennel.

- **HVAC (Heating, Ventilation, and Air conditioning)**
  
  The general structure, or foundation, for the shelter would be made out of cement. This is because it is easy to construct, maintain, and clean. Since it is easy to construct and maintain, it is therefore cost-effective. Cement is generally chosen over other alternatives, like wood, because it is easy to clean. This is most important in the shelter because they are dealing with animals, who cannot take care of themselves. Remember, these animals are generally strays or wandering the streets, and therefore come in dirty and aren’t always potty trained, etc. Cement is easy to clean with just water from a hose and there is no worry of ruining the shelter, unlike a wood structure. Also cement is a good insulator and therefore can help keep the heat within the building. In order to heat the cement, hot water pipes are run through the cement floors.

  Since there is a use of water hoses to clean the kennels, there are drains that are placed in the floors. These drains must be at least 4” in diameter that have drain covers of stainless steel. They must also include drain traps and lead-away pipes that are 6” in diameter. In addition, electrical sockets must be placed about 3 feet above the floor to avoid getting wet. Ventilation is another important consideration in which there may be fans, AC, etc. in the shelter. The kennels may have guillotine doors, which are doors that connect the kennel to the outdoors, which may provide for ventilation when open. Lighting must also be considered. Well lit rooms where fixtures are placed over the dog kennels and hallways are important for safety.
Energy Efficient Solutions

- **Solar Thermal Energy**

Solar thermal energy is based on using solar energy for heat. The heat form the sun’s rays are collected in flat plates/panels, or also known as solar thermal collectors, and are used to heat water, swimming pools, air, etc. These collectors produce more than half of the hot water needed for houses and buildings in the U.S. (1) This system heats water and air by the trapped heat within the panels. For air, there is an inlet and an outlet where the air can enter and escape respectively. There is a fan at the one end to move cool air into the panel and out the other end. This system is similar to heat water in where there is a pipe running through the solar panel so that it is heated up by the trapped solar thermal energy. This application is an energy efficient way to help heat the shelter as well as provide hot water.

A.

![Solar Panel to Heat Air](image1)

B.

![Solar Panel to Heat Water](image2)


C. Solar panels for water heating on top of a hotel in Perissa, Santorini, Greece.
• Solar Electricity

Solar electricity follows the same concept as solar thermal energy where solar panels are used to trap the energy from the sun’s rays. The difference is that the panels used for electric power production are high temperature collectors. These collectors use mirrors to help concentrate the sunlight. (3) Instead of using solar energy for heat, this energy is directly converted into electricity. Solar energy is converted into electricity when a Photovoltaic (PV) cell is exposed to light. Electrical charges are generated and are conducted to make a direct current. (4) This application can be used to make the shelter more energy efficient because the electrical output from the solar energy can be used to run appliances, lighting, air conditioner, etc. Not only is using the sun environmentally friendly, but it also helps reduce costs to run the shelter. In addition, if more energy is generated than used by the shelter, then the shelter can sell back this energy and will be making money off the sun. This money can be used to pay for services at the shelter.

• Green Roof

A green roof is a roof that is covered with vegetation. These are used to help reduce heating and cooling by somewhat acting like an insulator. These roofs also reduce water runoff, due to the absorption from the vegetation. Pollutants and CO2 can be filtered out also due to the vegetation. This application is an energy efficient solution because it helps to keep hot or cool air with the building, it increases the life span of the roof, and it helps out the environment by generally cleaning/filtering the air. (6)

D. An example of a green roof.
By Erik Christensen (7)

A Sample Shelter Design
(provided by Bucks County SPCA and Julie Fagan)

Community Service Project

E. (above) Shelter Flooprint
Shelter Design

- 120’ X 40’
- 3,500 Square Feet
- Capacity:
  - 20 Canines
  - 34 Felines
- Facility contents
  - 10 Canine healthy holding kennels
  - 2 Canine Isolation kennels
  - 2 Canine Quarantine kennels
  - 6 Canine Adoption kennels
  - 12 Feline healthy holding
  - 6 Feline adoption
  - 8 Feline isolation
  - 8 Feline quarantine
  - Lobby
- Grooming
- Office
- Mechanical/Cleaning
- Laundry/Food Prep
- Exam Room
- Bathroom

- Roof
  - 25% solar panels extending from current panels on South and West Walls
  - 75% Green Roof
  - Roof will be slightly sloped to prevent water pooling and other rooftop collections associated with flat roofs

**Shelter Description**

There are many things that need to be taken into account if you are going to consider building a facility that houses animals like we want to do with a no kill animal shelter. First, we want to make a relatively small facility that is 120 feet by 40 feet. This has a capacity of 20 canines and 34 felines. This would likely make us a Class I facility housing less than 50 different dogs over the course of a calendar year. That is, unless we have substantial adoption of our dogs in which case this could change. The classes only determine how much money has to be given to the state per year. The breakdown is $75 for 50 dogs or less; $200 for 51-100 dogs; $300 for 101-150 dogs; and the higher classes are unlikely to be needed for our purposes.

We decided to have our facility on an East-West axis with the longest faces of the building facing the south yard and exercise area, and the north parking lot. We have the Healthy holding dog runs in the back of the facility with an outdoor portion of the kennel under a solar panel over hang outside. This gives the dogs some access to the outdoors. This is accomplished through the use of guillotine doors splitting the outdoor and indoor runs. Having direct access to the outside also allows us to comply with the law that says that each dog needs an entryway with unfettered clearance out to the exercise area. We kept adoption rooms to the front of the building. We decided this because people will be entering through the front lobby so these rooms will be the first things that they see. Further, the adoption rooms being in the front means that they will be away from the noisiest portion of the shelter which is in the back with the healthy holding dog runs. Further, canine and feline rooms are generally on opposite sides of the building to reduce noise and thus stress. Creating an environment that is as calm and quiet as possible is good for the employees, the animals, and the visitors.

The building being oriented on an East-West axis with the north and south faces being the longest allows passive solar heating/cooling. With fewer windows on the North end and more windows on the south side we will passively heat the facility. Further, since the strongest sun will be focused on the south and west sides, we will have solar panel over hangs in those two spots. This accomplishes two things: first that the strongest solar rays are focused on the solar panels more efficiently; and secondly that in the summer these over hangs will block the high, strong summer sun from further heating the facility, but will allow the low winter sun to come in through the windows passively heating the facility.

This design would benefit the community because it allows for the survival of animal shelters. Since it is green and cost effective due to its energy efficient solutions, the dependence on donations and funding is omitted. Nevertheless, the shelter can now provide its original service of keeping animals off the streets and provide them with adequate services in the hopes
that the pet will be adopted. This design would also benefit the community because it is environmentally friendly. By using resources that will not have adverse effects on the environment is good for the nature of all living things. Our design provides a service to the people, pets, and environment and it is hoped that other shelters as well will consider our energy-efficient design.

References

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Editorials

E-mailed to The Star Ledger (eletters@starledger.com) on Nov. 2, 2010

“Designing an energy efficient no-kill animal shelter”

By Jeanna Allen

A group of undergraduate students at Rutgers University in New Brunswick, have a huge heart for the abandoned and unwanted animals that are left to wander the streets. These students, Ryan and Jeanna, are taking a course called Issues in Animals and Agriculture and had to devise some community service project for the issue that they were inspired to change. They acknowledge the fact that our current economy isn’t doing too great which has made it harder for some owners to keep their pets. Therefore with this knowledge, these students want to help. They have decided to build an energy-efficient animal shelter with a no-kill policy. The no-kill policy means that animals will not be euthanized based on no more space in the shelter. These students wanted to design this shelter to be more environmentally friendly and therefore are
including energy-efficient solutions to help run the shelter. They have researched the pet laws and shelter regulations of NJ in order to design a valid shelter. Although this project may only get as far as a design, it is only the beginning to something that could help these abandoned animals find loving homes. It is hoped that this idea of energy-efficient no-kill shelters will actually one day be built.

Editorial by Ryan McCoyd sent to the Philadelphia Inquirer

Importance of Animal Shelters

Stray animals are a problem in many cities around the country. Further, animal neglect and cruelty is prevalent anywhere that people own and care for pets. Common solutions for these problems include animal shelters and other positive options but, more often than not, animals’ final fate is to be euthanized. Whether the animal has been so long neglected that it would require too much work (read: money and effort), or the local animal shelter is too crowded, the only option for many is euthanasia.

Further, as can be inferred from above, many animal shelters have problems with being at full capacity and having proper funds. Moreover, many shelters are not built to best meet the needs of both the employees and the resident animals. Careful considerations need to be considered when designing shelters. From the health and safety of the employees, to the well being of the resident animals, the way the shelter is designed can have many consequences.

One problem that arises when shelters are over crowded is the use of the kennels, specifically guillotine doors. The purpose of guillotine doors is to allow the employees to safely and efficiently clean the animal’s kennels. When it is time to clean, the animals kennel they are put in the other area separated by the door. However, with over crowded shelters, many times, there will be animals in both areas. This presents a sanitation issue both for the animals and for the employees. Without proper cleaning, disease can run rampant through the shelter and many animals can become afflicted. This increases the amount of care that each animal needs and consequently the amount of money that is needed.

Further, the way manner in which the animal cages are arranged can present issues. When animals are placed facing each other (something that is frequently done to increase capacity), it stimulates the animals. This stimulation many times causes the animals to create noise. As many people know, once one animal begins making noise, others will follow. Studies have shown that the noise levels in animal shelters frequently get above the range of common dosimeters which are made to measure sound levels. A consequence that is not immediately obvious from this is that the louder a shelter is, the less time people tend to spend in it. This will then directly lead to less animals being adopted which puts more burden on finances and space without as many animals being adopted. Further, hormonal cortisol levels increase in both humans and animals when stressed. This is neither good for employees nor animals as it is a catabolic hormone which promotes the break down of tissues.

Lastly, building new structures places strain on the environment. From the space, to the materials, to the energy needed to create and maintain a building, a toll is taken on the environment. There are measures to combat the detrimental effects on the environment. Using geothermal heat is a great way of combating oil heat environmental issues as well as keeping costs low. By the same token, solar panels can contribute to the electricity of the facility while also offering a tax break. All these things together keeps our environment clean, and keeps
facility costs low. In conclusion, animal shelters in general need support. Further, supporting no kill shelters is better, and supporting a green no kill shelter is better yet still.