- Fill the 7.5 cm cavity between the double wall with this wet sand

- Make a frame of top cover with bamboo (165 cm x 115 cm) frame and straw or dry grass etc. Make attach/ shed over the chamber in order to protect it from direct sun or rain

- Keep the sand, bricks and top cover of the chamber wet with water
- Water twice daily in order to achieve desired temperature and relative humidity or fix a drip system with plastic pipes and micro tubes connected to an overhead water source
- Store the fruits and vegetables in this chamber by keeping in perforated plastic crates. Cover these crates with a thin polyethylene sheet
- The cool chamber should be reinstalled once in 3 years with new bricks utilizing the old bricks for other purposes

## Areas of application

- Short term storage of fresh vegetables, fruits and flowers
- Growing of white button mushroom
- Ripening of tomato and banana
- Plant propagation
- Storage of processed fruit products

## SHELF LIFE OF FRUITS AND VEGETABLES IN ZERO ENERGY COLD STORAGE

- The shelf life of fruits and vegetables in zero energy cold storage can vary greatly depending on factors such as:
- Type of produce
- Storage conditions (temperature, humidity, air circulation)
- Handling and preparation before storage
- Maturity and quality at time of storage

## Precaution

- Site in a place where breezes blow
- Build on an elevated site to avoid water logging
- Use clean bricks with good porosity
- Always keep the bricks, top cover and sand saturated with water
- Prevent water drops coming in contact with stored material
- Keep the chamber clean and disinfect the chamber to protect from fungus, insect/ pests, reptiles etc
- Construct under a thatch to avoid direct exposure to sun light


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# ZERO ENERGY COLD STORAGE


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# Introduction

Zero Energy Cold Storage (ZECS) uses natural ventilation and insulation to store produce without electricity to maintain a cool temperature. Zero Energy Cold Storage uses natural ventilation and insulation to store produce without electricity.

In India, quality deterioration of horticultural produce takes place immediately after harvest due to lack of on-farm storage. Spoilage of fresh fruits and vegetables is a serious problem. Due to highly perishable in nature, about 20-30% of total fruit production and 30- 35% of total vegetable production in India are wasted during various steps of the post-harvest chain. Quality deterioration of horticultural crops immediately after harvest due to lack of on-farm storage.

Cool storage can prolong the life of fresh produce, but refrigeration equipment is expensive to buy, run and maintain involving large initial capital investment. Considering acute energy crisis of the district and lack of cool storage facility efforts made to develop low cost or zero energy cool chambers. These zero energy cool chambers stay 10- 15° C cooler than the outside temperature and maintain about 90 % relative humidity.

## Principle

- Based on the principles of Direct evaporative cooling
- Cooling effect obtained by evaporation of water and faster the evaporation, greater is the cooling
- Cool temperatures stew respiration process, allowing fresh produce for longer time and avoid spoilage

## Evaporative cooling

- Water evaporates into air raising its humidity and same time cooling the bed
- Efficiency depends on humidity of the surrounding air
- Very dry, low humidity air can absorb a lot of moisture so considerable cooling occurs

## Site selection

- Site having natural air flow
- Shaded place, well-ventilated and away from direct sunlight
- Construct the chamber in an elevated place to avoid water logging
- Easy to build out of locally available materials, such as brick, sand, bamboo, straw, and gunny bags

## Dimension of a unit

- 1.6 m x 1.2 m x 0.68 m (L x B x H)
- Cavity spacing for riverbed sand: 7.5 cm
- Capacity: 100-150 kg

## Material required

- Bricks
- Sand
- Bamboo
- Cow dung
- Gunny bag

## Steps

- Mix mud, sand and cow-dung in the ratio of 1:1:2 and make a ball and keep for 48 hours

- The site needs to be on flat ground under shade and near water source
- Remove any debris, vegetation & obstruction to create a flat and even surface

- Make floor with brick 165 cm x 115 cm and mud plaster it
- Erect the double wall to a height of 67.5 cm leaving a cavity of 7.5 cm and mud plaster all the sides of the wall.

- Drench the chamber with water
- Soak the fine river bed sand with water