

# COOLBot™ EQUIPPED SMALL SCALE COLD ROOM

**Introduction:** Commercial refrigeration systems are available in most parts of the world and are used for restaurants, stores and other small-scale cold room needs. The system consists of an air-cooled compressor/condenser unit installed outside and an evaporator unit (refrigeration coil) installed inside the cold room. A complete installation also requires electrical connections, a thermostat controller, refrigeration piping to connect the compressor/condenser with the evaporator, and a charge of refrigerant. A system installed in the United States costs about \$7000 for 3.5 kW (1 ton) of refrigeration capacity.

A small-scale option is to use a modified room air conditioner, a method originally developed by Boyette and Rohrbach in 1993. The control system of the unit is modified to allow it to produce low air temperatures without building up ice on the evaporator coil. The ice restricts airflow and stops cooling. Recently a company has developed an easily installed controller known as the COOLBot™ that prevents ice build-up, does not require modifying the control system of the air conditioner (Store It Cold, LLC), and works by overriding the air conditioner's temperature gauge, tricking it into working harder.



Room air conditioner controlled by CoolBot unit.



**Design Options & Materials Needed:** The better the insulation used to build a cold room, and the more air tight it is, the lower the operating costs will be for keeping the room cold. As a general rule, insulation with a minimum rating of R20 should be used in the walls, floor and ceiling. The floor can be covered with plywood or any sturdy surface covering that is easy to clean. Rigid polyurethane foam insulation (available in 4 x 8 foot sheets) or spray-on foam will provide excellent protection from outside heat if a thickness of 3 to 4 inches is used during construction or for retrofitting of an existing cold room. Three inches is enough insulation if you intend you operate the cold room at 5°C (41°F) or above. Reflective metal foil bubble insulation (available in rolls in 24" or 48" widths) is a bit more expensive, but provides approximately R30 in insulation rating when using only a single very thin layer. Caulking and weather stripping can help seal any gaps and cracks. Don't forget to insulate the door and check the door seals for air leaks.

**Costs & Benefits:** Total out-of-pocket cost for operating a refrigerated cold room is the sum of the costs for installing the mechanical refrigeration and the insulated cold room plus the electricity expense for operating the refrigeration system. Assuming US pricing, the room air conditioner and COOLBot™ control system costs about 90% less than a new commercial refrigeration system. The control system is designed so that any

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moisture condensed on the refrigeration coils is returned to the cold room air and the system will therefore cause less product moisture loss than the commercial refrigeration system. Insulated sandwich style panels for constructing a cold room are about 75% less costly in India than panels purchased in the US and electricity costs are \$0.09/kWh, about half as much as in the USA, so these lower costs result in significantly lower costs in India. Options for further reducing costs in the USA and elsewhere are to build the cold room with used insulated panels or self-build with local materials, and increasing the product throughput per year. Storage will be financially feasible if the cost of storage is less than the increased value of the stored crops when sold during the off-season. In the following example, 4 uses of the cold room will pay for the investment.

**Potato Storage in India:** Assumption -- Plastic crates can be cleaned and reused 100 or more times.

6000 kg of potatoes (6 MT)	Potatoes must be sold soon after harvest	Potatoes can be stored in the cold room for 3 months
<b>COSTS</b>		
20m <sup>2</sup> Cold room with air conditioner & COOLBot (6MT capacity)		\$4300
Capital costs (initial investment assuming no labor cost)		<b>\$4300</b>
Electricity for initial cooling (\$85 per MT, \$0.09/kWh)		\$ 510
Electricity \$18 per month for 3 months, \$0.09/kWh at 7 C		\$ 54
Recurring costs		\$564
Relative total cost		\$ 4864*
<b>EXPECTED BENEFITS</b>		
% losses	30%	5%
Amount for sale	4200 kg	5700 kg
Market value/kg	\$0.10	\$0.40
Total market value of one load	\$420	\$ 2280
Market value – recurring costs	\$420	\$ 2280- \$564= \$1716
Relative profit for one load stored for 4 months		+ \$ 1296

### References cited

Boyette, M. D. and R. P Rohrbach. 1993. A low-cost, portable, forced-air pallet cooling system. Applied Engineering in Agriculture 9(1):97-104.

### For further information

COOLBot™ manufactured by Store It Cold, LLC <http://storeitcold.com> <http://storeitcold.com/coolerconstruction.html>  
 Info sheet on the COOLBot™ (2012) [https://horticulture.ucdavis.edu/main/media%20page/technologies\\_CoolBot.pdf](https://horticulture.ucdavis.edu/main/media%20page/technologies_CoolBot.pdf)  
 Postharvest Technology Center (UC Davis) <http://postharvest.ucdavis.edu>  
 Postharvest Innovations LLC <http://www.postharvestinnovations.com>

The Postharvest Education Foundation (PEF) <http://www.postharvest.org>

(contact PEF for 30% discounts on the retail price of COOLBot™ -- offer available to individuals, companies and organizations working in developing countries)

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