

REF: 03 DESIGN FEATURES

FEATURE 1: ISO MARINE SHIPPING CONTAINERS

There is much practical potential in the creative reuse of industrial products in the housing. Nowhere is this more obvious than with the ISO standard marine shipping container which, in communities where trade deficits are the norm, often accumulate in great numbers. Shipping containers, such as the one featured here, are being left in U.S. harbors because it is cheaper for steamship lines to leave empty containers at American ports charging nominal fees than to pay the freight to ship them back to their ports of origin, mostly in Asia.



Containers are clear-span steel box frames at the 20' length size and are structurally sound, with or without their wall and roof skins, thus allowing the sides of the box to be modified in any fashion without presenting any loss of structural integrity. A variety of lift devices and dollies - some with integral motors - can be attached to the sides of containers to make them self-mobile.

Their simple modular forms and their inherently non-toxic composition of steel and aluminum have proven highly versatile. The so-called Hi-Cube containers, featuring a 9' height and commonly used for refrigerated containers, seem most useful. They feature heat cured polyurethane or styrofoam core aluminium and steel sandwich panel walls and aluminum plank decking. They are like low-cost, ready-made, non-toxic buildings. Refrigerated shipping containers are insulated with four inches all around 100mm. The outer walls are always made of aluminium with stainless steel interior walls and floor. The floor finish is made of teak. In the tropics, it is most advisable to paint the containers in light colours, so as to reflect the excessive heat.

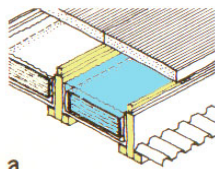
The concept of "Nomadic Housing" (i.e. housing designed for rapid demountability and easy transport) has lately become quite compelling all over the world, particularly among the people intrigued by the idea of economical and practical housing which can be routinely transported from place to place around the globe along with all personal belongings, and the shipping container meets the idea quite well.

Containers are both a solution to today's urban housing problems as well as a sensible way to recycle industrial products.

FEATURE 2: SKYTHERM® ROOF POND

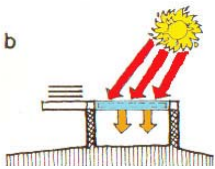
Roof ponds, such as the Harold Hay's SKYTHERM® system, have been designed and used in the hot dry climates of Arizona and New Mexico in the USA, but also in the moderate temperatures such as that of the California coast.

The roof pond, or SKYTHERM®, places the thermal mass in the roof structure. It depends on a switchable, exterior insulation scheme, to make it effective for both heating and cooling. In the heating mode, the insulation is deployed by night, while in the cooling mode, the insulation is deployed by day. The thermal mass, such as the water in containers, must remain in direct thermal contact with the interior of the building. A structural steel deck is a typical thermal connector for the system.



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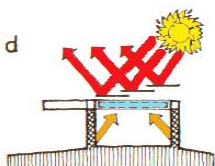
a) Water-filled polythene bags on a steel-deck roofing, covered with polyurethane panels that can slide, bifold or roll, either manually or mechanically, to cover or expose the bags;



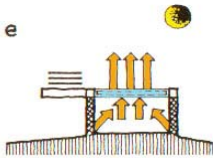
b) Winter heating by day;



c) Winter heating by night;



d) Summer cooling by day;



e) Summer cooling by night.

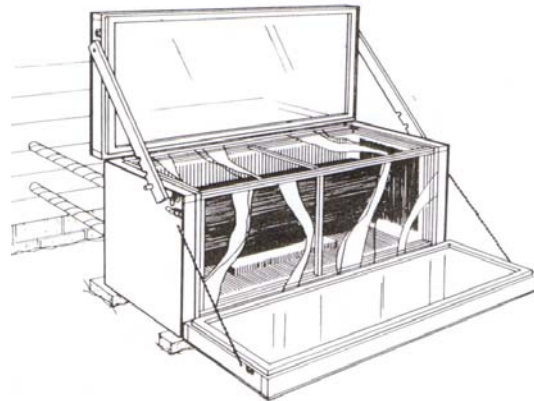
Effectiveness of the SKYTHERM® system has been well displayed in a 140.55m² single-storey house in Shiraz, Iran, where it reduced the heating demands by 86% and cooling loads by 52%.

FEATURE 3: PASSIVE SOLAR BATCH WATER HEATER

This is a 30-gallon water tank mounted in a double, or triple glazed box, fitted with insulated reflective covers.

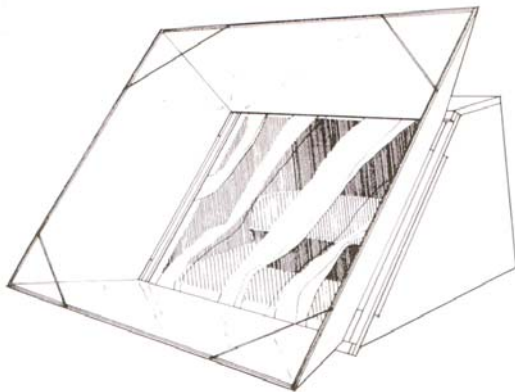
During the day, the covers are opened to let the sun's rays hit the black surface of the tank and heat the water within; at night, the shutters are closed to conserve the heat. The freezing shutters are optional in mild climates, albeit essential where freezing is a danger.

It can be self-made and requires moderate carpentry and plumbing skills. Building it generally costs from US\$300 to US\$400 (installation and plumber's fees included), but cost can be further reduced by obtaining a used water tank in good condition, and by building the insulated heater box of recycled lumber.



The batch water heater saves as much as 25% of water-heating costs in moderate and cold climates, but savings can be further increased by using two (or more) 30-gallon tanks.

FEATURE 4: PASSIVE SOLAR OVEN



Since most cooking can be done in less than 4 hours, the solar oven is well-adapted to the sun's schedule. It is ideal for the slow, crock-pot type of meal that requires slow cooking at relatively low temperatures. Turkey, for instance, will cook as fast in a solar oven as in an electric one.

It is yet another example of the greenhouse effect. Light enters and is transformed into longwave heat. The insulation is designed to hold in this heat and is painted flat black to increase the heat absorptiveness of the oven. Convection and conduction losses are minimised by caulking.

The reflecting panels act like mirrors; when set at a proper angle, they bounce all the light and heat that strikes them into the window opening. This causes a further rise in oven temperature.

The skills required to build this oven are quite moderate. Generally, a solar oven can cost from US\$40 to US\$50, but even less expensive units can be built of cardboard, costing only US\$25.

Without the reflectors, oven temperature will reach 139°C (250F) on a clear, 36°C (65F) on an overcast day. With the reflectors, oven temperatures will reach from 194°C to 222°C (350F to 400F).

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