EcoHaven, An Ecohouse Design

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Located in the center of downtown Toronto is our eco-house, Eco-Haven. The building facilitates both a three bedroom unit for a family of four, and also a flower shop at ground level. On the north end of the house, there is also a roof top garden for the family's enjoyment. The name EcoHaven symbolizes a sustainable home for both plants and a retreat for the occupants.

Green ideas for the Eco-House are not limited to the building but also the relationship with the surroundings. Qualities and the characteristics EcoHaven's surrounding, and regional climate all affects its design. As Toronto is a predominately cold climate region, maintaining heat and protection from the cold is the design's main concern. However, summer heat must not be forgotten. Eco-Haven's design must also be able to deal with the summer heat. To accommodate thermal comfort for both seasons, Eco-Haven's qualities changes throughout the year. Like a blooming flower, it opens up itself to the city during the summer months, and closes up from the cold weather during the winter for hibernation.

The goal of the eco-house design is to reduce energy and resource consumption without compromising on thermal delight or architectural aesthetics. Most of the strategies implemented in EcoHaven are based on basic principles of vernacular architecture, avoiding the use of high tech equipments. After all, this is a private residence and practicality is a concern. With careful planning, most sustainable features can be integrated into the building design, adding character to its appearance. For example, the sunscreens on the south are practical for sun control, yet at the same time add character to the otherwise plain looking brick building.

A three tier approach is set for the design of Eco-Haven[1]:

1. Whenever possible, sustainable strategies are integrated into the basic program and building design

2. Maximize use of natural and renewable energy; take advantage of "free energy", such as solar energy (passive or active)

3. Mechanical systems are in effect only when required. Efficient mechanical equipments and systems that consume minimal energy are installed.

Site surrounding is critical for creating a pleasant microclimate for EcoHaven, since location is permanent, and not much can be modified. Building design is important, but it is more flexible; it can design to accommodate its surroundings. To reduce conserve greenfields, we have chosen to build on a brownfield. The site is situated in a pedestrian friendly area, which is excellent for promoting pollution free mode of transportations such as walking or by bike. It is also relatively close to public transit system. Bike racks and protected walkway is designed to enhance a vehicular free environment. The idea of a weather protection route is inspired from York's Computer Science building design, where a weather proof passage that extends to adjacent buildings is built to promote campus walk[2]. Not only is this idea effective in enhancing a pedestrian environment, by pulling traffic between buildings at ground level (as oppose to underground passages), it really animates the campus as a whole, especially with its large glass facades.

York Computer Science Building
Protected walkway that promotes campus walk

[1] Lechner, Pg.8
[2] http://www.busby.ca/9814york/index.htm

Many of the facilities and resources are shared between the flower shop and residence to minimize energy and resource usage. Building programs are stack to reduce site impact. Busy streetscape is ideal for a store at ground, while privacy and isolation upstairs is perfect as a living headquarter. Programs are arranged depending when its function and time of use in relation to daylight requirement and energy consumption. EcoHaven is divided into zones; systems are only activated when spaces are in use. For instance, heating is lowered upstairs during the day when occupants are in the store. The store is located on the south to maximize day lighting use. Mechanical room requires little light is located on the north where it also becomes a buffer zone on the north end to reduce heat loss from the store. Program organization follows similar criteria as the design Mayo Replacement School, Mayo Yukon. Energy conservation in this project is extremely important due to high fuel and energy cost. Similarly, the school combines different programming to maximize the building usage. The design also attempts achieve its best energy efficiency by use of programmatic zones in relation to mechanical zones[3].

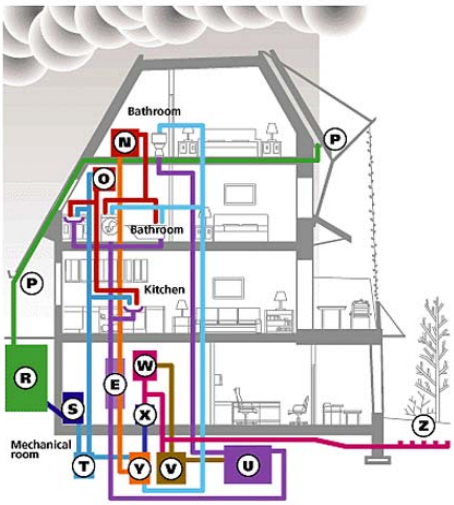
Materials are selected with the concept of resource conservation in mind. Most of the house is constructed of old material, either reuse or salvaged from another site. Reclaiming old material benefits both in resource conservation and in cost. In cases where new material is needed, it should contain high recycle content to reduce wastages and demand for virgin materials. To support regional economy and decrease pollution from transportation, attempt to order materials manufactured regionally. Another alternative is to choose rapidly renewable materials such as bamboo for the interiors. The Princess Street Campus of Red River College, Winnipeg Manitoba is an excellent example that proves the success of

Red River College
Preserving the existing facade

[3] Shawna, Pg 6-7

reusing material. Instead of demolishing the existing building, existing facades are used. Salvaged materials include reclaimed bricks, timbers, glass, millwork and tiles. Approximately 75% of the existing shell was dept, while 10% of the materials are reused[4].

As this is a private residential house, simple yet effective design strategies are used. Although there are many high tech devices for conserving energy, they are often too complex and costly for residential use. CMHC house in Toronto is an excellent design that exemplifies simple yet effective ideas[5]. Similar to the design of the CMHC house, Eco-Haven is self sufficient in providing most of its water usage by means of storm water collection and water purification system. Water efficiency is an important consideration for Eco-Haven since it houses a floral shop and large amount of water is required. An extensive storm and grey water collection system will be efficient for reducing usage of portable water significantly. Storm water is collected with extensive drainages and slanted roofs that are integrated in the design of Eco-Haven. Grey water from laundry, kitchen and shower is collected and filtered for cleaning and watering plants in the shop.



CMHC
Water and Waste Water Management System

Retaining heat is the first step in conserving energy during the winter months. Like a flower, Eco-House closes up in the winter to protect itself from the harsh winter. Using basic principles of vernacular architecture of cold regions, Eco-Haven is designed as a compact unit by stacking programs.

[4] Barhydt, Bedard, Macintosh, Mitchell Pg.7
[5] http://www.cmhc-schl.gc.ca/popup/hhtoronto/water.htm

Reducing surface exposure reduces heat loss by means of convection. Heat escapes mostly through openings such as window where heat resistance is low, thus windows are only placed where necessary either for lighting or ventilation purposes.

Solar gain is a simple and economical strategy for additional heat needed for winter. Solar gain is achieved easily by careful selection of materials, window placement, and spatial arrangement depending on its activities. Thermal mass flooring material is used for absorbing heat during the day and released at night. For maximum light penetration, most of the windows are located on the south side. Where additional heat is required, it is supplied mechanically with Heat Recovery system. HRV system can typically recover 70-80% of heat from exhaust air and reuse it to heat supply air, thus reducing the required energy to heat fresh air to a comfortable temperature[6].

Cooling is achieved mostly by means of shading and ventilation. The overhang above the store is designed so that solar rays are blocked during the summer but penetrated during the winter as the sun angle changes. Exterior screens on the south are adjusted accordingly to season. Maximum ventilation is encouraged during the summer for cooling; the house opens up to draw heat out. The front façade of the store can be opened completely when the weather is warm, inducing maximum ventilation. The center atrium is designed for stack effect drawing heat out Eco Haven through the skylight at the top. The atrium also works effectively as a light well, diffusing light to penetrate into the center of Eco-Haven.

Lighting and solar penetration is controlled with louvers and overhang on the south. East and west of the EcoHaven is shaded by surrounding buildings. The screens act as a second skin that protect the house from direct sunlight, and

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[6] http://oee.nrcan.gc.ca/r-2000/english/public/summ09.cfm?Text=N

as a buffer from harsh winter wind. During the winter months these louvers can be opened completely or partially for desired solar and light penetration. In the summer, they are angled to block direct solar gain, but diffuse light into the house. With the right angle, the screens can also help in inducing wind into the house. This concept of a second skin is adapted the design of the Finnish Embassy in Berlin by the Finnish design group, Viiva Arkkitehtuuri. The giant louvered grilles of the Embassy are constructed from larch strips; these louvers are adjusted throughout the day to control interior lighting conditions[7].

Finnish Embassy in Berlin
Louvers for Solar control

Sustainable ideas for EcoHaven are inspired and collected from various green projects of cold climates. Although selected precedents vary in building type, and their appearance are modern in style, the strategies adapted returns to the fundamental of vernacular architecture. EcoHaven is a building that works with nature, like the plants in the house, it is able to adapt to the changing environment and ultimately become a part of it its environment.

[7] http://www.ark.fi/ark6_99/suomensuureng.html

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