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Highlands, Victoria, BC Canada

A PARTIAL CERTIFIED LIVING BUILDING (October 2010)

Achieved 4 four of the 6 petals (12 of the 16 prerequisites)

“The Greenest Modern Home in the World”

Quote from Jason McLennon, CEO of Cascadia Region Green Building Council

### Features:

- Earthen Architecture: Cob is clay, sand and straw
- First load bearing code approved cob dwelling in North America
- Engineered and fully permitted, completed Dec. 2008 – 20 months to complete
- Mass wall system insulated with locally mined pumice. Estimated R-20
  - Roof insulation: R-40 (formaldehyde free fibreglass insulation)
  - floor insulation: R-12.5 (rigid styrofoam)
- Many interior walls constructed with light clay infill
- Passive solar design; window overhangs, natural chimney, natural lighting, light tubes, opening windows, high efficiency fiberglass frame windows, selective window glazing. No windows on north wall. Deciduous plants on west exposure.
- 2 kW solar array with grid tie to BC hydro.
  - Produced 2470 kWh in first year of monitoring (02/01/08 - 01/31/09)
  - Used 2154 kWh during this period
  - sold 315kWh back to the grid. NET ZERO electricity
- 60 solar evacuated tubes for heating hot water - unique energy efficient design
  - for hydronic in floor space heating
  - for potable domestic use
- Wood gasification wood stove for winter heating - 85% efficient
- Living roof custom design with less manufactured materials (EPDM, armtec 400, perlite, filter cloth, pumice, leaf mulch, native plants and creeping thyme)
  - benefits: beauty, quiet, fire resistant, sound insulation, increase roof r-value, habitat replacement, storm water management, mini-watershed for water filtration, reduce roof temperature thereby increases solar PV production
- Rain water harvesting: 10,000 Gal (37,854 litres) for irrigation of food gardens
- Domestic indoor water comes from an existing well on site.
  - Water conservation: no flush toilets; low flow fixtures; no bathtubs
  - Early water usage data is about 40 litres/person/day (only 2 weeks of data)
  - Average BC usage is 490 litres/person/day

- Resource recovery:
  - Grey water: filtration of organic solids into worm castings
  - Water re-used for fruit/nut tree irrigation
  - Composting odorless toilet (no water). Based on the Humanure system.
    - Compost is tested after 2 years for bacterial pathogens and is safe to use in the food garden. Testing in 2009.
- Earthen floors, earthen counters, natural plasters, natural milk paints
  - No VOC's
  - No toxic off gassing
- Energy Efficiency: wired for 24vDC and 110vAC. Workshop also has 240vAC
  - LED lighting
  - DC appliances (2 fridges and one shared freezer)
  - HE front loading shared washer, drying room in mechanical room, clothes line, no kitchen appliances
  - DC brushless fans for bathroom ventilation and range hoods
  - bedrooms have master AC switch to turn off power
  - No phantom loads
  - No cordless phones
  - laptops, small stereos/radios, parents have small TV
- Propane cook stoves in both kitchens
  - Family cooks food from scratch and eats mostly local with food gardens providing much of the family's food. Chickens for eggs and meat.
  - Cob cold storage for root cellar
- High flyash concrete – reduces carbon footprint
- Recycled materials
  - 80% of wood
  - Most plumbing and lighting fixtures
- Exterior lime plaster – almost carbon neutral, used iron oxides for pigments
- Lower cob wall built by hand in 7 weeks with two people
  - Cob and floors mixed with rototiller using 25 litres of gas
  - House materials: 90 yards sand, 90 yards clay, 100 bales of local straw, 40 yards pumice.
- Integrated systems design: house, land, water, energy, and lifestyle
- Multigenerational family home for 6 (includes one level suite for parents with pass through between the two kitchens)

### **Benefits of earthen architecture:**

- Extended life span – cob is about 500 years
- Small carbon footprint – embodied energy in the materials is very low
- Almost fireproof
- Non-toxic - healthy indoor air quality
- No vapour barriers required in walls – limited manufactured materials
- Natural humidity control with NO mold growth
- Greater stimulus to local economy due to higher percentage of labour to materials cost than conventional construction
- Resiliency – Value added premium for energy, water, fire, storm, food security

**Affordability - Cob House Expenses:** 2500ft<sup>2</sup> outside 2150ft<sup>2</sup> inside  
Includes suite for parents – total 5 bedroom, 2 bath, 2 kitchen

<u>Section</u>	<u>Total</u>	<u>Notes</u>	<u>\$/ft2</u>	<u>% of total</u>
Infrastructure	6,572	not including septic system completion	2.63	1.8%
Foundation	7,277		2.91	2.0%
house wiring	19,576	ac and dc	7.83	5.3%
house plumbing	9,011		3.60	2.4%
structure	51,762	includes \$3729 for 42 yards of pumice	20.70	14.0%
finishing	44,584	includes \$14,932 for appliances	17.83	12.0%
living roof	12,994	a bit more to come	5.20	3.5%
Communications	1,464	running wires for phone/internet/ etc	0.59	0.4%
Solar Electrical	45,016	Includes grid intertie	18.01	12.1%
Heating and hot water	34,778	Hydronic heating, tubes, boiler, etc	13.91	9.4%
Water system	11,714	storage tanks, pumps, irrigation, etc	4.69	3.2%
Professional	9,712	Engineer, CAD plans, permits, HPO	3.88	2.6%
Hired Labour	14,575		5.83	3.9%
Our Labour	101,600	20 months	40.64	27.4%
<b>TOTALS</b>	<b>370,635</b>		<b>148.25</b>	<b>100.0%</b>

**Energy:**

- Net Zero Electricity; No monthly energy bills; net annual supplier to BC Hydro
- Total energy **estimates** from all sources used per ft<sup>2</sup> = 9.99 kWhrs/ft<sup>2</sup> (based on outside square footage of 2500ft<sup>2</sup>) **Breakdown:**
  - wood gasification 16705 kWhrs = 6.682 kWhrs/ft<sup>2</sup>
  - Solar thermal collection 4238 kWhrs = 1.70 kWhrs/ft<sup>2</sup>
  - Electricity 2154 kWhrs = 0.84 kWhrs/ft<sup>2</sup>
  - Cooking Propane (biogas in future) 1901 kWhrs = 0.76 kWhrs/ft<sup>2</sup>
- Based on Natural Resources Canada (NRCAN) National Energy Use Database:
  - BC average: 15.48 kWhr/ft<sup>2</sup> Eco-Sense: 9.99 kWhr/ft<sup>2</sup>
  - Per Person Data: BC: 5.53 kWhr/ft<sup>2</sup>/person Eco-Sense: 1.67 kWhr/ft<sup>2</sup>/person

