Sustainable commercial buildings

Engineering

The paper " Sustainable Commercial Buildings" is a perfect example of an assignment on engineering and construction.

Name of the Building and locationSustainability factorsBeddington Zero Energy Development (BedZED)UKBeaufort Court renewable energy center zero emissions buildingKings Langley, UKMEC - Mountain Equipment Co-opMontreal, QuebecTOHU, la Cite des arts du cirque / Circus ArtsMontreal, QuebecGovernment of Canada BuildingYellowknife, Northwest TerritoriesEnergy EfficiencyExtensive insulation used over walls, roofs, and floors; Natural ventilation with heat recovery from roof cowls was preferredUse of passive solar techniques, high insulation, daylight, natural ventilation, solar control, recycled materials for maximum sustainability as well as active systems like artificial cooling, mechanical ventilation was also usedInsulation from radiant piping within the concrete slabs linked to a system of geothermal wells provides heating and cooling to the building. The building’s energy consumption is 50% less than that compared to regular buildings.

- A reduction in energy consumption by about 55% over ASHRAE 90. 1
- Energy consumption has been reduced by approximately 45% through the high-efficiency glass, fluorescent lighting, optimum use of natural daylight through glass walls and opaque transoms, roof overhangs, exterior window shades, and deciduous trees to act as sun-shading devices to reduce heat gain, and a Green Roof for additional insulation.
- A low energy consumption heat pump enabled savings of around $1, 670 /year in energy costs.

- High output T5 lighting. High-efficiency indirect lighting provides superior light quality and daylight integration while minimizing lighting energy use. Anticipated lighting power density is 0. 5 Watts/sq. foot in conjunction with limited and specific task lighting (budget 0. 2 W/SF).
- Controlled lighting, heating and cooling systems like Shallow floor plates to maximize daylight penetration
- Continuously dimming daylight control.
- Opaque wall and roof insulation values optimized for economic return relative to overall building performance and cost as well as occupant comfort; effective R20 walls and R35 roof
- A compartmentalized four-pipe and two-pipe fan coil system with underfloor delivery provides superior indoor air quality, occupant comfort, and occupant control while providing a superior overall level of energy efficiency through the elimination of reheat.

Use of recycled materialsRecycled materials from demolished buildings were usedMajority of the old building was reusedThe building’s roof and walls were filled with cellulose fibre obtained from recycled newsprintBuilt from 99% of the original building’s materials. Recycled building materials that provide durability, performance, low embodied energy, and non-toxic were usedUse of safe alternative materials Concrete floor slabs are used for insulating the building. The concrete was also produced with lower energy due to the presence of a 27% slag. Solar tubes harness solar energy for base heating for the building, thermal energy in stormwater helps to heat or cool the building. Solar domestic hot water heating, High-efficiency condensing boilers, Variable speed drives, and high-efficiency motorsWaste

management Most of the dirt, rock, and rubble from the excavation is reused for backfill or berming. Water ManagementReduced domestic water consumption by water-saving toilets, smaller flush tanks, and taps and showers with flow restrictors Stormwater retention in an underground cistern to provide water for landscape irrigation and in toilets.

- Reduction in site water use by approximately 90% (2 million liters/year)
- a reduction in building water usage by over 20%
- A green roof was built for stormwater management that resembles the natural water cycle. The collected stormwater is also used to irrigate the landscape. Waterless urinals and low flow faucets, a stormwater storage tank that stores water for toilets and car wash are some of the methods adopted for reducing the burden on municipal water. These water conservation features reduced site water use by 90% (2 million liters/year) and building water usage by over 20%.

Reduction of stormwater run-off from the site through the increased use of pervious pavements, landscaping and a green roof thereby reducing the quantity of stormwater requiring treatmentBiodiversity Extensive landscaping Asphalt paving was replaced by natural landscaping. A parking space landscaped which also allows rainwater collection, filtering of contamination, groundwater recharge and supports wildlife and plants was developedTransport energy managementUse of local materials obtained from within 35 miles from the building site; Carpool schemes and use of electric vehiclesSalvaged and local materials were extensively used. Local materials were used. Embodied energyThe building has its own heat and

power unit with a capacity of 130kw of electricity. A combustion engine generates heat and power of 350000kw of electricity per year.

- Majority of the old building was reused
- Use of passive solar techniques, high insulation, daylight, natural ventilation, solar control, recycled materials for maximum sustainabilitySeasonal heat store for heating
- A biomass crop cultivated in the neighborhood
- Provision for groundwater cooling in summer
- 225kw Wind turbine that supplements power supply for the building
- 54m2 of PV/thermal array and 116m2 of solar thermal panels for electricity and hot water generation
- underground heat store in 1100m3 of the water body

Geothermal energy, radiant heating, and cooling systems, and natural ventilation systems were adopted

- Optimization of the building footprint, orientation, and massing. A novel triangular shape which maximizes daylighting within the constraints of the site while using an atrium to reduce the net effective perimeter area
- Reduced embodied energy due to the preferred use of material with recycle content/ salvaged material/ from local/regional areas

Minimization of pollutionMaterials containing VOCs (volatile organic compounds) have not been used at all A new type of concrete was used to reduce CO2 emissionsIndoor Environmental Quality (IEQ) interior materials, mechanical systems, and Noise systems are usedOthers

- Favorable site location and layout

Efficient building envelope: multi-pane high-performance glazing (clear triple pane, two spectrally-selective AFG Ti-R Low-E coatings) with fiberglass frames for the punched window sections and clear 4-element Vision Wall framing for the atrium south face.