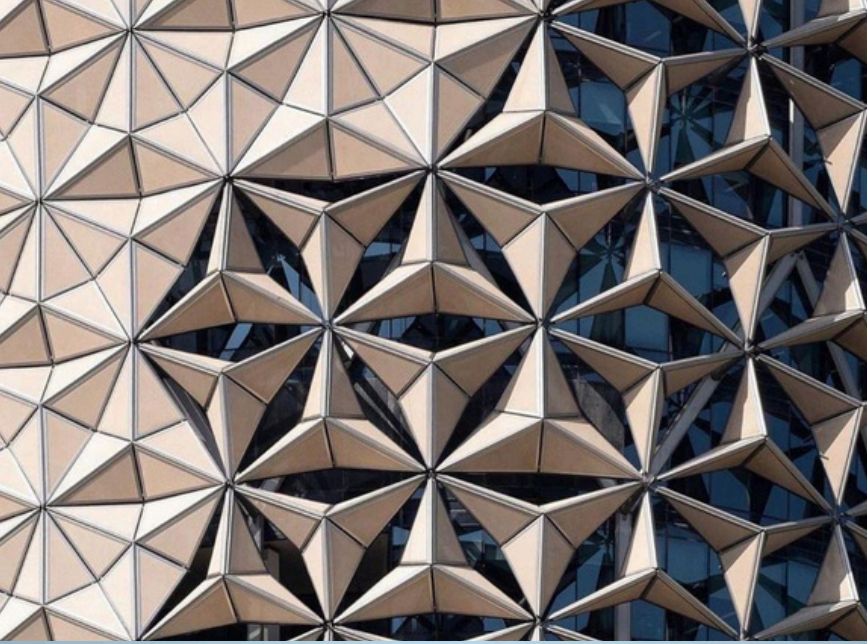




Sustainable Design Approach

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PROJECT 4
TEAM 13



HEMP INSULATION

Hemp Insulation is used to enhance the building's quality and interior comfort while limiting the environmental impact of its construction.

Commonly grown accross Canada, hemp can be turned into batt insulation which then can be used in wood and steel construction.



WHAT IS HEMP?

Hemp is a fast-growing plant part of the *Cannabis sativa* botanical class. It is used to make a wide variety of consumable and industrial products.



PROS OF HEMP INSULATION

- Fire resistant
- High energy efficiency
- Non-toxic
- Renewable and recyclable

THIS IS OUR MAIN SUSTAINABLE FEATURE

WHAT DO WE WANT TO FOCUS ON?

HEMP INSULATION

Hemp is a plant of the family Cannabaceae. It is often mistaken for cannabis/marijuana since they derive from the same family, however hemp is a cannabis sativa and it has characteristics that separates itself from its sister plant. At first glance you might not notice it, but hemp is taller and it has skinnier leaves.

Also, hemp contains significantly lower THC (Tetrahydrocannabinol) content but a higher CBD (Cannabidiol) content compared to cannabis. Hemp contains less than 0.3% of THC, while cannabis has a THC content of 5-20%.

Hemp-based products in construction are an excellent alternative to make your building more sustainable. Hemp is also commonly grown across Canada which makes it local and accessible. Alberta, Saskatchewan as well as Manitoba are among the top provinces that grow hemp. There are different products in the industry such as hempcrete which is a bio-composite made of lime and the inner core of the hemp plant. There are hemp insulation panels, hemp fibre insulation and hemp fibre fill as well.

If we focus on a local company here in Quebec called Nature Fibres, they offer many selections of hemp products, but their hemp batt insulation is perfect to enhance the building's quality and interior comfort while limiting the environmental impact of its construction.

Their product named "ProfibMat" is a hemp fibre thermal batt insulation that can be used both in wood and steel construction. In their technical data sheet, it describes that the product can be suitable for exterior walls, ceilings, attics, attics and roof trusses as well as interior walls (soundproofing). It is composed of 92% hemp fibre as well as 8% polyester fibre.

DEALING WITH LATERAL LOADS

Hemp fiber insulation is not designed to be structural, but it is designed to be a thermal and an acoustic insulation. Given it is soft and compressible, it does not offer the stiffness and support that a building needs. However, if you use hempcrete, it can be used for infill in timber stud walls. Although its name resembles concrete, it can't replace concrete, due to its low compressive strength.

ALLOWING FOR THERMAL MOVEMENT AND CONSTRUCTION TOLERANCES

Since hemp fiber insulation is semi-rigid and flexible, this allows the structure to expand or contract without doing drastic changes to the insulation. Unlike rigid foam insulation which can crack or deform.

THIS IS OUR MAIN SUSTAINABLE FEATURE

MINIMIZING HEAT LOSS & LIMITING CONDENSATION

The Profib Mat minimizes heat loss in the building envelope in many different ways. It has an R-Value around 3.5/inch which is similar to fiberglass or mineral wool. This product also describes its ability to regulate humidity (hygroscopic potential) and its ability to slow down heat transfer. A material having hygroscopic potential means that it has the ability to absorb and hold water from the surrounding air or environment without losing insulating power. This also helps limit condensation which will reduce the risk of mold growth. This is one of its primary benefits compared to traditional insulations like fiberglass or foam. The insulation being packed tightly between studs, rafters or joists also minimizes air leakage within the building envelope which is one of the main contributors of heat loss.

ProfibMat offers several performance benefits. In terms of thermal efficiency, it has an R-value of approximately 3.5 per inch, which is comparable to traditional insulations like fiberglass or mineral wool. Its hygroscopic properties allow it to regulate humidity by absorbing moisture from the air without losing its insulating power. This feature helps reduce condensation and prevents mold growth.

preventing air infiltration + water infiltration

The insulation being tightly fit between the structural members minimizes the air gaps within the building envelope. This prevents air leakage from occurring. The hemp fibres make this product dense which helps reduce internal air movement within the insulation itself and it improves thermal performance. The permeability rate of this product is 9.58 or 547.85ng/(Pa.s.m²). Its Hygroscopic properties help with controlling moisture without damaging itself. It also deals with humidity by having a good vapor permeability so it prevents water vapor from condensing into liquid.

OTHER ISSUES LIKE FIRE RESISTANCE, ACOUSTICS, HEALTH AND SAFETY, ETC.

Fire resistance → FSI 255 SDI 30, FSI (Flame Spread Index) SDI (Smoke Developed Index)

Although this product is classified as a material that burns quickly, it produces little smoke which is a positive aspect when it comes to occupant safety. The product should not be left exposed and should be put behind fire-rated barriers.

Acoustics → It is considered a high performance acoustic insulation.

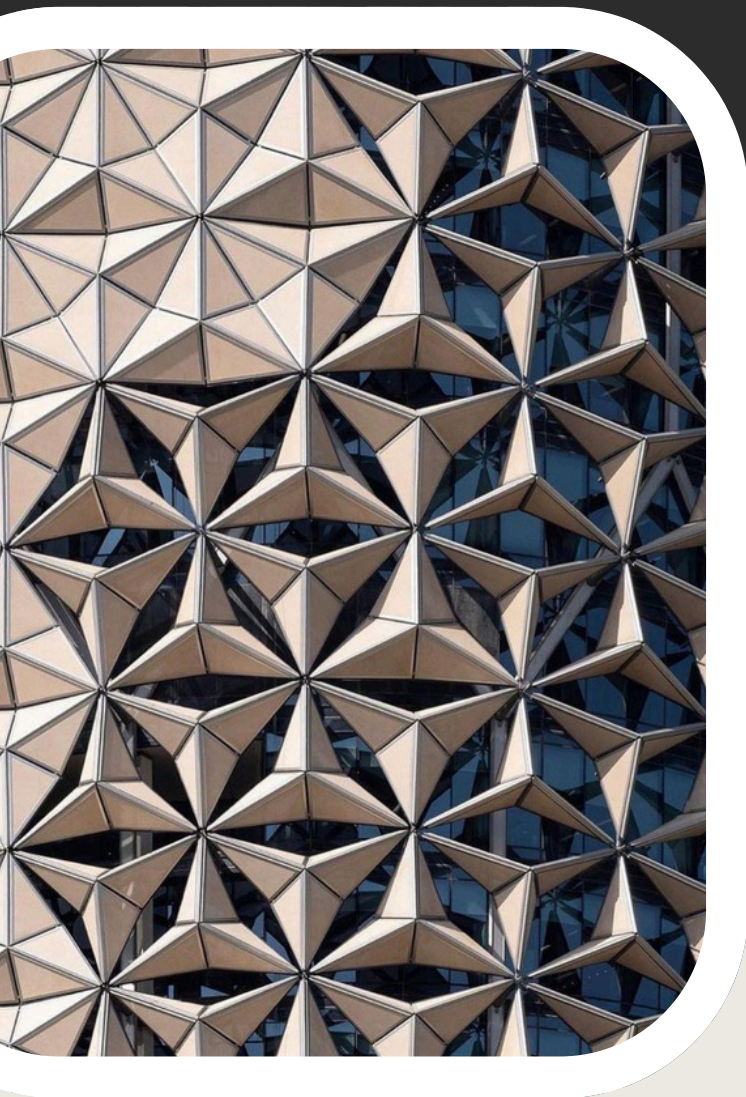
This product does not contain any VOCs (volatile organic compounds). This makes it furthermore non-toxic, non-irritating and non-abrasive. Makes the product easier to manipulate as well.

INNOVATIVE FEATURES OR QUALITIES OF THE PRODUCT

Hemp fiber insulation comes with many other features that make it stand out as a product.

- contributes to green building credits such as LEED for environmental impact, ingredients and emissions.

- It is a low-carbon building material. 0.68 kg CO₂ eq (1 RSI) To put into perspective, its carbon footprint is considerably low compared to other types of insulations.



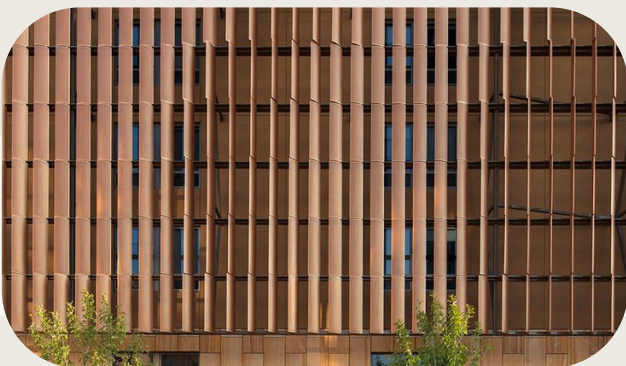
KINETIC FACADES

Enhances a building's performance and overall aesthetics. Due to its wide variety of possible system components, it is also known for its natural light optimization, regulation of solar heat gain, and ventilation improvement.



WHAT ARE KINETIC FACADES?

Dynamic architectural systems part of the building envelope that have the ability to move or transform depending on the chosen stimuli which can be sunlight, wind, temperature or user interaction.



PROS OF KINETIC FACADES

- Energy Efficient
- Increases comfort
- Provide natural lighting
- Aesthetically pleasing

THESE ARE OUR OTHER SUSTAINABLE FEATURES



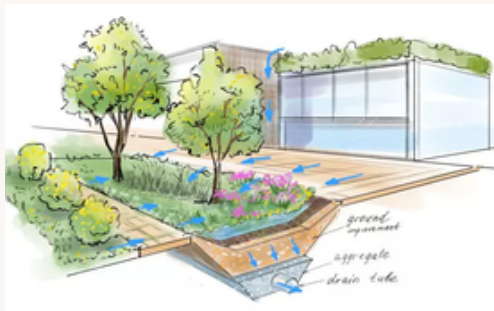
Low Flow Plumbing Fixtures

Low-flow plumbing fixtures are water-saving devices designed to reduce water consumption while maintaining performance, including toilets, faucets, and showerheads.



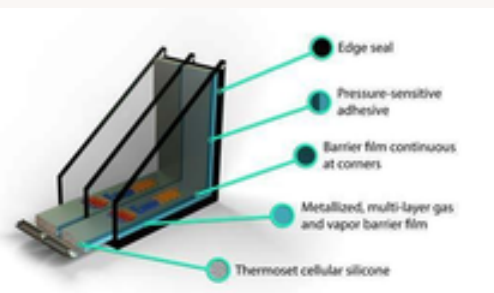
Green Roof

Can mitigate the heat island effect, reducing stormwater runoff, and lowering building energy consumption. They improve air quality, provide biodiversity habitats, and extend roof lifespans. While offering significant ecological benefits, they require high upfront costs, specialized structural support, and ongoing maintenance.



Stormwater Management

Building infrastructure that treats, retains, and infiltrates rain where it falls, reducing runoff pollution and flood risks compared to traditional pipe-and-drain methods. By mimicking natural hydrology through techniques like permeable paving and rain gardens, it protects water quality, recharges groundwater, and increases urban resilience.



Windows and Curtain Walls

Double or triple glazing, Low-E (low-emissivity) coatings, and sustainable frame materials like fiberglass, vinyl, or wood. Eco-friendly, energy-efficient, and durable windows are designed to reduce carbon footprints and energy bills by 15–55% through superior insulation.



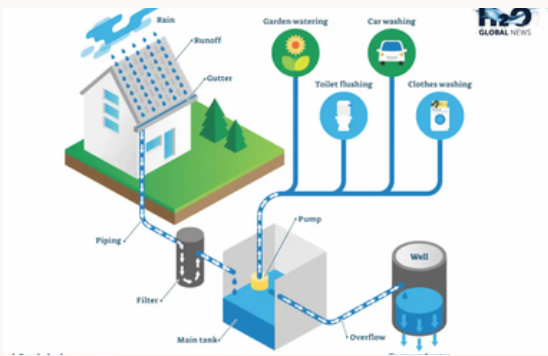
Reflective Window Film

Enhances energy efficiency through high solar reflectance, which reduces cooling loads in warm climates. They often feature low-emissivity (Low-E) coatings, double/triple glazing, and sustainable materials to minimize environmental impact and improve insulation. These systems contribute to LEED certifications by controlling solar gain and allowing natural light, decreasing reliance on HVAC and artificial lighting. It also allows for more privacy for occupants.



Skylights and Curtain Walls

Improve energy efficiency by maximizing natural daylight by reducing artificial lighting needs by up to 70–80%. Modern eco-friendly options feature high-performance glazing, recycled aluminum/PVC materials, and ENERGY STAR certification.



Rainwater Collection

Helps preserve our natural water sources. By collecting rainwater, we ease the demand on rivers and wells, ensuring these vital resources stick around for the long haul. This conservation is a big win for our ecosystems and the balance of our natural world. Common uses include lawn and garden watering, greenhouse irrigation, and indoor toilet and urinal flushing.



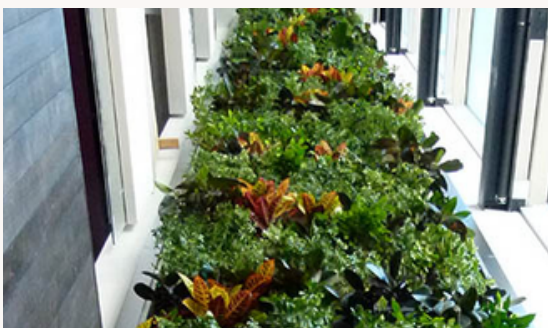
Linoleum Finish

A popular sustainable flooring choice, combining durability and modern aesthetics. With its roots in natural, renewable materials, linoleum offers numerous environmental benefits for those looking to reduce the ecological impact of their flooring options. It's rapidly renewable natural content, resilience, as well as its non allergenic properties make it a superior flooring choice. An excellent choice in schools and healthcare facilities.



Cork Finish

A highly sustainable material because it is made from the renewable bark of cork oak trees, which are harvested every 9–14 years without killing the tree. The material is carbon-negative, recyclable, and biodegradable, and . It is also durable, lightweight, antimicrobial, and hypoallergenic, making it a low-maintenance, eco-friendly choice for interiors. +Soundproofing properties.



Living Wall and Replanting Trees

Enhancing energy efficiency through natural insulation, reducing urban heat islands, and improving air quality by filtering pollutants. Re-planting trees is sustainable because it restores ecosystems, sequesters atmospheric carbon dioxide to combat climate change, and boosts biodiversity. Trees act as natural carbon sinks, storing carbon for centuries while preventing soil erosion and improving air/water quality.



The Wildlife Conservation Challenge

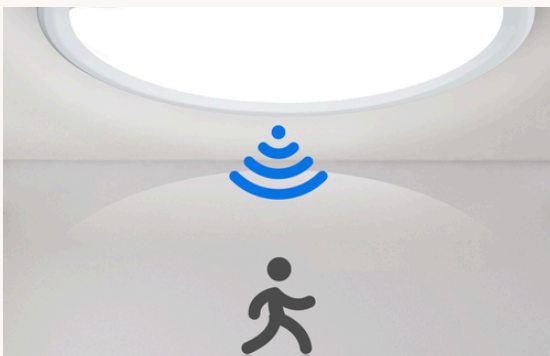
The Vanier College Student Housing project is situated within the habitat of multiple species. In order to reduce the harm caused to these native species, this project will focus on maintaining the existing ecological balance as closely as possible. Some preservation measures will include:

- Identifying existing habitats through a thorough site assessment before construction begins
- Using native plants for landscaping
- Implementing low-impact construction methods to reduce disturbances to nearby species
- Incorporating safe passageways for native wildlife within the landscaping
- Replanting every tree removed on-site and planting additional trees
- Integrating wildlife habitats for birds and insects into the green roof design



Green House and Bees

The green house will serve as a community garden, but it will also serve as a pollinating ground and housing for bees. This will allow year-round plant growth, protection from pests and weather and a controlled growing environment. This will contribute to the protection of bee habitats. Bumblebees are known to thrive in greenhouses.



Motion Sensor Lights

All public spaces will be equipped with motion sensors which will turn lights on whenever movement is detected in order to save energy. These lights also reduce the light pollution and overall carbon emissions.



Pre-Built Sustainable Furniture

All furniture in this project will be sourced from local, sustainable Canadian suppliers. The focus will be on selecting furniture made from recycled and environmentally responsible materials. The same level of attention will be given to textile products, such as carpets.



This was our

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