

Retrofitting Buildings

– a phase and a fad, or a genuine opportunity for the future?

What is Retrofitting? It's important to establish what retrofitting buildings means.

Retrofitting is the process of upgrading or modifying an existing building to improve its performance, functionality, and efficiency. This can include improving insulation, upgrading mechanical systems, and installing new windows or lighting.

Retrofitting is necessary because many buildings were constructed before modern energy codes and standards existed, resulting in high energy consumption and increased environmental impact.



The importance of Solar Shading.

Retrofitting is not the same as renovation or refurbishment, it is the process of upgrading existing buildings to make them more energy-efficient, sustainable, and cost-effective.

It involves modifying the building's systems, such as lighting, heating, and cooling, to reduce energy consumption and carbon emissions. Retrofitting is crucial because buildings account for nearly 40% of global energy consumption and carbon emissions.

By retrofitting existing buildings, we can significantly reduce our carbon footprint and help create a more sustainable future for generations to come. From a fad to a future-focus: retrofitting buildings is the next step in sustainable construction, and an opportunity to create more energy-efficient environment.

By retrofitting buildings, we can:

- Reduce energy consumption
- Shrink greenhouse gas emissions
- Lower operating costs
- Improve occupant comfort and health.

It is a critical step towards creating sustainable and resilient communities.



Benefits of Retrofitting

Retrofitting buildings can have a significant impact on energy efficiency, resulting in reduced energy consumption and lower utility bills. In fact, retrofitting commercial buildings alone could save £46 billion (\$60 billion) in energy costs over the next decade.

In addition to cost savings, retrofitting also has a positive environmental impact. Studies have shown that retrofitting buildings can reduce greenhouse gas emissions by up to 30%.

Challenges of Retrofitting

One of the biggest challenges of retrofitting buildings is the cost. Many building owners are hesitant to invest in retrofitting projects because of the upfront expense. However, it's important to consider the long-term cost savings that come with increased energy efficiency and reduced maintenance needs. One solution to this challenge is to explore financing options, such as low-interest loans or grants, that can help offset the initial costs.

Another challenge is the complexity of retrofitting projects. Each building is unique and requires a tailored approach to address its specific needs. This can make planning and execution more difficult and time-consuming. To overcome this challenge, it's important to work with experienced professionals who have expertise in retrofitting projects.

They can help identify areas of improvement and develop a comprehensive plan to ensure success.

Case Studies

One case study of a successful retrofitting project is the Empire State Building in New York City. The building underwent a £420 (\$550) million retrofitting process that included upgrading the heating and cooling systems, installing energy-efficient lighting, and adding insulation. As a result, the building's energy consumption was reduced by 38%, saving £3.4 (\$4.4) million annually on energy costs.

Another example is the Bullitt Center in Seattle, which is considered the greenest commercial building in the world. The building features solar panels, rainwater harvesting, and composting toilets, among other sustainable features. The retrofitting process involved replacing the existing building with a new one that was designed to meet the Living Building Challenge, a rigorous certification for sustainable buildings.



Another example is the Bullitt Center in Seattle, which is considered the greenest commercial building in the world. The building features solar panels, rainwater harvesting, and composting toilets, among other sustainable features. The retrofitting process involved replacing the existing building with a new one that was designed to meet the Living Building Challenge, a rigorous certification for sustainable buildings.



Shade Your Way to Energy Efficiency: The Importance of External Solar Shading for Retrofitting Buildings

Energy efficiency is becoming increasingly important in today's world, and retrofitting existing buildings is one way to achieve this goal. However, retrofitting can be challenging, and that's where external solar shading comes in. External solar shading is an effective way to improve the energy efficiency of buildings, and it has many other benefits as well. It can help to reduce glare and heat gain, improve occupant comfort, and enhance the aesthetics of the building.

The Problem with Retrofitting

Retrofitting buildings can be a daunting task, especially when it comes to improving energy efficiency and comfort. In many cases, older buildings were not designed with these factors in mind, which can make it difficult to achieve the desired outcomes.

One of the biggest challenges of retrofitting is balancing energy efficiency with occupant comfort. For example, adding insulation to a building can help reduce energy consumption, but it may also make the building too warm or too cold for occupants. Similarly, sealing air leaks can improve energy efficiency, but it can also lead to poor indoor air quality if ventilation is not properly addressed.

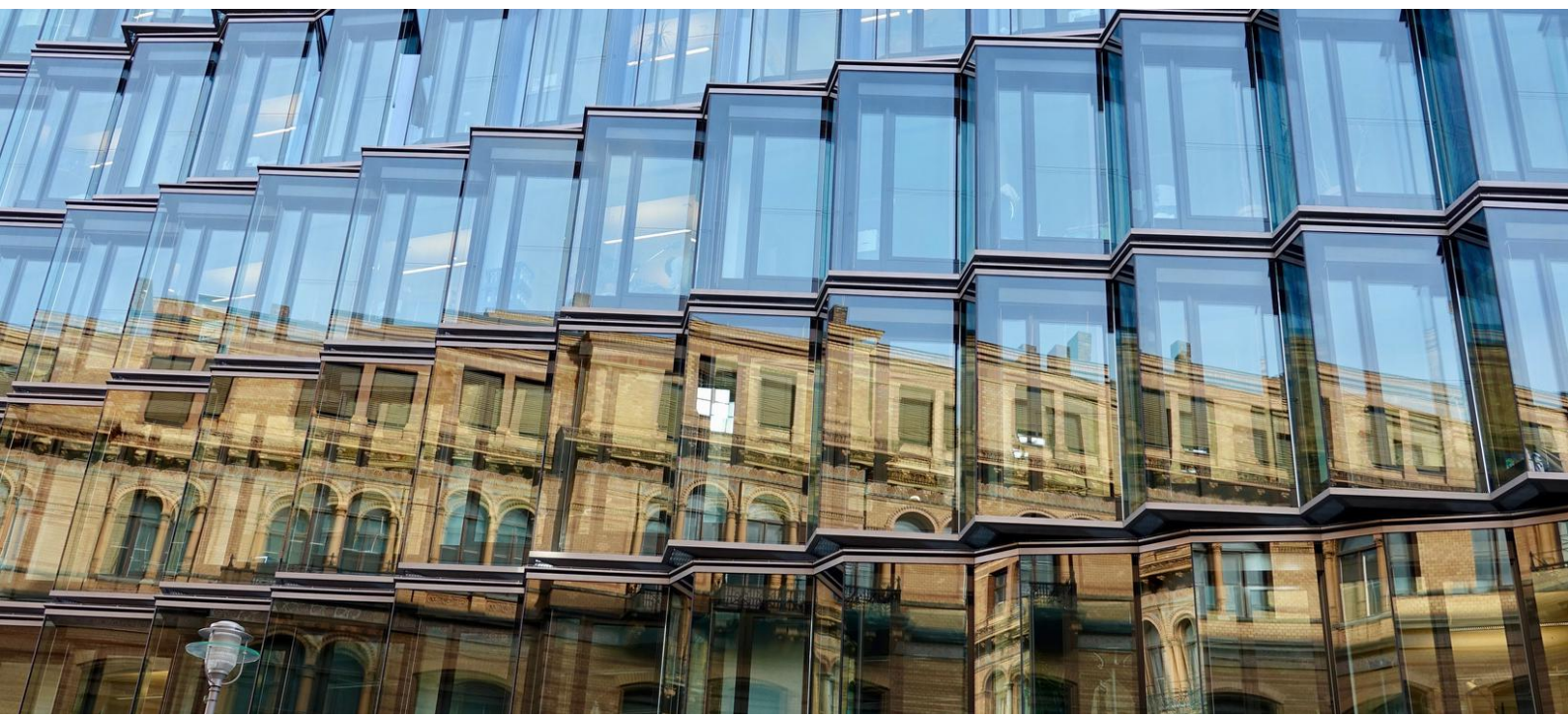
The Benefits of External Solar Shading

External solar shading is a highly effective way to improve the energy efficiency of buildings, particularly those that are being retrofitted. By reducing the amount of solar radiation that enters a building through windows, external shading can significantly reduce cooling loads and improve indoor comfort levels.

This can result in lower energy bills, improved occupant satisfaction, and increased productivity.

In addition to its energy-saving benefits, external solar shading can also enhance the aesthetic appeal of a building. With a wide range of materials, colours, and designs available, it is possible to create shading systems that are both functional and visually appealing.

From sleek, modern designs to traditional, ornate styles, there is a solution to suit every building and budget.



Types of External Solar Shading

External solar shading comes in two main types: fixed and adjustable systems. Fixed systems are typically made up of horizontal or vertical louvers that are positioned at a fixed angle to provide shade and reduce glare. These systems are best suited for buildings with a consistent orientation and predictable solar angles. Adjustable systems, on the other hand, use movable louvers or blinds that can be adjusted to control the amount of sunlight and heat entering the building. These systems are more versatile and can be used on buildings with varying orientations and solar angles.

Both fixed and adjustable external solar shading systems can be used in retrofitting projects to improve energy efficiency and comfort. Fixed systems are often used on buildings with a consistent orientation and can be designed to complement the building's architecture. Adjustable systems are more versatile and can be used on buildings with varying orientations and solar angles. They can also be integrated with building automation systems to automatically adjust the shading based on the time of day and weather conditions.

There is an even more versatile and effective way to create and maintain an effective and consistent internal temperature all year round and it has the vastly important benefit of not using any non-recyclable components, will last for decades at full efficacy, and be fully, 100%, recyclable at the end of its life. KoolShade® is quite simply, the best of all worlds.



A result of decades of extensive international research and development, KoolShade® is a high-performance, woven metal fabric, with its weft constructed of bronze louvres. It can be used in its fabric form or tensioned in a frame, for controlling and diffusing sun, light and air.

The micro-fine louvres are angled to suit a number of applications, whether to ensure optimum light in or redirect light, whilst blocking heat and glare, or to allow ventilation and filtration of air.

The key benefits for retrofitting KoolShade® are:

- 100% Heat Block
- Full Vision Out
- Sustainable
- Maintenance Free
- Allows Ventilation
- Easy To Install

And for occupants:

- Daylight
- Emotional Wellbeing
- Beautiful Sunny Views
- Vitamin D
- Physical Health



Design Considerations

When designing external solar shading systems for retrofitting buildings, there are several important considerations to keep in mind.

One of the most critical factors is orientation. The shading system should be designed to block direct sunlight during the hottest parts of the day at a minimum, while still allowing natural light to enter the building.

This requires analysis of the building's location and orientation, as well as the angle of the sun at different times of day and year.

Another key consideration is the shading coefficient of the system. This refers to the amount of solar heat gain that is blocked by the shading system. A lower shading coefficient means that more solar heat gain is allowed into the building, which can be beneficial in colder climates but can lead to overheating in warmer areas. The shading coefficient should be carefully selected based on the climate and location of the building.

With the increasing demand for sustainable buildings, external solar shading should be considered as an essential element in any retrofitting project.

As we all know, the environment is facing a number of challenges, from climate change to resource depletion. However, there are solutions out there that can help us tackle these issues head-on. One such solution is passive, external solar shading.

External Solar Shading

External solar shading is a simple but effective way to reduce energy consumption in buildings while improving indoor comfort. By blocking the sun's rays before they reach the building envelope, external shading devices prevent excess heat gain and reduce the need for air conditioning.

This not only saves energy but also reduces greenhouse gas emissions and lowers utility bills.

In addition to its energy-saving benefits, external shading can also enhance the visual appeal of a building and provide privacy for occupants. For example, horizontal louvers can be used to create an interesting pattern on the facade while still allowing natural light to filter through.



Passive Solar Shading

Passive solar shading refers to a design theory that uses strategies to control the amount of sunlight that enters a building.

This can include features such as overhangs, awnings, and louvers, which are strategically placed to block direct sunlight and the heat that that generates.

By reducing the amount of solar radiation that enters a building, passive solar shading helps to maintain a comfortable indoor temperature and reduce the need for energy-intensive cooling systems.

Passive solar shading works by using the physical properties of light and heat to regulate the temperature inside a building. When sunlight enters a space, it heats up the air and surfaces inside, causing the temperature to rise. By blocking or redirecting this sunlight, passive solar shading helps to keep the interior cool and comfortable. This strategy is particularly effective in hot climates, where excessive heat gain can be a major problem.

Being passive means it has no moving parts or requirement for energy consumption to operate.

The Importance of Sustainable Design

Sustainable design is not just a buzzword, it is a necessity for the future of our planet. According to the United Nations, buildings and construction account for 39% of global energy-related carbon dioxide emissions. By incorporating sustainable design practices, we can significantly reduce this number and work towards a more sustainable future.

In addition to reducing carbon emissions, sustainable design also has numerous benefits such as improving indoor air quality, reducing operating costs, and increasing property values. It's not just good for the environment, it's good for business too. By investing in sustainable design, we are investing in our future.

Global Environmental Sustainability

Passive solar shading is a simple yet effective way to reduce energy consumption and improve indoor comfort while also contributing to global environmental sustainability.

By using shading devices such as KoolShade® the exterior of buildings, we can block direct sunlight from entering the building in the summer, reducing the need for air conditioning. In the winter, when the sun is lower in the sky, they can be removed to provide natural warmth, reducing the need for heating.



Small changes like implementing passive solar shading can have a significant impact on the environment. According to the Department of Energy, buildings account for 39% of total U.S. energy consumption and 38% of carbon dioxide emissions. By reducing energy consumption in buildings through passive solar shading, we can help to mitigate climate change and create a more sustainable future for ourselves and future generations.

Success stories of building retrofitting projects in the UK (and a couple of outstanding examples further afield).

Although retrofitting presents challenges such as cost and complexity, there are solutions and strategies available to overcome these obstacles.

By learning from successful case studies and collaborating with experts in the field, we can make retrofitting projects more feasible and effective.

The benefits of building retrofitting, challenges faced by the industry, funding options available, and the role of architects, engineers, and building occupants in these projects is valuable to study.

We will delve into case studies of successful retrofitting projects and explore the future of this industry.

Case study 1: The Crystal

The Crystal is a prime example of successful building retrofitting due to its innovative design and energy-efficient features. Located in London, this sustainable building was retrofitted to achieve the highest level of environmental certification, LEED Platinum.



The retrofitting process involved the installation of a range of energy-saving technologies, such as solar panels, rainwater harvesting systems, and a ground source heat pump. The building also features an intelligent building management system that monitors and controls energy use, ensuring maximum efficiency.

Case study 2: The University of Bradford

The University of Bradford is a prime example of successful building retrofitting. The project involved the refurbishment of two buildings, which were originally constructed in the 1960s and 1970s, respectively.

The retrofitting included the installation of new insulation, double-glazed windows, LED lighting, and a new heating system. These improvements resulted in a 25% reduction in energy consumption and a 26% reduction in carbon emissions.



One of the most impressive features of the University of Bradford retrofitting project is the use of renewable energy sources.

The project includes a combined heat and power plant, which generates electricity and heat from natural gas. Additionally, the university has installed a photovoltaic array on the roof of one of the buildings, which generates renewable electricity. These initiatives have helped the university to achieve its goal of becoming carbon-neutral by 2030.

Case study 3: The National Trust

The National Trust is a UK-based charity organization that is dedicated to preserving historic buildings and landscapes. In 2012, the National Trust embarked on a major retrofitting project to improve the energy efficiency of its properties.



The project involved upgrading insulation, installing energy-efficient lighting and heating systems, and using renewable energy sources such as solar panels and ground-source heat pumps.

The National Trust's retrofitting project has been highly successful, reducing the organization's carbon emissions by 40% and saving over £4 million in energy costs. The project has also improved the indoor comfort of the buildings, making them more pleasant and welcoming for visitors. Overall, the National Trust's retrofitting project is a great example of how building retrofitting can benefit both the environment and the bottom line.

Challenges of building retrofitting

Building retrofitting projects can often face significant challenges, particularly in terms of cost and technical difficulties. Retrofitting an existing building can be more expensive than constructing a new one, as it requires careful planning, design, and construction to ensure that the retrofit achieves its intended goals. Additionally, retrofitting can be technically challenging, especially when working with older buildings that may have outdated systems or materials.

However, there are several solutions and strategies that can help overcome these challenges. For example, careful planning and design can help reduce costs by identifying the most effective retrofit measures and prioritizing them based on their impact and cost-effectiveness.

Collaboration between different stakeholders, including architects, engineers, contractors, and building owners, can also help ensure that the retrofit is designed and executed effectively. Finally, leveraging available funding options, such as government grants and loans, can help reduce the financial burden of retrofitting projects.

Funding options for building retrofitting

Building retrofitting projects can be expensive, but there are funding options available to help make them more accessible. One option is government grants and loans, which can provide financial assistance to building owners looking to improve their energy efficiency.

These programs often have eligibility requirements and application processes that must be followed. Private financing is another option for funding building retrofitting projects. This can include loans from banks or other financial institutions, as well as investments from private individuals or companies. While this option may require more upfront costs, it can offer greater flexibility and control over the project.

The role of architects and engineers

Architects and engineers play a critical role in building retrofitting projects. They are responsible for designing and implementing energy-efficient solutions that meet the needs of the building occupants while also reducing energy consumption and carbon emissions.

The success of a retrofitting project depends on their expertise and ability to collaborate with other stakeholders, such as building owners, contractors, and utility providers.

Collaboration and communication are key components of successful building retrofitting projects.

Architects and engineers must work closely with other stakeholders to ensure that the retrofitting solutions are feasible, cost-effective, and sustainable.

They must also communicate effectively with building owners and occupants to ensure that they understand the benefits of the retrofitting project and are willing to participate in energy conservation practices.

The future of building retrofitting

The future of building retrofitting looks promising, with emerging technologies and trends set to have a significant impact on the industry. One such trend is the use of Building Information Modelling (BIM), which allows for more detailed planning and analysis of retrofitting projects.

Additionally, the development of smart building systems and the Internet of Things (IoT) will allow for real-time monitoring and control of energy usage in buildings.

Another emerging technology is the use of advanced materials, such as phase-change materials and aerogels, which can improve insulation and reduce energy consumption.

Finally, the growing focus on circular economy principles and sustainable materials will lead to more environmentally friendly retrofitting solutions. Overall, these trends and technologies are poised to make building retrofitting even more effective and efficient in the years to come.

The importance of monitoring and evaluation

Monitoring and evaluation are critical components of any successful building retrofitting project. By tracking and analysing data, stakeholders can identify areas for improvement and measure the impact of their efforts. This information is essential for making informed decisions and ensuring that the project is achieving its sustainability and energy efficiency goals.

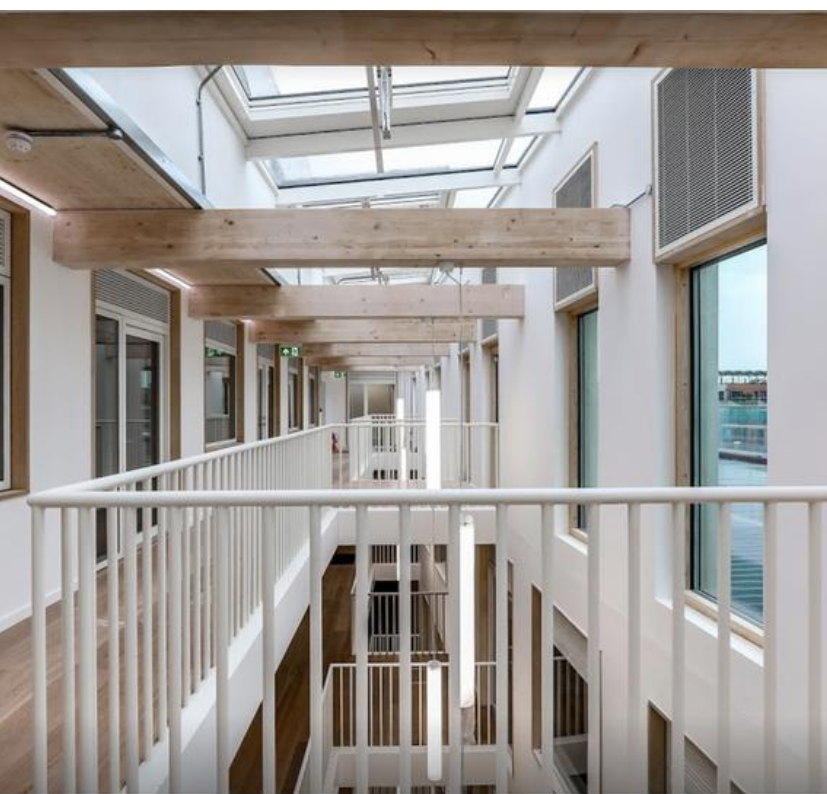
There are many tools and methods available for monitoring and evaluating building retrofitting projects. One common approach is to use energy management systems (EMS) to track energy consumption and identify opportunities for improvement.

Another method is to conduct post-occupancy evaluations (POEs) to assess the performance of the building after it has been retrofitted. Additionally, surveys and interviews can be used to gather feedback from occupants and stakeholders about the building's comfort, functionality, and overall satisfaction.

Case study 4: The Green House

The Green House, located in Cambridge, is a prime example of successful building retrofitting. Originally built in the 1970s as a residential property, it underwent a major renovation in 2010 to become a sustainable and energy-efficient office space.

The retrofitting project included upgrades such as insulation, triple-glazed windows, a green roof, and solar panels. As a result, the building achieved an impressive BREEAM (Building Research Establishment Environmental Assessment Method) rating of "Outstanding" - the highest possible rating.



One of the unique features of The Green House is its use of natural ventilation.

The building's design incorporates a central atrium that acts as a thermal chimney, drawing warm air up and out of the building.

This allows for passive cooling and reduces the need for mechanical ventilation systems.

Overall, The Green House serves as an excellent example of how retrofitted buildings can achieve high levels of sustainability and energy efficiency while still maintaining functionality and aesthetic appeal.

Case study 5: The Co-operative Group

The Co-operative Group is a British consumer co-operative with a diverse range of businesses, including food retail, funeral care, and insurance. In 2013, the Co-operative Group embarked on a building retrofitting project for its headquarters in Manchester, which involved upgrading the building's insulation, lighting, heating, and ventilation systems.



The retrofitting project resulted in a 50% reduction in energy consumption and a 80% reduction in carbon emissions, making it one of the most successful retrofitting projects in the UK.

The Co-operative Group also installed a rooftop garden, which provides insulation, reduces rainwater runoff, and promotes biodiversity.

The project demonstrates that retrofitting can not only improve energy efficiency and sustainability, but also create a more pleasant and productive work environment.

Case study 6: The Royal Albert Hall

The Royal Albert Hall, a historic concert hall in London, underwent a major retrofitting project to improve its energy efficiency and sustainability.

The project included the installation of a new cooling system, LED lighting, and insulation upgrades. These improvements resulted in a 40% reduction in energy usage and a 35% reduction in carbon emissions.



In addition to the energy savings, the retrofitting project also improved the comfort and experience for both performers and audience members. The new cooling system provides better air quality and temperature control, while the LED lighting enhances the visual experience of performances. Overall, the retrofitting project was a success in terms of both energy efficiency and user experience.

The role of building occupants

Building occupants play a crucial role in building retrofitting projects. While architects and engineers are responsible for designing and implementing energy-efficient systems, it is up to the occupants to use them effectively.

This means adopting behaviour change practices such as turning off lights and electronics when not in use, using natural light instead of artificial light, and adjusting thermostats to reduce energy consumption.

In addition, building occupants can also contribute to energy conservation by being mindful of their daily habits. For example, bringing reusable water bottles and coffee cups to work can reduce waste and energy use associated with disposable items.

Encouraging employees to carpool or use public transportation can also reduce carbon emissions and improve air quality. By promoting sustainability and energy efficiency practices among building occupants, retrofitting projects can achieve even greater success.

The importance of community engagement

Community engagement is a crucial element in building retrofitting projects. Engaging with local communities can help to build trust and support for the project, as well as providing valuable insights into the needs and priorities of the community.

Successful community engagement initiatives include workshops, public meetings, and online forums, which allow stakeholders to share their opinions and ideas. These initiatives have been shown to have a positive impact on the success of retrofitting projects, by improving communication, increasing awareness, and fostering collaboration between stakeholders.

The role of policy and regulation

Policy and regulation play a critical role in promoting energy efficiency and sustainability in building retrofitting projects. Governments can incentivize building owners to invest in energy-efficient upgrades by offering tax credits, grants, or low-interest loans. Additionally, building codes and standards can be updated to require higher levels of energy performance and encourage the use of renewable energy sources.

For example, the UK government's Green Deal provided financing for energy-saving home improvements, such as insulation and double glazing. The Energy Performance of Buildings Directive sets minimum energy performance requirements for all buildings in the European Union.

The US Department of Energy's Better Buildings Initiative provides technical assistance and resources to help building owners and operators improve energy efficiency.

Case study 7: The University of East Anglia

The University of East Anglia is a UK-based university that has implemented a successful building retrofitting project. The project involved upgrading the university's teaching wall, which consisted of four buildings built in the 1960s and 1970s, to improve their energy efficiency and reduce carbon emissions.



The retrofitting project included the installation of a new heating and cooling system, LED lighting, and insulation upgrades. Additionally, the project involved the integration of a Building Energy Management System (BEMS) that allows the university to monitor and control the energy usage of the buildings in real-time.

The BEMS also provides data on the energy performance of the buildings, allowing for ongoing optimization and improvement.

Case study 8 (USA): The Tower at PNC Plaza

Not in the UK, but a fantastic example of retrofitting for sustainability. The Tower at PNC Plaza is a 33-story building located in Pittsburgh, Pennsylvania. It was designed to be one of the most environmentally friendly skyscrapers in the world and has achieved LEED Platinum certification.



One of the key features of the Tower at PNC Plaza is its innovative double-skin facade, which consists of two layers of glass separated by an air gap. This design helps to reduce energy consumption by minimizing heat loss in the winter and heat gain in the summer.

The building also utilizes a rainwater harvesting system to irrigate the surrounding landscape and a solar chimney to improve air circulation. These features, along with many others, have helped the Tower at PNC Plaza to achieve a 50% reduction in energy use compared to similar buildings.

Case study 9 (Switzerland): The Campus Pictet De Rochement

Beautiful Form, Sustainable Function and a Beacon for Future Architecture. The Conurbation around Geneva is undergoing a transformation. It is a re-invention of Urban and City spaces, conceptualised with the benefit of hindsight, and planned for a conscious future.

At the heart of the Campus Pictet de Rochemont will be a showcase building. A place to live, work and thrive in the knowledge that they are part of the remedy to the Global Warming Crises.

The building facade design is using a unique woven louvre material, known as MicroLouvre Koolshade from SmartLouvre Technology, that will bring immense benefits to the occupants of the building and to the environment itself.

The Campus Pictet de Rochemont will become one of the most environmentally conscious buildings in Europe and most emblematic areas of the Praille-Acacias-Vernets (PAV) project.



The role of technology in building retrofitting

Technology plays a crucial role in building retrofitting projects as it enables the implementation of smart building systems that can monitor and control the energy consumption of buildings in real-time.

Smart building systems use sensors to collect data on various aspects of a building's performance, such as temperature, humidity, and lighting levels. This data is then analysed using data analytics tools to identify areas where energy efficiency improvements can be made.

For example, by installing smart thermostats that can automatically adjust the temperature based on occupancy patterns, buildings can reduce their energy consumption and save costs.

Similarly, by using occupancy sensors to control lighting, buildings can reduce their energy consumption while maintaining adequate lighting levels. In addition, data analytics tools can help building managers identify opportunities for energy savings by analysing energy consumption patterns and identifying areas where improvements can be made.

The importance of stakeholder engagement

Stakeholder engagement is a critical component of any successful building retrofitting project. Engaging with stakeholders, including building owners, occupants, architects, engineers, contractors, and government officials, can help ensure that the project meets the needs and expectations of all parties involved.

By involving stakeholders in the planning and implementation stages of the project, you can gain valuable insights and perspectives that can help you make informed decisions and avoid potential issues down the line.

Successful stakeholder engagement initiatives have been shown to have a significant impact on the success of building retrofitting projects. For example, involving building occupants in energy conservation programs can lead to a reduction in energy consumption and costs.

Engaging with local communities can help build support for the project and create a sense of ownership and pride in the building. Collaborating with government officials can help ensure that the project complies with relevant regulations and policies and may even lead to additional funding opportunities.

The role of education and awareness

Education and awareness play a critical role in building retrofitting projects. By educating building occupants on the benefits of energy efficiency and sustainability, we can encourage behaviour change and promote energy conservation practices.

Awareness initiatives can also help to raise public awareness about the importance of building retrofitting and its potential impact on the environment.

Successful education and awareness initiatives include workshops, seminars, and training programs that provide building occupants with the knowledge and skills they need to reduce their energy consumption.

These initiatives have been shown to have a significant impact on behaviour change and energy conservation, resulting in reduced energy costs and carbon emissions.

