- **Estimating Labor Expenses for Repair Services**
  Estimating Labor Expenses for Repair Services Comparing Replacement Part Prices for Various Systems Reviewing Maintenance Plan Rates in Detail Exploring Payment Arrangements for Major Overhauls Analyzing Long Term Savings with Efficient Upgrades Investigating Seasonal Discounts from Service Providers Understanding Monthly Budgeting for HVAC Projects Balancing Initial Spending with Potential Savings Evaluating Total Costs for System Retrofits Preparing for Unexpected Repair Fees Weighing Return on Investment for Modern Equipment Identifying Hidden Expenses in Older Units
- **Understanding Local Building Code Requirements**
  Understanding Local Building Code Requirements Reviewing State Regulations for HVAC Installation Exploring County Permit Applications for Mobile Homes Navigating EPA 608 Certification Steps Recognizing UL Rated Components for Safety Determining Required Inspections for New Units Preparing Official Documents for System Upgrades Knowing When to Seek Professional Licensing Support Identifying Legal Mandates for Refrigerant Disposal Sorting Out Utility Guidelines for Meter Upgrades Meeting Deadlines for Permit Renewals Locating Reliable Compliance Resources for Homeowners
- **About Us**

Evaluating the total costs for system retrofits in HVAC systems involves a comprehensive understanding of various components that play critical roles. These components not only determine the efficiency and functionality of the HVAC system but also significantly influence the financial implications of retrofitting. Identifying these key components is essential to making informed decisions that align with both performance expectations and budgetary constraints.

The primary component in any HVAC retrofit is the heating and cooling units themselves. These units are often responsible for significant energy consumption, making them prime candidates for upgrade during a retrofit. Proper insulation improves HVAC efficiency in mobile homes **Mobile Home Furnace Installation** knowledge. Modern systems offer improved energy efficiency, which can lead to substantial cost savings over time. However, these initial investments can be high, so it's crucial to evaluate potential energy savings against upfront costs to ensure a favorable return on investment.

Another vital component is the ductwork and ventilation system. Over time, ductwork can become inefficient due to leaks or poor insulation. Retrofitting may involve sealing leaks, adding insulation, or even redesigning the duct layout to improve airflow efficiency. Although these changes might seem minor compared to replacing major equipment, they can dramatically impact overall system performance and reduce operational costs.

Control systems represent another key aspect of HVAC retrofits. The integration of advanced control technologies such as programmable thermostats and building automation systems can optimize operation schedules and monitor usage patterns to enhance efficiency. While upgrading control systems requires an initial outlay, they often result in improved user comfort and reduced energy waste, leading to long-term savings.

Additionally, attention should be given to auxiliary components such as pumps and fans within the HVAC infrastructure. Upgrading these elements with more efficient models can contribute positively towards overall system enhancement by ensuring optimal circulation of air or fluids at reduced energy consumption levels.

Finally, it's imperative not to overlook labor costs associated with retrofitting projects. Skilled technicians are needed for installation and calibration which adds another layer of expense but ensures that upgrades are performed correctly for maximum efficacy.

In conclusion, evaluating total costs for HVAC system retrofits necessitates careful identification of each component's role in both current operations and future enhancements. By considering factors like equipment efficiency improvements, potential energy savings through better controls or ductwork modifications alongside associated labor expenses; stakeholders can make strategic decisions that balance upfront expenditures against long-term operational benefits thus achieving sustainable economic outcomes from their retrofit investments.

When considering system retrofits, one of the first and most critical steps is assessing the initial costs, which typically encompass equipment, labor, and installation. This comprehensive evaluation forms the foundation for understanding the financial implications of a retrofit project and aids in making informed decisions that balance cost with long-term benefits.

The cost of equipment is often the most visible component in a system retrofit. It involves purchasing new machinery or technology to replace or enhance existing systems. When evaluating equipment costs, it is essential to consider not only the purchase price but also factors such as energy efficiency, compatibility with existing systems, expected lifespan, and potential savings in operational costs. Investing in high-quality equipment might seem costly upfront but can lead to significant savings over time through improved performance and lower maintenance needs.

Labor costs are another crucial element when assessing initial expenses for system retrofits. These costs include wages for skilled technicians or specialists required to perform the retrofit work. The complexity of the project directly impacts labor costs; more intricate systems require highly skilled workers who command higher wages. Additionally, labor costs can fluctuate based on geographic location and market demand for specific skills. Therefore, it is beneficial to conduct thorough research and perhaps even solicit multiple bids to ensure competitive pricing without compromising on quality.

Installation expenses round out the initial cost considerations for retrofits. These entail all activities necessary to integrate new equipment into an existing setup effectively. Installation might involve structural modifications, electrical work, or even temporary shutdowns of current operations-all of which contribute to overall expenses. Proper planning during this phase can help mitigate unforeseen complications that could escalate costs further.

In conclusion, while assessing initial costs for equipment, labor, and installation may appear daunting at first glance, it serves as a pivotal step in evaluating total costs for system retrofits. By taking a detailed approach that considers not just immediate expenses but also long-term impacts on efficiency and performance, organizations can make strategic decisions that align with their financial goals and operational requirements. Ultimately, a clear understanding of these components ensures that retrofitting projects deliver value both today and well into the future.

Posted by on

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Steps to Accurately Estimate Labor Expenses for HVAC Repair Services

Evaluating the long-term operational costs of system retrofits is crucial for any organization aiming to enhance efficiency and sustainability. Among the most significant considerations are energy efficiency and maintenance, both of which play pivotal roles in determining the overall cost-effectiveness of a retrofit project.

Energy efficiency is often seen as the cornerstone of modern system retrofits. With rising energy costs and increasing environmental awareness, integrating energy-efficient technologies is not only economically sensible but also socially responsible. Retrofitting systems with advanced technologies can lead to substantial reductions in energy consumption, translating into lower utility bills over time. The initial investment might seem steep, but the savings accrued from reduced energy usage often justify the expense. For example, upgrading HVAC systems or installing LED lighting can dramatically cut down on electricity costs while simultaneously reducing an organization's carbon footprint.

However, focusing solely on energy efficiency without considering maintenance can lead to unforeseen expenses that may offset anticipated savings. Maintenance involves ensuring that all components of a retrofit continue to operate at optimal levels throughout their lifespan. This includes routine inspections, timely repairs, and occasionally replacing parts that have degraded over time. An effective maintenance strategy ensures that a system remains efficient and extends its longevity, thereby maximizing return on investment.

When evaluating potential retrofits, it's important to conduct a comprehensive analysis that considers both initial installation expenses and ongoing operational costs. This analysis should include projected energy savings alongside anticipated maintenance needs and expenses over the system's lifetime. By comparing these figures against current operational costs, organizations can make informed decisions about which retrofits offer the best value.

In conclusion, evaluating long-term operational costs requires a balanced approach that takes into account both energy efficiency gains and maintenance requirements. A thorough understanding of these factors enables organizations to make strategic decisions that not only improve their bottom line but also contribute positively to their environmental impact. By investing wisely in system retrofits today, businesses can pave the way for sustainable operations well into the future.

Tools and Software for Estimating Labor Costs in Mobile Home HVAC Repairs

When undertaking system retrofits, a comprehensive evaluation of total costs is essential to ensure that the project is not only economically viable but also environmentally and regulatory compliant. Retrofitting involves upgrading existing systems or structures to improve their performance, efficiency, and compliance with current standards. However, this process is inherently complex due to the myriad of factors that can influence overall costs. Among these factors, environmental and regulatory impacts play pivotal roles.

The environmental impact of retrofitting projects cannot be overstated. In an era where sustainability is at the forefront of global priorities, any retrofit must consider its ecological footprint. This includes assessing how the project affects local ecosystems, energy consumption, and emissions levels. Projects that incorporate sustainable materials or technologies may have higher upfront costs but offer long-term savings through reduced energy use and lower environmental impact fees. Moreover, by minimizing waste and optimizing resource usage during retrofits, organizations can achieve significant reductions in operational costs over time.

From a regulatory standpoint, compliance with laws and standards is non-negotiable for any retrofit project. Regulations related to building codes, safety standards, energy efficiency requirements, and environmental protection are constantly evolving. Non-compliance can result in hefty fines or even forced cessation of operations until issues are rectified. Thus, understanding current regulations and anticipating future changes are critical components in estimating total retrofit costs. Engaging with regulatory bodies early in the planning phase helps mitigate risks associated with non-compliance while ensuring that the project aligns with legal expectations.

Incorporating both environmental considerations and regulatory requirements into the cost evaluation process provides a more holistic view of what a retrofit will entail financially. It allows stakeholders to identify potential cost savings opportunities through rebates for energy-efficient upgrades or incentives for using renewable materials. Additionally, it enables them to allocate budgets more effectively by accounting for necessary compliance-related expenditures.

Ultimately, considering environmental and regulatory impacts when evaluating total system retrofit costs is an exercise in prudent foresight. It not only ensures financial feasibility but also aligns projects with broader societal goals such as sustainability and legal accountability. By doing so, organizations position themselves as responsible stewards of both economic resources and natural environments while paving the way for future innovations in system design and functionality.

Case Studies: Examples of Labor Cost Estimation in Various Repair Scenarios

Analyzing financial incentives and rebates for system upgrades is a critical component of evaluating total costs for system retrofits. As businesses and individuals consider enhancing their existing systems, whether they be HVAC, electrical, or technological infrastructures, understanding the financial landscape is crucial. This process involves not only assessing the immediate expenses associated with purchasing new equipment and installation but also taking into account potential savings brought by various incentives and rebates.

Financial incentives often come in the form of tax credits, grants, or direct rebates provided by government agencies or utility companies to encourage energy efficiency and sustainability. These incentives can significantly reduce the initial outlay required for system upgrades. By easing the financial burden on consumers and businesses, these programs aim to promote environmentally-friendly practices while simultaneously boosting economic activity through increased spending on newer technologies.

For instance, many governments offer tax credits for solar panel installations or energy-efficient heating systems. These credits directly reduce tax liability, making them an attractive option for those looking to lower their upgrade costs. Similarly, utility companies may provide rebates based on kilowatt-hour reductions achieved through upgraded systems. Such mechanisms not only make retrofitting financially viable but also incentivize reducing energy consumption-a win-win for both consumers and broader environmental goals.

However, evaluating total costs goes beyond simply accounting for these upfront savings. It requires a comprehensive analysis that includes long-term operational savings due to increased efficiency and reduced maintenance needs. Modernized systems often boast enhanced performance characteristics that lead to lower operational costs over time.

Evaluating these benefits against initial investment gives a more accurate picture of the true cost-effectiveness of a retrofit project.

Furthermore, decision-makers must consider potential disruptions during installation that might impact productivity or service delivery. Opportunity costs arising from downtime should be factored into the overall assessment as they can influence the timeline within which an investment pays off through cost savings.

In conclusion, analyzing financial incentives and rebates is indispensable when evaluating total costs for system retrofits. While upfront discounts make upgrades more accessible, it is imperative to conduct a holistic evaluation that considers long-term savings alongside any potential operational impacts. By doing so, stakeholders can make informed decisions that align with their financial capabilities and strategic objectives while contributing positively to environmental sustainability initiatives.

Tips for Managing and Reducing Labor Expenses Without Compromising Quality

Calculating the Return on Investment (ROI) for retrofit projects is a crucial aspect of evaluating the total costs associated with system retrofits. As industries strive to enhance efficiency, reduce environmental impact, and ensure economic viability, understanding ROI becomes imperative. Retrofits often involve significant upfront costs, making it vital to assess whether the long-term benefits justify these initial investments.

At its core, ROI is a financial metric used to gauge the profitability of an investment relative to its cost. In the context of retrofit projects, it helps decision-makers determine whether upgrading existing systems will yield satisfactory returns over time. Calculating ROI involves comparing the net gains from the investment against its costs. This can be expressed as a percentage or ratio, providing a clear picture of potential financial gains.

To accurately calculate ROI for retrofit projects, several factors must be considered. Initial costs include expenses related to equipment purchase, installation, labor, and any disruptions caused during implementation. These are weighed against anticipated savings in energy consumption, maintenance costs, and operational efficiencies gained through modernized systems.

For instance, consider a manufacturing plant contemplating an HVAC system retrofit aimed at reducing energy use and improving air quality. The plant would first quantify all incurred costs such as equipment procurement and installation fees. Next, it would project future savings by analyzing reduced energy bills and potential enhancements in worker productivity due to improved working conditions.

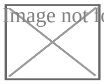
Another critical aspect is the timeline over which returns are expected. ROI calculations should account for both short-term and long-term benefits. While some improvements might yield immediate savings-like reduced utility expenses-others could take longer to manifest fully but result in substantial cumulative savings over time.

Moreover, assessing non-monetary benefits enhances understanding of true ROI value for retrofit projects. Improved environmental sustainability often accompanies retrofitting efforts; thus contributing positively towards corporate social responsibility goals while potentially unlocking tax incentives or rebates from government bodies focused on promoting green initiatives.

In conclusion, calculating ROI for retrofit projects requires meticulous evaluation of both direct financial implications and peripheral advantages like environmental impact reduction or enhanced brand reputation through sustainability efforts. By conducting comprehensive analyses encompassing all relevant parameters-from initial expenditures through projected savings across multiple dimensions-organizations can make informed decisions about investing in retrofits that align with their strategic objectives while ensuring robust returns on investment both financially and environmentally.

About Modular building

For the Lego series, see Lego Modular Buildings.



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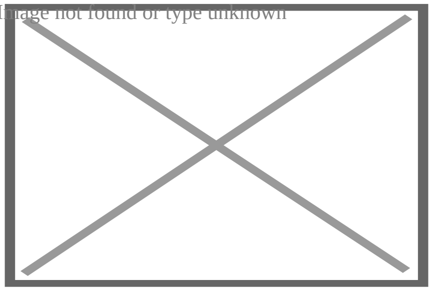
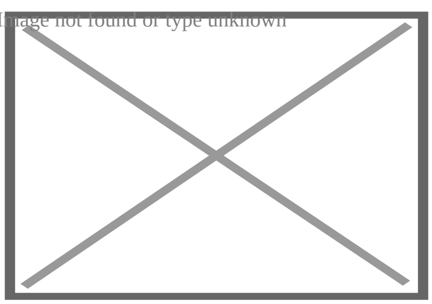


Prefabricated house in Valencia, Spain.

A **modular building** is a prefabricated building that consists of repeated sections called modules.[1] Modularity involves constructing sections away from the building site, then delivering them to the intended site. Installation of the prefabricated sections is completed on site. Prefabricated sections are sometimes placed using a crane. The modules can be placed side-by-side, end-to-end, or stacked, allowing for a variety of configurations and styles. After placement, the modules are joined together using inter-module connections, also known as inter-connections. The inter-connections tie the individual modules together to form the overall building structure.[2]

Uses

[edit]



Modular home prefab sections to be placed on the foundation

Modular buildings may be used for long-term, temporary or permanent facilities, such as construction camps, schools and classrooms, civilian and military housing, and industrial facilities. Modular buildings are used in remote and rural areas where conventional construction may not be reasonable or possible, for example, the Halley VI accommodation pods used for a BAS Antarctic expedition.[3] Other uses have included churches, health care facilities, sales and retail offices, fast food restaurants and cruise ship construction. They can also be used in areas that have weather concerns, such as hurricanes. Modular buildings are often used to provide temporary facilities, including toilets and ablutions at events. The portability of the buildings makes them popular with hire companies and clients alike. The use of modular buildings enables events to be held at locations where existing facilities are unavailable, or unable to support the number of event attendees.

Construction process

[edit]

Construction is offsite, using lean manufacturing techniques to prefabricate single or multi-story buildings in deliverable module sections. Often, modules are based around standard 20 foot containers, using the same dimensions, structures, building and stacking/placing techniques, but with smooth (instead of corrugated) walls, glossy white paint, and provisions for windows, power, potable water, sewage lines, telecommunications and air conditioning. Permanent Modular Construction (PMC) buildings are manufactured in a controlled setting and can be constructed of wood, steel, or concrete. Modular components are typically constructed indoors on assembly lines. Modules' construction may take as little as ten days but more often one to three months. PMC modules can be integrated into site built projects or stand alone and can be delivered with MEP, fixtures and interior finishes.

The buildings are 60% to 90% completed offsite in a factory-controlled environment, and transported and assembled at the final building site. This can comprise the entire building or be components or subassemblies of larger structures. In many cases, modular contractors work with traditional general contractors to exploit the resources and advantages of each type of construction. Completed modules are transported to the building site and assembled by a crane.[4] Placement of the modules may take from several hours to several days. Off-site construction running in parallel to site preparation providing a shorter time to project completion is one of the common selling points of modular construction. Modular construction timeline

Permanent modular buildings are built to meet or exceed the same building codes and standards as site-built structures and the same architect-specified materials used in conventionally constructed buildings are used in modular construction projects. PMC can have as many stories as building codes allow. Unlike relocatable buildings, PMC structures are intended to remain in one location for the duration of their useful life.

Manufacturing considerations

[edit]

The entire process of modular construction places significance on the design stage. This is where practices such as Design for Manufacture and Assembly (DfMA) are used to ensure that assembly tolerances are controlled throughout manufacture and assembly on site. It is vital that there is enough allowance in the design to allow the assembly to take up any "slack" or misalignment of components. The use of advanced CAD systems, 3D printing and manufacturing control systems are important for modular construction to be successful. This is quite unlike on-site construction where the tradesman can often make the part to suit any particular installation.

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  spray booth
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Roof shingled and siding installed

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  Two-story modular dwelling

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  Two-story modular dwelling
  Pratt Modular Home in Tyler Texas

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Pratt Modular Home in
Tyler Texas

Upfront production investment

[edit]

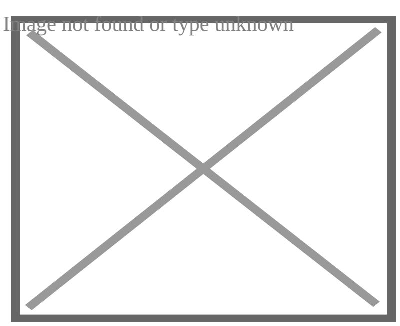
The development of factory facilities for modular homes requires significant upfront investment. To help address housing shortages in the 2010s, the United Kingdom Government (via Homes England) invested in modular housing initiatives. Several UK companies (for example, Ilke Homes, L&G Modular Homes, House by Urban Splash, Modulous, TopHat and Lighthouse) were established to develop modular homes as an alternative to traditionally-built residences, but failed as they could not book revenues quickly enough to cover the costs of establishing manufacturing facilities.

Ilke Homes opened a factory in Knaresborough, Yorkshire in 2018, and Homes England invested £30m in November 2019,[5] and a further £30m in September 2021.[6] Despite a further fund-raising round, raising £100m in December 2022,[7][8] Ilke Homes went into administration on 30 June 2023,[9][10] with most of the company's 1,150 staff made redundant,[11] and debts of £320m,[12] including £68m owed to Homes England.[13]

In 2015 Legal & General launched a modular homes operation, L&G Modular Homes, opening a 550,000 sq ft factory in Sherburn-in-Elmet, near Selby in Yorkshire.[14] The company incurred large losses as it invested in its factory before earning any revenues; by 2019, it had lost over £100m.[15] Sales revenues from a Selby project, plus schemes in Kent and West Sussex, started to flow in 2022, by which time the business's total losses had grown to £174m.[16] Production was halted in May 2023, with L&G blaming local planning delays and the COVID-19 pandemic for its failure to grow its sales pipeline.[17][18] The enterprise incurred total losses over seven years of £295m.[19]

Market acceptance

[edit]



Raines Court is a multi-story modular housing block in Stoke Newington, London, one of the first two residential buildings in Britain of this type.

(December 2005)

Some home buyers and some lending institutions resist consideration of modular homes as equivalent in value to site-built homes.[*citation needed*] While the homes themselves may be of equivalent quality, entrenched zoning regulations and psychological marketplace factors may create hurdles for buyers or builders of modular homes and should be considered as part of the decision-making process when exploring this type of home as a living and/or investment option. In the UK and Australia, modular homes have become accepted in some regional areas; however, they are not commonly built in major cities. Modular homes are becoming increasingly common in Japanese urban areas, due to improvements in design and quality, speed and compactness of onsite assembly, as well as due to lowering costs and ease of repair after earthquakes. Recent innovations allow modular buildings to be indistinguishable from site-built structures.[20] Surveys have shown that individuals can rarely tell the difference between a modular home and a site-built home.[21]

Modular homes vs. mobile homes

[edit]

Differences include the building codes that govern the construction, types of material used and how they are appraised by banks for lending purposes. Modular homes are built to either local or state building codes as opposed to manufactured homes, which are also built in a factory but are governed by a federal building code.[22] The codes that govern the construction of modular homes are exactly the same codes that govern the construction of site-constructed homes.[*citation needed*] In the United States, all modular homes are constructed according to the International Building Code (IBC), IRC, BOCA or the code that has been adopted by the local jurisdiction.[*citation needed*] In some states, such as California, mobile homes must still be registered yearly, like vehicles or standard trailers, with the Department of Motor Vehicles or other state agency. This is true even if the owners remove the axles and place it on a permanent foundation.[23]

Recognizing a mobile or manufactured home

[edit]

A mobile home should have a small metal tag on the outside of each section. If a tag cannot be located, details about the home can be found in the electrical panel box. This tag should also reveal a manufacturing date.[*citation needed*] Modular homes do not have metal tags on the outside but will have a dataplate installed inside the home, usually under the kitchen sink or in a closet. The dataplate will provide information such as the manufacturer, third party inspection agency, appliance information, and manufacture date.

Materials

[edit]

The materials used in modular buildings are of the same quality and durability as those used in traditional construction, preserving characteristics such as acoustic insulation and energy efficiency, as well as allowing for attractive and innovative designs thanks to their versatility.[24] Most commonly used are steel, wood and concrete.[25]

- Steel: Because it is easily moldable, it allows for innovation in design and aesthetics.
- Wood: Wood is an essential part of most modular buildings. Thanks to its lightness, it facilitates the work of assembling and moving the prefabricated modules.
- Concrete: Concrete offers a solid structure that is ideal for the structural reinforcement of permanent modular buildings. It is increasingly being used as a base material in this type of building, thanks to its various characteristics such as fire resistance, energy savings, greater acoustic insulation, and durability.[26]

Wood-frame floors, walls and roof are often utilized. Some modular homes include brick or stone exteriors, granite counters and steeply pitched roofs. Modulars can be designed to sit on a perimeter foundation or basement. In contrast, mobile homes are constructed with a steel chassis that is integral to the integrity of the floor system. Modular buildings can be custom built to a client's specifications. Current designs include multi-story units, multi-family units and entire apartment complexes. The negative stereotype commonly associated with mobile homes has prompted some manufacturers to start using the term "off-site construction."

New modular offerings include other construction methods such as cross-laminated timber frames.[27]

Financing

[edit]

Mobile homes often require special lenders.[28]

Modular homes on the other hand are financed as site built homes with a construction loan

Standards and zoning considerations

[edit]

Typically, modular dwellings are built to local, state or council code, resulting in dwellings from a given manufacturing facility having differing construction standards depending on the final destination of the modules.[29] The most important zones that manufacturers have to take into consideration are local wind, heat, and snow load zones.[*citation needed*] For example, homes built for final assembly in a hurricane-prone, earthquake or flooding area may include additional bracing to meet local building codes. Steel and/or wood framing are common options for building a modular home.

Some US courts have ruled that zoning restrictions applicable to mobile homes do not apply to modular homes since modular homes are designed to have a permanent foundation.[*citation needed*] Additionally, in the US, valuation differences between modular homes and site-built homes are often negligible in real estate appraisal practice; modular homes can, in some market areas, (depending on local appraisal practices per Uniform Standards of Professional Appraisal Practice) be evaluated the same way as site-built dwellings of similar quality. In Australia, manufactured home parks are governed by additional legislation that does not apply to permanent modular homes. Possible developments in equivalence between modular and site-built housing types for the purposes of real estate appraisals, financing and zoning may increase the sales of modular homes over time.[30]

CLASP (Consortium of Local Authorities Special Programme)

[edit]

The Consortium of Local Authorities Special Programme (abbreviated and more commonly referred to as CLASP) was formed in England in 1957 to combine the resources of local authorities with the purpose of developing a prefabricated school building programme. Initially developed by Charles Herbert Aslin, the county architect for Hertfordshire, the system was used as a model for several other counties, most notably Nottinghamshire and Derbyshire. CLASP's popularity in these coal mining areas was in part because the system permitted fairly straightforward replacement of subsidence-damaged sections of building.

Building strength

[edit]

Modular Home being built in Vermont photo by Josh Vignona

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Modular home in Vermont

Modular homes are designed to be stronger than traditional homes by, for example, replacing nails with screws, adding glue to joints, and using 8–10% more lumber than conventional housing.[31] This is to help the modules maintain their structural integrity as they are transported on trucks to the construction site. However, there are few studies on the response of modular buildings to transport and handling stresses. It is therefore presently difficult to predict transport induced damage.[1]

When FEMA studied the destruction wrought by Hurricane Andrew in Dade County Florida, they concluded that modular and masonry homes fared best compared to other construction.[32]

CE marking

[edit]

The CE mark is a construction norm that guarantees the user of mechanical resistance and strength of the structure. It is a label given by European community empowered authorities for end-to-end process mastering and traceability.[*citation needed*]

All manufacturing operations are being monitored and recorded:

- Suppliers have to be known and certified,
- Raw materials and goods being sourced are to be recorded by batch used,
- Elementary products are recorded and their quality is monitored,
- Assembly quality is managed and assessed on a step by step basis,
- When a modular unit is finished, a whole set of tests are performed and if quality standards are met, a unique number and EC stamp is attached to and on the unit.

This ID and all the details are recorded in a database, At any time, the producer has to be able to answer and provide all the information from each step of the production of a single unit, The EC certification guaranties standards in terms of durability, resistance against wind and earthquakes.[*citation needed*]

Open modular building

[edit]
See also: Green building

The term Modularity can be perceived in different ways. It can even be extended to building P2P (peer-to-peer) applications; where a tailored use of the P2P technology is with the aid of a modular paradigm. Here, well-understood components with clean interfaces can be combined to implement arbitrarily complex functions in the hopes of further proliferating self-organising P2P technology. Open modular buildings are an excellent example of this. Modular building can also be open source and green. Bauwens, Kostakis and Pazaitis[33] elaborate on this kind of modularity. They link modularity to the construction of houses.

This commons-based activity is geared towards modularity. The construction of modular buildings enables a community to share designs and tools related to all the different parts of house construction. A socially-oriented endeavour that deals with the external architecture of buildings and the internal dynamics of open source commons. People are thus provided with the tools to reconfigure the public sphere in the area where they live, especially in urban environments. There is a robust socializing element that is reminiscent of pre-industrial vernacular architecture and community-based building.[34]

Some organisations already provide modular housing. Such organisations are relevant as they allow for the online sharing of construction plans and tools. These plans can be then assembled, through either digital fabrication like 3D printing or even sourcing low-cost materials from local communities. It has been noticed that given how easy it is to use these low-cost materials are (for example: plywood), it can help increase the permeation of these open buildings to areas or communities that lack the know-how or abilities of conventional architectural or construction firms. Ergo, it allows for a fundamentally more standardised way of constructing houses and buildings. The overarching idea behind it remains key - to allow for easy access to user-friendly layouts which anyone can use to build in a more sustainable and affordable way.

Modularity in this sense is building a house from different standardised parts, like solving a jigsaw puzzle.

3D printing can be used to build the house.

The main standard is OpenStructures and its derivative Autarkytecture.[35]

Research and development

[edit]

Modular construction is the subject of continued research and development worldwide as the technology is applied to taller and taller buildings. Research and development is carried out by modular building companies and also research institutes such as the Modular Building Institute[36] and the Steel Construction Institute.[37]

See also

[edit]

- Image not found or type unknown Housing portal
- Affordable housing
- Alternative housing
- Commercial modular construction
- Construction 3D printing
- Container home
- Kit house
- MAN steel house
- Manufactured housing
- Modern methods of construction
- Modular design
- Portable building
- Prefabrication
- Open-source architecture
- Open source hardware
- OpenStructures
- Prefabricated home
- Relocatable buildings
- Recreational vehicles
- Shipping container architecture
- Stick-built home
- Tiny house movement
- Toter

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Sick building syndrome	
Specialty	Environmental medicine, immunology Image not found or type unknown Edit this on Wikidata

Sick building syndrome (**SBS**) is a condition in which people develop symptoms of illness or become infected with chronic disease from the building in which they work or reside.[1] In scientific literature, SBS is also known as **building-related illness (BRI)**, **building-related symptoms (BRS)**, or **idiopathic environmental intolerance (IEI)**.

The main identifying observation is an increased incidence of complaints of such symptoms as headache, eye, nose, and throat irritation, fatigue, dizziness, and nausea. The 1989 Oxford English Dictionary defines SBS in that way.[2] The World Health Organization created a 484-page tome on indoor air quality 1984, when SBS was attributed only to non-organic causes, and suggested that the book might form a basis for legislation or litigation.[3]

The outbreaks may or may not be a direct result of inadequate or inappropriate cleaning.[2] SBS has also been used to describe staff concerns in post-war buildings with faulty building aerodynamics, construction materials, construction process, and maintenance.[2] Some symptoms tend to increase in severity with the time people spend in the building, often improving or even disappearing when people are away from the building.[2][4] The term *SBS* is also used interchangeably with "**building-related symptoms**", which orients the name of the condition around patients' symptoms rather than a "sick" building.[5]

Attempts have been made to connect sick building syndrome to various causes, such as contaminants produced by outgassing of some building materials, volatile organic compounds (VOC), improper exhaust ventilation of ozone (produced by the operation of some office machines), light industrial chemicals used within, and insufficient fresh-air intake or air filtration (*see* "Minimum efficiency reporting value").[2] Sick building syndrome has also been attributed to heating, ventilation, and air conditioning (HVAC) systems, an attribution about which there are inconsistent findings.[6]

Signs and symptoms

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An air quality monitor

Human exposure to aerosols has a variety of adverse health effects.[7] Building occupants complain of symptoms such as sensory irritation of the eyes, nose, or throat; neurotoxic or general health problems; skin irritation; nonspecific hypersensitivity reactions; infectious diseases;[8] and odor and taste sensations.[9] Poor lighting has caused general malaise.[10]

Extrinsic allergic alveolitis has been associated with the presence of fungi and bacteria in the moist air of residential houses and commercial offices.[11] A study in 2017 correlated several inflammatory diseases of the respiratory tract with objective evidence of damp-caused damage in homes.[12]

The WHO has classified the reported symptoms into broad categories, including mucous-membrane irritation (eye, nose, and throat irritation), neurotoxic effects (headaches, fatigue, and irritability), asthma and asthma-like symptoms (chest tightness and wheezing), skin dryness and irritation, and gastrointestinal complaints.[13]

Several sick occupants may report individual symptoms that do not seem connected. The key to discovery is the increased incidence of illnesses in general with onset or exacerbation in a short period, usually weeks. In most cases, SBS symptoms are relieved soon after the occupants leave the particular room or zone.[14] However, there can be lingering effects of various neurotoxins, which may not clear up when the occupant leaves the building. In some cases, including those of sensitive people, there are long-term health effects.[15]

Cause

[edit]

ASHRAE has recognized that polluted urban air, designated within the United States Environmental Protection Agency (EPA)'s air quality ratings as unacceptable, requires the installation of treatment such as filtration for which the HVAC practitioners generally apply carbon-impregnated filters and their likes. Different toxins will aggravate the human body in different ways. Some people are more allergic to mold, while others are highly sensitive to dust. Inadequate ventilation will exaggerate small problems (such as deteriorating fiberglass insulation or cooking fumes) into a much more serious indoor air quality problem.[10]

Common products such as paint, insulation, rigid foam, particle board, plywood, duct liners, exhaust fumes and other chemical contaminants from indoor or outdoor sources, and biological contaminants can be trapped inside by the HVAC AC system. As this air is recycled using fan coils the overall oxygenation ratio drops and becomes harmful. When combined with other stress factors such as traffic noise and poor lighting, inhabitants of buildings located in a polluted urban area can quickly become ill as their immune system is overwhelmed.[10]

Certain VOCs, considered toxic chemical contaminants to humans, are used as adhesives in many common building construction products. These aromatic carbon rings / VOCs can cause acute and chronic health effects in the occupants of a building, including cancer, paralysis, lung failure, and others. Bacterial spores, fungal spores, mold spores, pollen, and viruses are types of biological contaminants and can all cause allergic reactions or illness described as SBS. In addition, pollution from outdoors, such as motor vehicle exhaust, can enter buildings, worsen indoor air quality, and increase the indoor concentration of carbon monoxide and carbon dioxide.[16] Adult SBS symptoms were associated with a history of allergic rhinitis, eczema and asthma.[17]

A 2015 study concerning the association of SBS and indoor air pollutants in office buildings in Iran found that, as carbon dioxide increased in a building, nausea, headaches, nasal irritation, dyspnea, and throat dryness also rose.[10] Some work conditions have been correlated with specific symptoms: brighter light, for example was significantly related to skin dryness, eye pain, and malaise.[10] Higher temperature is correlated with sneezing, skin redness, itchy eyes, and headache; lower relative humidity has been associated with sneezing, skin redness, and eye pain.[10]

In 1973, in response to the oil crisis and conservation concerns, ASHRAE Standards 62-73 and 62-81 reduced required ventilation from 10 cubic feet per minute (4.7 L/s) per person to 5 cubic feet per minute (2.4 L/s) per person, but this was found to be a contributing factor to sick building syndrome.[18] As of the 2016 revision, ASHRAE ventilation standards call for 5 to 10 cubic feet per minute of ventilation per occupant (depending on the occupancy type) in addition to ventilation based on the zone floor area delivered to the breathing zone.[19]

Workplace

[edit]

Excessive work stress or dissatisfaction, poor interpersonal relationships and poor communication are often seen to be associated with SBS, recent[*when?*] studies show that a combination of environmental sensitivity and stress can greatly contribute to sick building syndrome.[15][*citation needed*]

Greater effects were found with features of the psycho-social work environment including high job demands and low support. The report concluded that the physical environment of office buildings appears to be less important than features of the psycho-social work environment in explaining differences in the prevalence of symptoms. However, there is still a relationship between sick building syndrome and symptoms of workers regardless of workplace stress.[20]

Specific work-related stressors are related with specific SBS symptoms. Workload and work conflict are significantly associated with general symptoms (headache, abnormal tiredness, sensation of cold or nausea). While crowded workspaces and low work satisfaction are associated with upper respiratory symptoms.[21] Work productivity has been associated with ventilation rates, a contributing factor to SBS, and there's a significant increase in production as ventilation rates increase, by 1.7% for every two-fold increase of ventilation rate.[22] Printer effluent, released into the office air as ultra-fine particles (UFPs) as toner is burned during the printing process, may lead to certain SBS symptoms.[23][24] Printer effluent may contain a variety of toxins to which a subset of office workers are sensitive, triggering SBS symptoms.[25]

Specific careers are also associated with specific SBS symptoms. Transport, communication, healthcare, and social workers have highest prevalence of general symptoms. Skin symptoms such as eczema, itching, and rashes on hands and face are associated with technical work. Forestry, agriculture, and sales workers have the lowest rates of sick building syndrome symptoms.[26]

From the assessment done by Fisk and Mudarri, 21% of asthma cases in the United States were caused by wet environments with mold that exist in all indoor environments, such as schools, office buildings, houses and apartments. Fisk and Berkeley Laboratory colleagues also found that the exposure to the mold increases the chances of respiratory issues by 30 to 50 percent.[27] Additionally, studies showing that health effects with dampness and mold in indoor environments found that increased risk of adverse health effects occurs with dampness or visible mold environments.[28]

Milton et al. determined the cost of sick leave specific for one business was an estimated $480 per employee, and about five days of sick leave per year could be attributed to low ventilation rates. When comparing low ventilation rate areas of the building to higher ventilation rate areas, the relative risk of short-term sick leave was 1.53 times greater in the low ventilation areas.[29]

Home

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Sick building syndrome can be caused by one's home. Laminate flooring may release more SBS-causing chemicals than do stone, tile, and concrete floors.[17] Recent redecorating and new furnishings within the last year are associated with increased symptoms; so are dampness and related factors, having pets, and cockroaches.[17] Mosquitoes are related to more symptoms, but it is unclear whether the immediate cause of the symptoms is the mosquitoes or the repellents used against them.[17]

Mold

[edit]
Main article: Mold health issues

Sick building syndrome may be associated with indoor mold or mycotoxin contamination. However, the attribution of sick building syndrome to mold is controversial and supported by little evidence.[30][31][32]

Indoor temperature

[edit]
Main article: Room temperature § Health effects

Indoor temperature under 18 °C (64 °F) has been shown to be associated with increased respiratory and cardiovascular diseases, increased blood levels, and increased hospitalization.[33]

Diagnosis

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While sick building syndrome (SBS) encompasses a multitude of non-specific symptoms, building-related illness (BRI) comprises specific, diagnosable symptoms caused by certain agents (chemicals, bacteria, fungi, etc.). These can typically be identified, measured, and quantified.[34] There are usually four causal agents in BRi: immunologic, infectious, toxic, and irritant.[34] For instance, Legionnaire's disease, usually caused by *Legionella pneumophila*, involves a specific organism which could be ascertained through clinical findings as the source of contamination within a building.[34]

Prevention

[edit]

- Reduction of time spent in the building
- If living in the building, moving to a new place
- Fixing any deteriorated paint or concrete deterioration
- Regular inspections to indicate for presence of mold or other toxins
- Adequate maintenance of all building mechanical systems
- Toxin-absorbing plants, such as sansevieria[35][36][37][38][39][40][41][*excessive citations*]
- Roof shingle non-pressure cleaning for removal of algae, mold, and *Gloeocapsa magma*
- Using ozone to eliminate the many sources, such as VOCs, molds, mildews, bacteria, viruses, and even odors. However, numerous studies identify high-ozone shock treatment as ineffective despite commercial popularity and popular belief.
- Replacement of water-stained ceiling tiles and carpeting
- Only using paints, adhesives, solvents, and pesticides in well-ventilated areas or only using these pollutant sources during periods of non-occupancy
- Increasing the number of air exchanges; the American Society of Heating, Refrigeration and Air-Conditioning Engineers recommend a minimum of 8.4 air exchanges per 24-hour period
- Increased ventilation rates that are above the minimum guidelines[22]
- Proper and frequent maintenance of HVAC systems
- UV-C light in the HVAC plenum
- Installation of HVAC air cleaning systems or devices to remove VOCs and bioeffluents (people odors)
- Central vacuums that completely remove all particles from the house including the ultrafine particles (UFPs) which are less than 0.1 ?m
- Regular vacuuming with a HEPA filter vacuum cleaner to collect and retain 99.97% of particles down to and including 0.3 micrometers
- Placing bedding in sunshine, which is related to a study done in a high-humidity area where damp bedding was common and associated with SBS[17]
- Lighting in the workplace should be designed to give individuals control, and be natural when possible[42]
- Relocating office printers outside the air conditioning boundary, perhaps to another building
- Replacing current office printers with lower emission rate printers[43]
- Identification and removal of products containing harmful ingredients

Management

[edit]

SBS, as a non-specific blanket term, does not have any specific cause or cure. Any known cure would be associated with the specific eventual disease that was cause by exposure to known contaminants. In all cases, alleviation consists of removing the affected person from the building associated. BRI, on the other hand, utilizes treatment appropriate for the contaminant identified within the building (e.g., antibiotics for Legionnaire's disease).[*citation needed*]

Improving the indoor air quality (IAQ) of a particular building can attenuate, or even eliminate, the continued exposure to toxins. However, a Cochrane review of 12 mold and dampness remediation studies in private homes, workplaces and schools by two independent authors were deemed to be very low to moderate quality of evidence in reducing adult asthma symptoms and results were inconsistent among children.[44] For the individual, the recovery may be a process involved with targeting the acute symptoms of a specific illness, as in the case of mold toxins.[45] Treating various building-related illnesses is vital to the overall understanding of SBS. Careful analysis by certified building professionals and physicians can help to identify the exact cause of the BRI, and help to illustrate a causal path to infection. With this knowledge one can, theoretically, remediate a building of contaminants and rebuild the structure with new materials. Office BRI may more likely than not be explained by three events: "Wide range in the threshold of response in any population (susceptibility), a spectrum of response to any given agent, or variability in exposure within large office buildings."[46]

Isolating any one of the three aspects of office BRI can be a great challenge, which is why those who find themselves with BRI should take three steps, history, examinations, and interventions. History describes the action of continually monitoring and recording the health of workers experiencing BRI, as well as obtaining records of previous building alterations or related activity. Examinations go hand in hand with monitoring employee health. This step is done by physically examining the entire workspace and evaluating possible threats to health status among employees. Interventions follow accordingly based on the results of the Examination and History report.[46]

Epidemiology

[edit]

Some studies have found that women have higher reports of SBS symptoms than men.[17][10] It is not entirely clear, however, if this is due to biological, social, or occupational factors.

A 2001 study published in the Journal Indoor Air, gathered 1464 office-working participants to increase the scientific understanding of gender differences under the Sick Building Syndrome phenomenon.[47] Using questionnaires, ergonomic investigations, building evaluations, as well as physical, biological, and chemical variables, the investigators obtained results that compare with past studies of SBS and gender. The study team found that across most test variables, prevalence rates were different in most areas, but there was also a deep stratification of working conditions between genders as well. For example, men's workplaces tend to be significantly larger and have all-around better job characteristics. Secondly, there was a noticeable difference in reporting rates, specifically that women have higher rates of reporting roughly 20% higher than men. This information was similar to that found in previous studies, thus indicating a potential difference in willingness to report.[47]

There might be a gender difference in reporting rates of sick building syndrome, because women tend to report more symptoms than men do. Along with this, some studies have found that women have a more responsive immune system and are more prone to mucosal dryness and facial erythema. Also, women are alleged by some to be more exposed to indoor environmental factors because they have a greater tendency to have clerical jobs, wherein they are exposed to unique office equipment and materials (example: blueprint machines, toner-based printers), whereas men often have jobs based outside of offices.[48]

History

[edit]

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In the late 1970s, it was noted that nonspecific symptoms were reported by tenants in newly constructed homes, offices, and nurseries. In media it was called "office illness". The term "sick building syndrome" was coined by the WHO in 1986, when they also estimated that 10–30% of newly built office buildings in the West had indoor air problems. Early Danish and British studies reported symptoms.

Poor indoor environments attracted attention. The Swedish allergy study (SOU 1989:76) designated "sick building" as a cause of the allergy epidemic as was feared. In the 1990s, therefore, extensive research into "sick building" was carried out. Various physical and chemical factors in the buildings were examined on a broad front.

The problem was highlighted increasingly in media and was described as a "ticking time bomb". Many studies were performed in individual buildings.

In the 1990s "sick buildings" were contrasted against "healthy buildings". The chemical contents of building materials were highlighted. Many building material manufacturers were actively working to gain control of the chemical content and to replace criticized additives. The ventilation industry advocated above all more well-functioning ventilation. Others perceived ecological construction, natural materials, and simple techniques as a solution.

At the end of the 1990s came an increased distrust of the concept of "sick building". A dissertation at the Karolinska Institute in Stockholm 1999 questioned the methodology of previous research, and a Danish study from 2005 showed these flaws experimentally. It was suggested that sick building syndrome was not really a coherent syndrome and was not a disease to be individually diagnosed, but a collection of as many as a dozen semi-related diseases. In 2006 the Swedish National Board of Health and Welfare recommended in the medical journal *Läkartidningen* that "sick building syndrome" should not be used as a clinical diagnosis. Thereafter, it has become increasingly less common to use terms such as *sick buildings* and *sick building syndrome* in research. However, the concept remains alive in popular culture and is used to designate the set of symptoms related to poor home or work environment engineering. *Sick building* is therefore an expression used especially in the context of workplace health.

Sick building syndrome made a rapid journey from media to courtroom where professional engineers and architects became named defendants and were represented by their respective professional practice insurers. Proceedings invariably relied on expert witnesses, medical and technical experts along with building managers, contractors and manufacturers of finishes and furnishings, testifying as to cause and effect. Most of these actions resulted in sealed settlement agreements, none of these being dramatic. The insurers needed a defense based upon Standards of Professional Practice to meet a court decision that declared that in a modern, essentially sealed building, the HVAC systems must produce breathing air for suitable human consumption. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers, currently with over 50,000 international members) undertook the task of codifying its indoor air quality (IAQ) standard.

ASHRAE empirical research determined that "acceptability" was a function of outdoor (fresh air) ventilation rate and used carbon dioxide as an accurate measurement of occupant presence and activity. Building odors and contaminants would be suitably controlled by this dilution methodology. ASHRAE codified a level of 1,000 ppm of carbon dioxide and specified the use of widely available sense-and-control equipment to assure compliance. The 1989 issue of ASHRAE 62.1-1989 published the whys and wherefores and overrode the 1981 requirements that were aimed at a ventilation level of 5,000 ppm of carbon dioxide (the OSHA workplace limit), federally set to minimize HVAC system energy consumption. This apparently ended the SBS epidemic.

Over time, building materials changed with respect to emissions potential. Smoking vanished and dramatic improvements in ambient air quality, coupled with code compliant ventilation and maintenance, per ASHRAE standards have all contributed to the acceptability of the indoor air environment.[49][50]

See also

[edit]

- Aerotoxic syndrome
- Air purifier
- Asthmagen
- Cleanroom
- Electromagnetic hypersensitivity
- Havana syndrome
- Healthy building
- Indoor air quality
- Lead paint
- Multiple chemical sensitivity
- NASA Clean Air Study
- Nosocomial infection
- Particulates
- Power tools
- Renovation
- Somatization disorder
- Fan death

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Further reading

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External links

[edit]

- Best Practices for Indoor Air Quality when Remodeling Your Home, US EPA
- Renovation and Repair, Part of Indoor Air Quality Design Tools for Schools, US EPA
- Addressing Indoor Environmental Concerns During Remodeling, US EPA
- Dust FAQs, UK HSE Archived 2023-03-20 at the Wayback Machine
- CCOHS: Welding - Fumes And Gases | Health Effect of Welding Fumes

Classification	◦ **MeSH**: D018877 D
External resources	◦ **Patient UK**: Sick building syndrome

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Heating, ventilation, and air conditioning

Fundamental concepts	○ Air changes per hour ○ Bake-out ○ Building envelope ○ Convection ○ Dilution ○ Domestic energy consumption ○ Enthalpy ○ Fluid dynamics ○ Gas compressor ○ Heat pump and refrigeration cycle ○ Heat transfer ○ Humidity ○ Infiltration ○ Latent heat ○ Noise control ○ Outgassing ○ Particulates ○ Psychrometrics ○ Sensible heat ○ Stack effect ○ Thermal comfort ○ Thermal destratification ○ Thermal mass ○ Thermodynamics ○ Vapour pressure of water

Technology	○ Absorption-compression heat pump ○ Absorption refrigerator ○ Air barrier ○ Air conditioning ○ Antifreeze ○ Automobile air conditioning ○ Autonomous building ○ Building insulation materials ○ Central heating ○ Central solar heating ○ Chilled beam ○ Chilled water ○ Constant air volume (CAV) ○ Coolant ○ Cross ventilation ○ Dedicated outdoor air system (DOAS) ○ Deep water source cooling ○ Demand controlled ventilation (DCV) ○ Displacement ventilation ○ District cooling ○ District heating ○ Electric heating ○ Energy recovery ventilation (ERV) ○ Firestop ○ Forced-air ○ Forced-air gas ○ Free cooling ○ Heat recovery ventilation (HRV) ○ Hybrid heat ○ Hydronics ○ Ice storage air conditioning ○ Kitchen ventilation ○ Mixed-mode ventilation ○ Microgeneration ○ Passive cooling ○ Passive daytime radiative cooling ○ Passive house ○ Passive ventilation ○ Radiant heating and cooling ○ Radiant cooling ○ Radiant heating ○ Radon mitigation ○ Refrigeration ○ Renewable heat ○ Room air distribution ○ Solar air heat ○ Solar combisystem ○ Solar cooling ○ Solar heating

- Air conditioner inverter
- Air door
- Air filter
- Air handler
- Air ionizer
- Air-mixing plenum
- Air purifier
- Air source heat pump
- Attic fan
- Automatic balancing valve
- Back boiler
- Barrier pipe
- Blast damper
- Boiler
- Centrifugal fan
- Ceramic heater
- Chiller
- Condensate pump
- Condenser
- Condensing boiler
- Convection heater
- Compressor
- Cooling tower
- Damper
- Dehumidifier
- Duct
- Economizer
- Electrostatic precipitator
- Evaporative cooler
- Evaporator
- Exhaust hood
- Expansion tank
- Fan
- Fan coil unit
- Fan filter unit
- Fan heater
- Fire damper
- Fireplace
- Fireplace insert
- Freeze stat
- Flue
- Freon
- Fume hood
- Furnace
- Gas compressor
- Gas heater
- Gasoline heater
- Grease duct

Components

- Grille

Measurement and control	○ Air flow meter ○ Aquastat ○ BACnet ○ Blower door ○ Building automation ○ Carbon dioxide sensor ○ Clean air delivery rate (CADR) ○ Control valve ○ Gas detector ○ Home energy monitor ○ Humidistat ○ HVAC control system ○ Infrared thermometer ○ Intelligent buildings ○ LonWorks ○ Minimum efficiency reporting value (MERV) ○ Normal temperature and pressure (NTP) ○ OpenTherm ○ Programmable communicating thermostat ○ Programmable thermostat ○ Psychrometrics ○ Room temperature ○ Smart thermostat ○ Standard temperature and pressure (STP) ○ Thermographic camera ○ Thermostat ○ Thermostatic radiator valve
Professions, trades, and services	○ Architectural acoustics ○ Architectural engineering ○ Architectural technologist ○ Building services engineering ○ Building information modeling (BIM) ○ Deep energy retrofit ○ Duct cleaning ○ Duct leakage testing ○ Environmental engineering ○ Hydronic balancing ○ Kitchen exhaust cleaning ○ Mechanical engineering ○ Mechanical, electrical, and plumbing ○ Mold growth, assessment, and remediation ○ Refrigerant reclamation ○ Testing, adjusting, balancing

Industry organizations	○ AHRI ○ AMCA ○ ASHRAE ○ ASTM International ○ BRE ○ BSRIA ○ CIBSE ○ Institute of Refrigeration ○ IIR ○ LEED ○ SMACNA ○ UMC
Health and safety	○ Indoor air quality (IAQ) ○ Passive smoking ○ Sick building syndrome (SBS) ○ Volatile organic compound (VOC)
See also	○ ASHRAE Handbook ○ Building science ○ Fireproofing ○ Glossary of HVAC terms ○ Warm Spaces ○ World Refrigeration Day ○ Template:Home automation ○ Template:Solar energy

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Employment

Classifications	○ Academic tenure
	○ Casual
	○ Contingent work
	○ Full-time job
	○ Gig worker
	○ Job sharing
	○ Part-time job
	○ Self-employment
	○ Side job
	○ Skilled worker
	    ○ Journeyman
	    ○ Technician
	    ○ Tradesperson
	○ Independent contractor
	○ Labour hire
	○ Temporary work
	○ Laborer
	○ Wage labour

Hiring	◦ Application ◦ Background check ◦ Business networking ◦ Cover letter ◦ Curriculum vitae ◦ Drug testing ◦ Employment contract ◦ Employment counsellor ◦ Executive search ◦ list ◦ Induction programme ◦ Job fair ◦ Job fraud ◦ Job hunting ◦ Job interview ◦ Letter of recommendation ◦ Onboarding ◦ Overqualification ◦ Person–environment fit ◦ Personality–job fit theory ◦ Personality hire ◦ Probation ◦ Realistic job preview ◦ Recruitment ◦ Résumé ◦ Simultaneous recruiting of new graduates ◦ Underemployment ◦ Work-at-home scheme
Roles	◦ Cooperative ◦ Employee ◦ Employer ◦ Internship ◦ Job ◦ Labour hire ◦ Permanent employment ◦ Supervisor ◦ Volunteering

Working class	○ Blue-collar ○ Green-collar ○ Grey-collar ○ Pink-collar ○ Precariat ○ White-collar ○ Red-collar ○ New-collar ○ No-collar ○ Orange-collar ○ Scarlet-collar ○ Black-collar ○ Gold-collar

Career and training

- Apprenticeship
- Artisan
  - Master craftsman
- Avocation
- Career assessment
- Career counseling
- Career development
- Coaching
- Creative class
- Education
  - Continuing education
  - E-learning
  - Employability
  - Further education
  - Graduate school
  - Induction training
  - Knowledge worker
  - Licensure
  - Lifelong learning
  - Overspecialization
  - Practice-based professional learning
  - Professional association
  - Professional certification
  - Professional development
  - Professional school
  - Reflective practice
  - Retraining
  - Vocational education
  - Vocational school
  - Vocational university
- Mentorship
- Occupational Outlook Handbook
- Practice firm
- Profession
  - Operator
  - Professional
- Tradesman
- Vocation

Attendance	◦ Break ◦ Break room ◦ Career break ◦ Furlough ◦ Gap year ◦ Leave of absence ◦ Long service leave ◦ No call, no show ◦ Sabbatical ◦ Sick leave ◦ Time clock
Schedules	◦ 35-hour workweek ◦ Four-day week ◦ Eight-hour day ◦ 996 working hour system ◦ Flextime ◦ On-call ◦ Overtime ◦ Remote work ◦ Six-hour day ◦ Shift work ◦ Working time ◦ Workweek and weekend

Wages and salaries	◦ Income bracket
	◦ Income tax
	◦ Living wage
	◦ Maximum wage
	◦ National average salary
	    ◦ World
	    ◦ Europe
	◦ Minimum wage
	    ◦ Canada
	    ◦ Hong Kong
	    ◦ Europe
	    ◦ United States
	◦ Progressive wage
	    ◦ Singapore
	◦ Overtime rate
	◦ Paid time off
	◦ Performance-related pay
	◦ Salary cap
	◦ Wage compression
	◦ Working poor

Benefits	◦ Annual leave ◦ Casual Friday ◦ Child care ◦ Disability insurance ◦ Health insurance ◦ Life insurance ◦ Marriage leave ◦ Parental leave ◦ Pension ◦ Sick leave ◦ United States ◦ Take-home vehicle

Safety and health	◦ Crunch
	◦ Epilepsy and employment
	◦ Human factors and ergonomics
	◦ Karoshi
	◦ List of countries by rate of fatal workplace accidents
	◦ Occupational burnout
	◦ Occupational disease
	◦ Occupational exposure limit
	◦ Occupational health psychology
	◦ Occupational injury
	◦ Occupational noise
	◦ Occupational stress
	◦ Personal protective equipment
	◦ Repetitive strain injury
	◦ Right to sit
	    ◦ United States
	◦ Sick building syndrome
	◦ Work accident
	    ◦ Occupational fatality
	◦ Workers' compensation
	◦ Workers' right to access the toilet
	◦ Workplace health promotion
	◦ Workplace phobia
	◦ Workplace wellness

Equal opportunity	◦ Affirmative action ◦ Equal pay for equal work ◦ Gender pay gap ◦ Glass ceiling

Infractions	- Corporate collapses and scandals
	  - Accounting scandals
	  - Control fraud
	  - Corporate behaviour
	  - Corporate crime
	- Discrimination
	- Exploitation of labour
	- Dress code
	- Employee handbook
	- Employee monitoring
	- Evaluation
	- Labour law
	- Sexual harassment
	- Sleeping while on duty
	- Wage theft
	- Whistleblower
	- Workplace bullying
	- Workplace harassment
	- Workplace incivility

Willingness	- Boreout
	- Careerism
	- Civil conscription
	- Conscription
	- Critique of work
	- Dead-end job
	- Job satisfaction
	- McJob
	- Organizational commitment
	- Refusal of work
	- Slavery
	  - Bonded labour
	  - Human trafficking
	  - Labour camp
	  - Penal labour
	  - Peonage
	  - Truck wages
	  - Unfree labour
	  - Wage slavery
	- Work ethic
	- Work–life interface
	  - Downshifting
	  - Slow living
	- Workaholic

Termination	- At-will employment
	- Dismissal
	    - Banishment room
	    - Constructive dismissal
	    - Wrongful dismissal
	- Employee offboarding
	- Exit interview
	- Layoff
	- Notice period
	- Pink slip
	- Resignation
	    - Letter of resignation
	- Restructuring
	- Retirement
	    - Mandatory retirement
	    - Retirement age
	    - Retirement planning
	- Severance package
	    - Golden handshake
	    - Golden parachute
	- Turnover

Unemployment	◦ Barriers to entry
	◦ Discouraged worker
	◦ Economic depression
	    ◦ Great Depression
	    ◦ Long Depression
	◦ Frictional unemployment
	◦ Full employment
	◦ Graduate unemployment
	◦ Involuntary unemployment
	◦ Jobless recovery
	◦ Phillips curve
	◦ Recession
	    ◦ Great Recession
	    ◦ Job losses caused by the Great Recession
	    ◦ Lists of recessions
	    ◦ Recession-proof job
	◦ Reserve army of labour
	◦ Structural unemployment
	◦ Technological unemployment
	◦ Types of unemployment
	◦ Unemployment benefits
	◦ Unemployment Convention, 1919
	◦ Unemployment extension
	◦ List of countries by unemployment rate
	◦ Employment-to-population ratio
	    ◦ List
	◦ Wage curve
	◦ Youth unemployment

Public programs	◦ Workfare ◦ Unemployment insurance ◦ Make-work job ◦ Job creation program ◦ Job creation index ◦ Job guarantee ◦ Employer of last resort ◦ Guaranteed minimum income ◦ Right to work ◦ *Historical:* ◦ *U.S.A.:* ◦ Civil Works Administration ◦ Works Progress Administration

Comprehensive Employment and Training Act

See also

- Bullshit job
- Busy work
- Credentialism and educational inflation
- Emotional labor
- Evil corporation
- Going postal
- Kiss up kick down
- Labor rights
- Make-work job
- Narcissism in the workplace
- Post-work society
- Presenteeism
- Psychopathy in the workplace
- Sunday scaries
- Slow movement (culture)
- Toxic leader
- Toxic workplace
- Workhouse

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- Aspects of corporations
- Aspects of jobs
- Aspects of occupations
- Aspects of organizations
- Aspects of workplaces
- Corporate titles
- Critique of work
- Organized labor

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Things To Do in Jefferson County

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Jefferson County Historical Village

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Visit Jefferson County Tennessee

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Jefferson Barracks Park

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Jefferson County Area Tourism Council

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Visit Jefferson County PA

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Rockford Park

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Driving Directions in Jefferson County

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Driving Directions From Trade N Games to Royal Supply Inc

Driving Directions From Five Below to Royal Supply Inc

Driving Directions From GameStop to Royal Supply Inc

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Driving Directions From Jefferson Barracks Park to Royal Supply Inc

Driving Directions From Visit Jefferson County PA to Royal Supply Inc

Driving Directions From Jefferson County Convention & Visitors Bureau to Royal Supply Inc

Driving Directions From Jefferson Barracks Park to Royal Supply Inc

Driving Directions From Jefferson County Historical Village to Royal Supply Inc

Driving Directions From Gardens of Jefferson County to Royal Supply Inc

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Reviews for Royal Supply Inc

Royal Supply Inc

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bill slayton

(1)

Went to get a deadbolt what they had was one I was told I'd have take it apart to lengthen and I said I wasn't buying something new and have to work on it. Thing of it is I didn't know if it was so that it could be lengthened said I didn't wanna buy something new I had to work on just to fit my door. He got all mad and slung the whole box with part across the room. A real business man. I guess the owner approves of his employees doing as such.

Royal Supply Inc

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Gidget McCarthy

(5)

Very knowledgeable, friendly, helpful and don't make you feel like you're inconveniencing them. They seem willing to take all the time you need. As if you're the only thing they have to do that day. The store is clean, organized and not cluttered, symmetrical at that. Cuz I'm even and symmetricals biggest fan. It was a pleasure doing business with them and their prices are definitely reasonable. So, I'll be doing business with them in the future no doubt.

Royal Supply Inc

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Toney Dunaway

(5)

This is another amazing place where we will do much more business. They are not tyrannical about the totally useless face diapers, they have a great selection of stock, they have very knowledgeable staff, very friendly staff. We got the plumbing items we really needed and will be getting more plumbing items. They also have central units, thermostats, caulking, sealants, doors, seems everything you need for a mobile home. We've found a local treasure and will be bringing much more business. Their store is clean and tidy as well!

Royal Supply Inc

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Terry Self

(1)

Horrible workmanship, horrible customer service, don't show up when they say they are. Ghosted. Was supposed to come back on Monday, no call no show. Called Tuesday and Wednesday, left messages both days. Nothing. Kinked my line, crooked to the pad and house, didn't put disconnect back on, left the trash.....

Evaluating Total Costs for System Retrofits**View GBP**

Frequently Asked Questions

What are the primary costs associated with retrofitting an HVAC system in a mobile home?

The primary costs include equipment purchase (such as heat pumps or air conditioning units), installation labor, potential upgrades to ductwork or electrical systems, permits, and any necessary structural modifications.

How do energy efficiency considerations impact the total cost of an HVAC retrofit in a mobile home?

Energy-efficient systems may have higher upfront costs but can lead to significant savings on utility bills over time. Evaluating energy ratings and potential rebates or incentives is crucial for understanding long-term cost impacts.

Are there financing options available for reducing the immediate financial burden of an HVAC retrofit in a mobile home?

Yes, many manufacturers and installers offer financing plans. Additionally, government programs and local utilities might provide loans or grants aimed at improving energy efficiency, which can help spread out costs.

What factors should be considered when assessing the return on investment (ROI) for an HVAC system retrofit in a mobile home?

Considerations should include initial costs versus expected savings on energy bills, lifespan of new equipment, maintenance requirements, impact on property value, and eligibility for tax credits or rebates.

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