Chemical Methodologies

Journal homepage: http://chemmethod.com

Original Article

Investigating Energy Saving in the Design of the Oil and Gas Industry Safety Training Center with the Perspective of Using Renewable Resources

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A R T I C L E I N F O

Article history

Submitted: 2024-02-05
Revised: 2024-02-25
Accepted: 2024-03-03

ID: CHEMM-2402-1762
Checked for Plagiarism: Yes
Language Checked: Yes

DOI: 10.48309/CHEMM.2024.441854.1762

K E Y W O R D S

Safety
Renewable resources
Sewage distribution and water recycling
Pipes with high thermal coefficient
Thermal package

A B S T R A C T

In the field of safety in the oil and gas industry, fire training centers are one of the most effective places that provide safety services in the three sectors of training, prevention and combat. Therefore, the design and construction of safety and rescue centers, the use of machines and the optimization of operation, increase the efficiency of the aid and rescue stations. The aim of the present study is to identify and investigate the amount of thermal comfort indicators and planning, sustainable development, climate design of architecture and the use of renewable resources in the design of the training center with climatic data and energy saving in the design of the oil and gas industry safety training center from the perspective of use. All buildings must be energy efficient buildings. The principle of saving resources, on the one hand, deals with the proper use of non-renewable resources and energy such as fossil fuels, in order to reduce consumption, and on the other hand, it pays serious attention to the control and use of natural resources as best as possible as renewable and lasting reserves. The results of the study showed that the use of pipes with a high thermal coefficient, thermal insulations suggested according to the study, thermal packages with renewable energies and adhesives with a thermal conductivity coefficient higher than 0.375 are very effective. Conducting the present study showed that the use of wastewater distribution and recycling of the resulting water to the environment using international standards saves water consumption by 29%.

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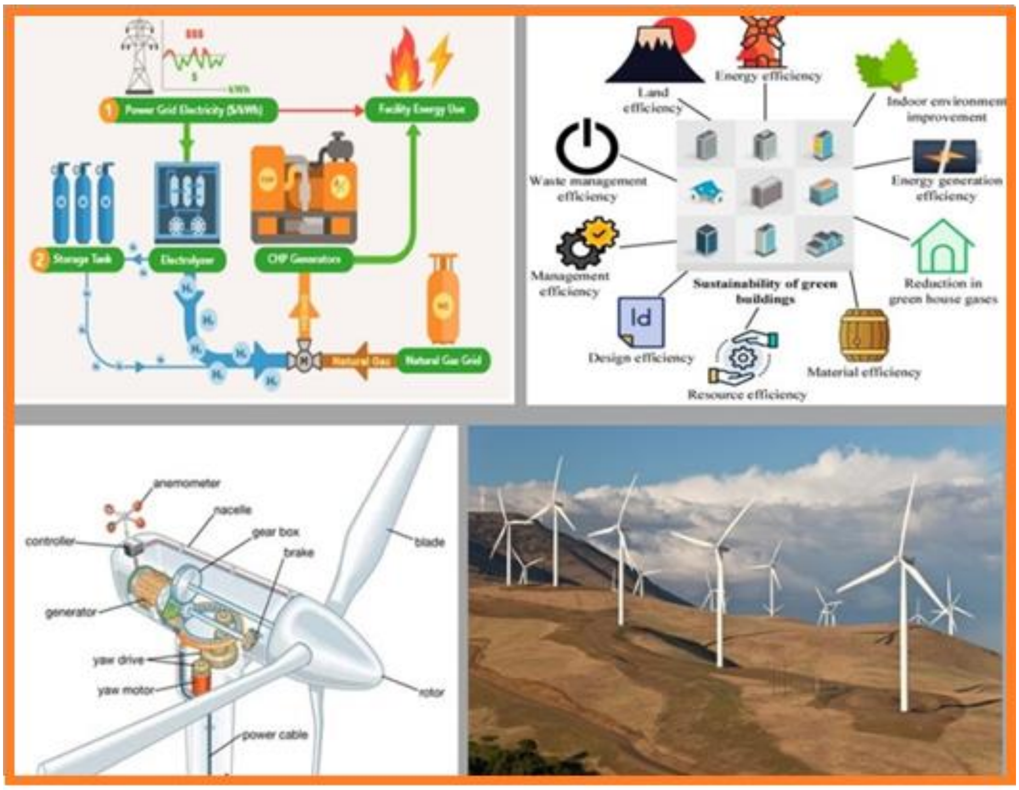
GRAPHICALABSTRACT



Introduction

Having safe buildings by observing safety aspects along with environmental issues has been one of the important concerns of organizations and responsible individuals. Although the creation of safety is accompanied by the presence of rescue groups and the establishment of rules, these rescuers and engineers cannot keep up with the updated technology without trial and error and equipment testing, and they need a place to train, practice and test safety equipment [1]. On the other hand, after the energy crisis in 1973, which occurred as a result of the oil embargo, the world's attention to the use of non-fossil renewable energies such as water and wind, solar energy, geothermal energy, biomass, etc. and the design of climate buildings increased [2]. Furtehrmore, paying attention to creating a more complete understanding of renewable energies and static cooling and heating methods, without dependence on fossil energies, are effective in creating people's physical comfort the goals of sustainable societies [3]. With the formation of new attitudes to architecture, environment, and safety with destruction of the environment through the increase in energy consumption in the world, the destruction of forests and pastures, and the extinction of animal species is happening while the current discussion of many international and national assemblies and agencies around the world is carried out with the aim of accelerated economic exploitation and industrial development [4]. It is like that both man and nature became victims of the accelerated movement of industrial development. From the beginning of the second half of the 20th century, the emergence and spread of environmental ideas, especially after the energy crisis in 1973, the issue of sustainable and harmless energy was seriously placed on the agenda of most countries of the world, especially industrialized countries [5]. On the other hand, the neglect and lack of domestic progress in research and use of sustainable energy, mainly due to the abundance of fossil energy resources inside the country, it is very low prices, which are much lower than the real price and its natural balance, which causes using it, the national capital of future generations will be wasted and the environment will be endangered. Although the low price of fossil energies makes their use more profitable than harmless energies [6]. However, this does not in any way mean that it is not economical to use harmless energies in the long term, especially from a macroeconomic viewpoint. Energy consumption in buildings, especially residential buildings, does not end only with heating and cooling. Rather, it includes all stages of design, construction, and operation of the building [7]. The aim of improving the quality of life, with the help of sustainable and green solutions and reducing dependence on fossil energies and minimizing energy consumption, knowing the safety methods and standards required for static cooling and heating that throughout history creation of human comfort conditions has been considered in a more detailed and comprehensive manner [8]. Accordingly, the aim of this study is to know the climatic features and to try to achieve a safety and rescue training center for rescuers for special, specialized exercises, and engineers to test comfort equipment with a sustainable architectural approach with a lasting look at resources, trying to reduce human dependence on energy. Fossils and issues related to renewable energies such as wind, water, sun, etc. as well as knowledge of static cooling and heating systems with each climate [9-11].

In this study, the aim is to identify and investigate the amount of thermal comfort indicators and planning, sustainable development, climate design of architecture, and the use of renewable resources in the design of the training center with climatic data and energy saving in the design of the oil and gas industry safety training center from the perspective of use.

Research Background

(1) NFPA (2012) in the set of standards under the title of the American National Institute of Fire Prevention, which has code 1402 regarding the design of the training center, has described the relevant standards and laws in general [12].

(2) Wright (2011) in a book entitled: "*Alphabet of sustainable architecture, the use of solar architecture*" has discussed the methods of sustainability in architecture and how to use new energies and the way to use solar energy as clean energy [13].

(3) Tomeh (2012) has presented the rules and regulations for the creation of a fire station in a book entitled: "*Designing identical fire stations*" [14].

(4) Atman (2011) defined green architecture in a book titled green architecture with advanced materials and technologies and introduced the approaches of green architecture with renewable materials [15].

(5) Hint Vehkaran (2013) in the book Smart Architecture defines smart architecture and the use of smart modern materials [16].

(6) Shams, Mohammad Hossein *et al.* (2013) discussed the use of solar energy and photovoltaic technology in a review article on solar energy production and comparing the statistics of the world's largest solar power plants [17].

Data Analysis Method

Collecting information for project research includes the following. Research on sustainable development, sustainable architecture, eco-oriented architecture, responsive architecture, green architecture, smart architecture, and renewable energies, and also drawing conclusions from the principles of sustainable design and adapting and applying these principles in the field of design according to the facilities and limitations of the site and regarding training centers are designed based on educational principles with the aim of various operational exercises with the possibility of reviewing, and analyzing the performed maneuvers.

Basic Components Include The Following: (NFPA1402,2012:7)

Purification of Water Sources

The maximum necessary water storage source should be estimated to the extent that a system is sufficient to provide the volume and pressure of water required for educational activities, fire protection systems, and current needs of the educational center. Water sources should be in the intended place and artificial water storage sources should be installed if necessary, underground sources can be further used. Pumps can also be used to transfer water under suitable pressures [18].

Water and Sewage Distribution

Wastewater disposal from firefighting operations, the degree of sewage pollution varies depending on its implementation. If its operational path deals with flammable or combustible hydrocarbons or other chemicals or compounds that cause environmental pollution, rules for separating contaminated materials should be concerned in advance. Care should be taken to avoid groundwater contamination [19].

Environmental Cleaning Activities

When we choose a place for the training center; environmental factors should be considered in it. It is important to make sure that the training center is environmentally safe. Factors that should be considered from an environmental aspect are water, air, and soil (land). The degree of sewage pollution varies depending on its implementation [20].

Education Center Buildings

It is preferred not to use the tower for live fire and to do this in a separate structure (NFPA1402, 2012: 16). The area around the training tower should be designed to accommodate training needs. It usually requires paving on all four sides. Barriers, sidewalks, street signs, light poles, and overhead power cables can be added to one or more sides. The height of the tower should depend on the local conditions and is usually between 40 and 70 feet. Connection of nozzles and vertical pipe should be at all levels of the floors. And the water source that can cover all the floors and the dividing valves that are under the control of the trainers can be used in operations. (NFPA1402, 2012: 17). An emergency staircase can be installed in the tower. Fences should be safe and high enough for a firefighter to escape easily. The emergency stairwell can end on the ground or a vertical ladder [21].
Aluminum and calcium concrete should not be used for concrete slabs, beams, walls, columns, or other building components that may bear pressure in the educational structure. In the design of the educational structure, attention should be paid to the issues caused by fire temperature and thermal shock (Figurre 1) [22].

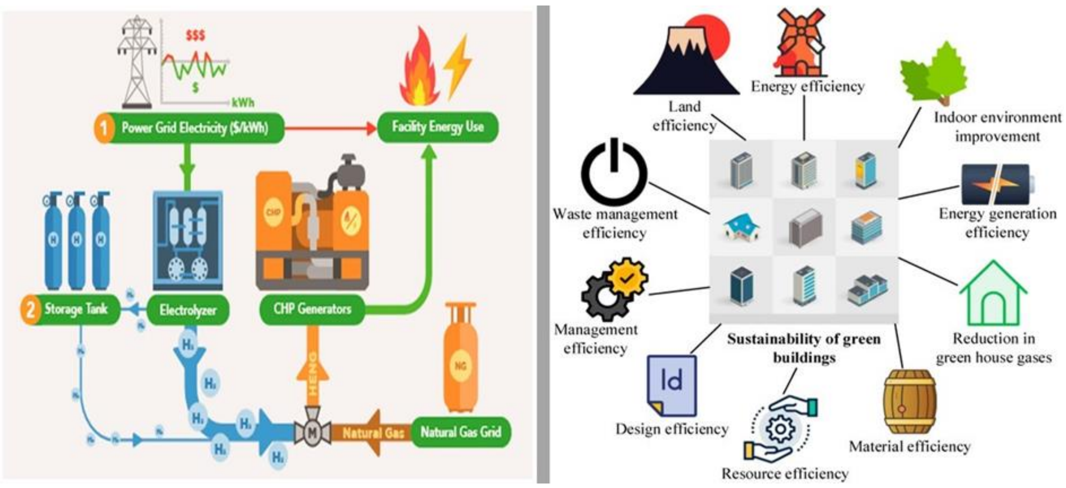


Figure 1: Digital twins for intelligent green buildings

Fire Station

When designing a fire station, the most important strategic attitude is that the different operational parts of the station are planned in a complex and interrelated manner so that the two effective factors of time, i.e. the time of access to operational vehicles and the time of sending to the mission, are reduced to the minimum possible time. In the design of the fire station, the key element is to consider the duration of the operation. For this purpose, all departments should be designed in such a way that the duration of movements and transfers in different parts of the station while maintaining the complete safety of all operational employees is reduced to the minimum possible time. Along with these effective elements, the existence of an efficient training center can provide great help to operational training and simulating the real environment for trainees and trainees [23].

Fire Station Design Rules and Regulations

The planning and design of fire stations requires the existence of a set of design rules and regulations in this field. Accordingly, the spatial structure of the fire station has been determined based on the uses and type of activity [24].

The Main Building of the Station

The main building of the station includes all the spaces that are used by the employees of various departments of operation, management and visitors to the station [25].

Information and Communication Room

This room should be soundproofed to create the possibility of full hearing. This room should be designed and located in such a way that it has full access to the traffic network adjacent to the exit station of the hangars and the entrance to the station, and it monitors and controls the entry and exit of all people in the building. The front part of this place is made of glass so that a person can see 180 degrees. This room should be made of fire-proof materials to protect it from all destructive losses that cause the slow response of alarm devices. In this room, the necessary space for installing the necessary tables and maps on the wall should be provided. This room should have good communication and access with the vehicle hangar. The security space of the communication room must be protected against the sun's rays and the glare caused by it. The hangar of fire and rescue vehicles has more complexity and functional variety compared to other spaces of the station. At the time of announcing the operation as the starting point of the operation group, the vehicle hangar is the last place where the employees from other areas of the station gather, and at the end of the operation and the group's return to the station, it is the first place of the station that the employees enter and through it to other areas [26-28].

The minimum height of the nest door is 3.6 meters and its width is 4.20 meters. Adjacent to the foam storage shed for storing these materials in special gallons, the spare hose storage includes a very clean and dry room with the possibility of natural ventilation and the installation of shelves with hooks for hanging the hoses. The location of breathing apparatus with proper ventilation to the open air and the possibility of high cleaning, the battery charging section, including a clean room with fresh and airy air, with door cabinets equipped with battery charging devices, should be provided according to the size and class of the station. To prevent the emission of smoke caused by the combustion of the engine of operational vehicles, hose pipes should be used that are connected to their exhaust pipe and through the piping network on the floor or ceiling, the smoke is directed out of the hangar space.

The Concept of Sustainable Energy Design in Architecture

Eco-friendly buildings provide healthy and livable environments for their residents. In Brotland's attitude, it is pointed out the necessity of pursuing a new approach based on sustainability thinking in various fields of design (including the design of industrial products, service systems, and the environment) [7].

Therefore, he emphasizes the efficiency of the design process and product from an environmental and economic point of view, and considers sensitivity to various aspects of environmental issues inevitable in design. The international document Agenda 21 in sustainable construction also emphasizes the contribution of the construction industry in energy consumption, gross national product, job creation, waste creation, and pollution production, and also emphasizes the need to pay attention to the consequences of the design and construction of the human environment and in line with the change in the current methods of design, construction, operation, and management of human spaces to be necessary and inevitable for the sustainable natural human environment [11].
As mentioned, since the end of the 20th century, a series of environmentally sensitive approaches have been followed, the main of which are energy-efficient design, solar design, green design, environmental design, sustainable design, and sustainable design. Paying attention to the environmental consequences of design decisions and trying to minimize the negative effects of the design (design product). What makes sustainable design higher than other design approaches is that it is always a question. The main issue is about the justification and accepting the design result and from the sustainable ethics viewpoint [12].
The answer to this question requires that other elements are involved in the decision-making process of the design process: Socio-cultural patterns, the design context, the main issues, and also needs of the biological community, future needs, and principles of sustainable ethics. Therefore, the approach of sustainable environmental design is presented as a comprehensive and innovative design approach to environmental issues, in which the designer's goal is not only to solve architectural problems, but also at a higher level, to respond to socio-cultural and ecological issues of the design platform. Only in this way can the designer truly claim to have worked based on a sustainable plan and process for the present and the future [29].

Principles of sustainable design in architecture

Achieving a sustainable architectural design is possible by following a set of design principles. These principles are:
(1) The scale of the environment, a comprehensive attitude towards the environment;
(2) Design with nature or nature as a design model [2];
(3) Time scale in the design, designing the cycle of the courtyard of the architectural effect; and
(4) Human design [14].

Environment Scale (Comprehensive Attitude towards the Environment)

As it was mentioned, in sustainable architecture, the environment beyond here, that is, the context surrounding the architectural work, is considered. Sustainable architecture does not end only with single buildings, but also the deep concept of connection with the universal context expands it on the scale of neighborhoods and biological complexes, cities, and their constructions, as well as beyond. From the moral-value position, the plan platform is the entire planet earth, with the belief that the consequences of design decisions have spread in scales far beyond the specific platform of the plan and affect a much wider range of direct users of the building.
However, special emphasis is always placed on the factors of the local context (surroundings) of the plan. In sustainable design, design solutions arise from Webster's possibility of design. Instead of imposing abstract and ecologically irrelevant solutions on the environment, solutions are formed that arise from the investigation and study of a specific place. Such a work can respond to the local conditions and the demands and needs of its residents and continue in its special context and place [30].

Designing With Nature (Nature as a Design Model)

In sustainable design, nature is considered as the model of a naturally sustainable system, the main model and basis of design. Therefore, what is intended is modeling of biological systems of nature and ecosystems. "Designing with bad nature means that the main origin of design ideas comes from the knowledge of ecological processes and patterns of nature. This means a detailed and thorough knowledge of nature's systems" are as follow:

(1) The sun is the origin and main source of energy and self-organization, they design, and manage their natural systems;

(2) Tendency towards dynamic balance and evolutionary development, dependence between evolutionary growths of different species [4];

(3) Hierarchical shared set of interrelationships;

(4) Dependence between the parts and the whole, the connection and interconnection between the parts while forming an integrated whole [17];

(5) Flexibility, adaptability and compatibility of natural systems with environmental and concrete conditions through feedback cycles [12]; and

(6) The desire to create a self-sustainable system, a system in which material and energy processes are turned into internal cyclical processes as much as possible [25].

Therefore, in sustainable design, a building is designed as a biological system with characteristics similar to natural systems. In addition, in sustainable design, nature is emphasized in the design. Therefore, the basis of this principle is the sense of social responsibility and respect towards nature and its processes, through the process and results of design, designs that make nature more tangible and closer and present to the eyes should be developed and promoted [30].

Time Scale in Design (Architecture Life Cycle Design)

From the ethical position of paying attention to future women's rights, intergenerational justice, and social justice is one of the basic principles of sustainability thinking, in sustainable design, this means "sustainability of the design product and establishing a balance between current demands, needs, and the uncertainty caused by possible necessities and demands in the future." Therefore, the dimension of time in sustainable design is considered one of its indicators [31].

Stability Components of the Plan

To achieve the optimal function of the architectural design, a more detailed and complete understanding of the mutual relationship between the building and the surrounding environment seems necessary, the complexity of this relationship, its wide and comprehensive scope, and the need to achieve a common expression in explaining and communicating the related concepts suggest a whole system approach. In the approach of the whole system, rather than dividing and transforming a structure into its components, it is emphasized to know the relationships between the components with each other and the whole environment system. Therefore, the path of knowledge in the whole system approach is from the whole to the part and from the part to the whole, which ultimately leads to the knowledge of the basic factors and the roots of a year, and as a result, more durable comprehensive and fair solutions. Based on what was mentioned, the building forms an open system, that is, it is a system that is in a constant two-way interaction with other domains (systems) beyond itself. Therefore, the conditions and situations it accepts rely on the conditions and status of other related systems and the environment that includes the complex, while emphasizing and focusing on the interaction between the building and its users.

Therefore, in sustainable design, the objective design goals for the environmental function of the design are explained and managed from the perspective of the environment (the ecological function of the design), the economic (the economic function of the design) and the socio-cultural (the socio-cultural function of the design) with the help of a whole system approach. In addition, the effects of the building as a living space on its users and residents, and vice versa, the effects of the residents on their living space can be investigated and managed [32].

Energy Sources

We divide all energy sources into two main non-renewable groups:

Renewable (Sustainable)
Sun [13]; Wind [15]; Biomass [1]; Geothermal 16]; and Nonrenewable [17].

Non-renewable: Fossil Fuels

Oil and its derivatives and Natural gas.
The mentioned conditions are unfortunate because not only these resources are used, but they are the only resources that cause pollution and global warming. It is our duty to change our use of non-renewable resources as quickly as possible.

Renewable Energy (Sustainable)

Although mankind has been using renewable energies such as wind and sun in his life for a long time, but with the discovery of sources of fossil fuels such as coal and oil and their attractions, the use of renewable energies has been gradually forgotten. Global investments in sustainable energy in 2008 were more than 155 million dollars, and investment in the field of new energy production (for example, wind, solar, biofuels, etc.) worldwide was 116.9 million dollars. In the report of UNEP (2009), the latest investment attraction from renewable energy is as follows: Wind energy 43%, solar energy 28%, and biofuels 14%, biomass and waste technology 7%. In 2008, investment in wind energy also experienced the fastest growth (123%) between 2007 and 2008 [19].

Solar Energy

Every year, more than three and a half times what a climate and environment friendly house needs for its daily needs is radiated by the sun's energy on its roof. The sun is not only a huge source of energy, but also the beginning of life and the source of all other energies. According to the scientific estimates, about 6,000 million years have passed since the birth of this fiery ball, and every second 2.4 million tons of the sun's mass is converted into energy. Concerning the weight of the sun, which is about 333 thousand times the weight of the earth, this luminous mountain can be considered as a huge source of energy for the next 5 billion years. The temperature in the center of the sun is about 10 to 14 million degrees Celsius, which radiates from its surface with a heat of nearly 5600 degrees in the form of electromagnetic waves.
The earth is located at a distance of 150 million kilometers from the sun, and it takes 8 minutes and 18 seconds for sunlight to reach the earth. Therefore, the share of the earth in receiving energy from the sun is about $\frac{1}{2*10^9}$of its total radiant energy. It is interesting that the fossil fuels stored in the depths of the earth, the energy of wind, waterfall, sea waves, and many other things are among the results of the same amount of energy received from the sun [20].

Applications of Solar Energy

In this era, solar energy is used and utilized by different systems and for different purposes, which are:
(1) Use of solar energy for domestic, industrial, and factory purposes;
(2) Direct conversion of the sun's rays into electricity by equipment called photovoltaic [32].

Use of Solar Thermal Energy

The growing need for energy and the depletion of fossil fuels on the one hand, and the increase in environmental pollution, on the other hand, have become a stimulus for researchers and investors in the energy sector to be attracted to harnessing and supplying energy from renewable sources. Concerning the high potential of radiation in large areas of Islamic Iran, among these sources, solar energy is more attractive. In a simple classification, the technologies of generating electricity from the sun are divided into three categories: Photovoltaic, concentrating solar heating, and emerging technologies, including ponds and solar ovens.

Among these three categories, photovoltaic technology, which operates based on the conversion of sunlight into electricity, has grown the most and today many countries use it in grid-connected and grid-independent formats. This part of solar energy applications includes two groups that collect and concentrate the sun's energy, creating high temperatures and the collected energy will be converted into electrical energy through heat exchangers, turbines, generators, or steam engines [14].

Non-solar Power Plant Applications

In addition to power plant use, solar energy can be used in the following industrial, commercial, and domestic fields:

(1) Water heating (solar water heaters for homes, buildings, factories, and swimming pools);

(2) Heating the interior of buildings [5];

(3) Cooling the interior of buildings with solar coolers;

(4) Solar water softeners (in household and industrial sizes);

(5) Solar dryers (for drying food and agricultural products) [22]; and

(6) Solar cookers.

Advantages of Solar Power Plant

(1) Electricity generation without fuel consumption;

(2) No need for a lot of water;

(3) No environmental pollution [30];

(4) The possibility of supplying electricity to small and regional networks;

(5) Low depreciation and long life; and

(6) No need for an expert [20].

Types of Solar Systems

Technologies of Photovoltaic Systems

In photovoltaic technology, solar rays are converted into electricity by small plates of photovoltaic semiconductors called solar cells. Photovoltaic cells are made in two forms, flat plate and concentrating. The flat plate type is the common solar cells that directly transmits light to a semi-conductor and converts it into electricity. But the concentrating cells first direct the sunlight with the help of a concentrated emitter and then direct it to the solar cell. A solar module is formed by connecting solar cells together. The production power of the solar cell and module alone may be enough to charge a small battery. Various materials have been used in the manufacture of solar cells, which have different efficiency and manufacturing costs. In fact, these cells should be designed in such a way that they can convert the wavelengths of sunlight that reach the earth's surface into useful energy with high efficiency. The materials used to make solar cells can be classified into three generations.

Solar Chemistry Systems

Chemical changes due to sunlight, photo electrolysis, photovoltaic cells, electrochemistry, and hydrogen production facilities;

Photovoltaic System

Converting solar energy into energy and solar cells [7];

Solar Thermal Systems

Including hot water supply systems, heating and cooling of buildings, fresh water supply, transmission and pumping systems, green space production systems (greenhouses), solar dryers, cooling systems, towers power, and solar dryer.

Wind Energy

Wind energy is the fourth type of green energy, which is related to solar energy, because it is produced by solar patterns and affects the topography of the earth. The rotation of the planet, weather, and topography affect the speed and direction of the wind that will be restrained. However, wind energy produces much less energy than solar energy. Wind energy is energy from moving air. Solar energy causes the earth to heat up, and the difference in temperature between two points causes air flow, and the earth's atmosphere, due to the movement of the earth's position, transfers heat from tropical regions to polar regions, which also causes wind. Ancient Iranians used wind power to pump water. Windmills were initially introduced to Europe in the 12th century. These mills were used for centuries to grind wheat and pump water. Windmills were originally used to pump water to fields and farms. Wind turbines were also responsible for generating electricity before electrifying villages in the 1930s. Where there is a lot of wind and electricity is expensive, wind power is often the best source of energy. All over the world, giant wind turbines and fields full of these turbines are producing electricity for power grids. Small turbines can become an excellent source of electricity for individual buildings where there is sufficient wind on site. Accordingly, they depend on the speed and duration of the wind. Of course, local wind conditions are very important and they should be investigated in the field for obstacles or especially favorable conditions. Mountain peaks, passes and beaches are often good places in all parts of the country.

Since the output power of a wind turbine is proportional to the cube of the wind speed, the presence of a windy area is very important, and there is also a great incentive to raise the turbine as high as possible to reach the wind at a higher speed. Wind machines are often placed on a mast. However, they can also be placed on buildings (Figure 2). The output power of a wind turbine is also proportional to the square of its blade length [1].

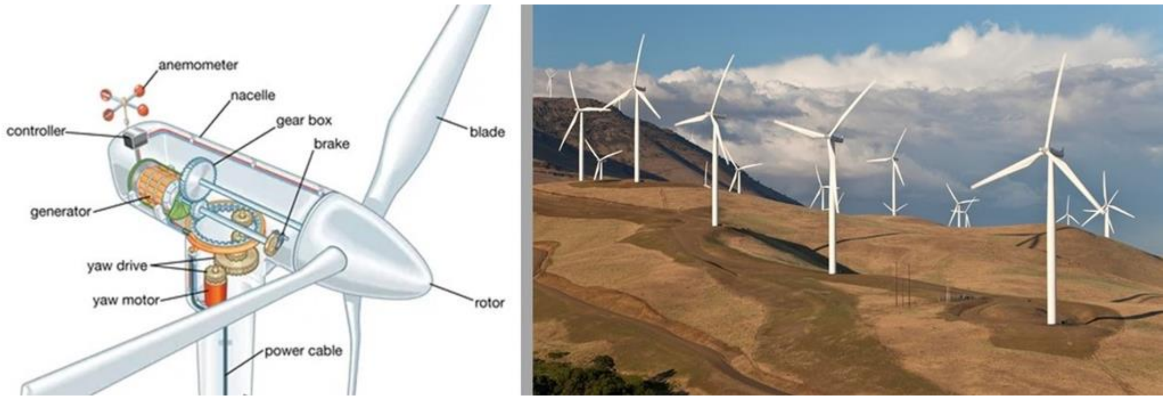


Figure 2: Wind generators

Geothermal Energy

Geothermal energy is one of the main sources of renewable energy. This energy is obtained from the heat of lava and the destruction of radioactive substances in the depths of the earth. Currently, it is not possible to extract heat directly from the earth. Only the heat that exists in the underground water can be used. Accordingly, the heat inside the earth is brought to its surface through the deep circulation of underground water and the penetration of water into the layers containing the molten lava of the earth. Today, thermal tanks are used in two main ways: indirect use of electricity production and direct use of thermal energy.

Discussion

Practical Solutions of Sustainable Architecture

The design of heating, cooling and lighting of the building is done in four stages.

A) The first stage is the design of the building body, so that heat dissipation in winter can be minimized and heat absorption in summer can be kept to its minimum value and light can be used effectively [7].

B) The second stage includes the use of natural energy through methods such as passive (static) heating, cooling and lighting systems. Appropriate decisions at this point can greatly reduce the amount of unsolvable problems in the first stage. Steps one and two of each are done through the design of the body of the building.

C) The third stage includes the use of natural energy through active (dynamic) systems, and

D) The fourth stage includes the design of mechanical equipment so that they can be used after the heat and light loads in stage 1, 2, and 3 have been reduced as much as possible. Therefore, the scale of mechanical equipment can be considered as an indicator of the architect's success or failure in using the body of the building to control its internal environment. It should be kept in mind that using intelligent management systems to adjust environmental conditions, it is possible to reduce mechanical equipment.

Keeping Warm and Staying Cool

In this chapter, we discuss the design of a seamless thermal wall [9]. The term thermal compartment is the right word to understand the facilities that a building evokes when it is completely thermally insulated. A thermal chamber has a suitable ratio in terms of area to volume, it is a very good insulator, and it is open to the outside, which is completely waterproof, and the entire chamber acts as a reflective screen.

Scientific Solutions about Keeping Warm and Staying Cool

The features of the design and materials used in the building have a great impact on the reactions of that building against the climatic elements around it. The amount of solar energy absorbed or penetrated in the building, air temperature, and internal surfaces, etc. depends on these characteristics [12].

Color and Texture

Dark colors absorb a lot of sunlight and become relatively hot. Because the temperature of the sun is much lower on light-colored surfaces than on dark-colored surfaces. One of the most efficient and certainly the least expensive methods of reducing heat absorption is the use of building procedures with light colors. A textured and uneven surface absorbs the sun's radiation waves more than a smooth surface of the same material.

Walls with holes or waves, such as a metal mesh or a corrugated sheet, provide maximum exchange surface for the minimum receiving area. When the absorbed light becomes infrared radiation, it is not dependent on different colors and it is absorbed by white color as much as black color. As polished metal surfaces have a high reflection value (reflection coefficient), however, they have little emission power and as a result, they are much warmer than bright colors that have high emission power.

Orientation Spatial Arrangement

The exposure to the external environment can be reduced by organizing the floor plan for thermal planning. Spaces that need or can tolerate colder temperatures should be placed on the north side of the building. Shock-absorbing spaces such as garages should be placed on the north side to protect the building from the cold or on the west side to protect the building from the summer heat. To prevent energy loss, the north face of the building should be less exposed to the sun as much as possible and the building should be hidden in the ground so that the surface in the vicinity of the wind is less. The building was built in such a way that it faces the cold winds [19].

Insulation

Insulation not only saves money, but also increases comfort, helps to create stable buildings, is relatively cheap, very durable, works both in summer and winter, and its installation during the initial implementation of the building, it is much easier than its future renovations. The insulating power of a material is determined by the amount of voids between its solid elements. These voids prevent the conduction of heat inside the materials. At the same time, it is better that the solid part also has low conductivity. The three main groups of insulation are:

Fibers

Glass wool, felt and bulk wool are among the types that are used in pillows and mattresses and have a lot of vacuum inside.

Sponge

Through freezing, a liquid is obtained that has many air bubbles injected into it. Among its examples are ordinary sponge, polyurethane and polyester and unolith.

Particles

It refers to the particles of objects that are crushed and made in bulk, such as sawdust, which is obtained from wood particles and has many voids.

Table 1 provides recommended insulation values. These values and values required in building regulations should be considered as minimum values. Among the other important features of insulation, we can mention resistance to moisture, fire resistance, the potential to produce toxic gases, physical resistance and its durability over time [6].

Table 1: Review of material, thermal resistance, physical form and their application in insulation

Description of the application	Physical form	Thermal resistance	A matter
Good fire resistance	Ra, pieces and blankets	3.2	Fiberglass
Relatively cheap	Injectable, hard	2.2 and 4.4	Rock wool
Good fire resistance	Injected, board	2.7	Pearlite
It can be injected in small holes; it needs processes to resist fire and decay.	Injected, spray board	3.2 and 3.5	Cellulose
The cost is relatively small. Flammable should be protected from fire and sunlight.	Hard board (glued board)	4	Polysterene
Very high resistance to moisture can be used underground; flammable should be protected from fire and sunlight.	Hard board	5	Polysterene
It is flammable and produces toxic fumes. It should be protected from moisture and fire.	Hardboard, foam in place	6.2 and 7.2	Urethane iso cyanurate
Effective in reducing the summer absorption of heat from the roof, the sheet should face the air, the sheet should face down to prevent dust from sitting on it.	Thin sheets with air space between them.	Variable	Reflective sheet

Most of the insulations used in the building are placed in one of the following five groups: Soft insulation (blanket), injected insulation, *in situ* foam insulation, boards, and radiation barriers [3].

Bam

The use of insulation in roofs has fewer problems. Because it can be installed easily, especially in the case of roofs with attic spaces. In addition, high ventilation usually prevents moisture from remaining in the insulating material or the roof skeleton. Although ventilation reduces the insulation effect.

Lab on the Floor

Insulation and Thermal Mass

Generally, buildings lose more heat at night than during the day. When the sun shines on the buildings in winter, it provides them with heat, but the energy loss continues to the outside. When the sun does not shine on the buildings, the elements that lose heat such as window frames, light fixtures, etc. should be insulated. Thermal mass can reduce heat absorption when temperatures fluctuate widely throughout the day. Its insulating effect reaches its most impressive when the daily temperature range varies from the top to the bottom of the comfort zone, that is, the situation seen in hot and dry climates. When a wall is exposed to the sun's energy, heat enters from one side of the wall, and after the wall heats up a lot, the heat leaves from the other side. This effect in directing the heat flow is known as time delay, which depends on the heat capacity and the time delay is longer. As a result, the higher the thermal mass, the higher the thermal capacity, and the longer the time delay [21].

This mass insulation effect has the greatest effect in hot and dry climates because it absorbs heat during the day in cold winter days and as a result of the time delay in the heat conduction from outside the wall to the inside, it brings the heat flow inside the building at night and in the summer. It also worked like this, but the building was cooled by night ventilation, while no heat entered the building during the day. Since the direction in the building experiences the major part of its heat absorption at a different time than other directions, the amount of time delay required for each wall and roof is different.

Table 2: Time delay of insulators

Time delay (hours)	Materials
10	Clay
10	Brick (regular)
6	Brick facade)
8	Heavy concrete)
20	Wood

Static (Passive) Solar Systems

Static solar systems include heating and cooling systems, which are described as follows:

Static Solar Heating System

Every static solar heating system has at least two elements. A collector that consists of south-facing windows and an energy storage element that usually consists of thermal mass such as stone or water. A static solar system is part of a logical design process that is carried out through a four-step approach. The initial step is to minimize the heat rejection from the building wall through insulation, orientation, and proper volume-to-surface ratios. The better the architect designs the thermal wall of the building; the less heating will be required. The second stage consists of collecting solar energy using static methods and finally mechanical equipment and fossil energy in the third stage [32].

Direct Absorption Systems

Any south-facing window creates a direct absorption system, while windows located in other directions lose more heat than they absorb in winter. The greenhouse effect enables the entry of solar energy with short wavelengths, but it prevents heat from escaping, then the thermal mass inside the building absorbs this heat to prevent the building from burning during the day, and it can be used in save for the night. When energy collection and initial costs are the main concern of the designer, the direct absorption of all static systems will be the most efficient system (Table 3).

Table 3: Comparison of thickness and area of building materials with glass

Surface area per square foot of glass	Thickness (inches)	Thermal mass
3	**4 to 6**	Masonry materials with concrete exposed to direct sunlight
6	**2 to 4**	Masonry materials with concrete exposed to the reflected radiation of the sun
About 1.2	**About 6**	Water

Except in very mild climates, double-glazed windows should be used. The building should be well-insulated. The area of south-facing windows in the direct absorption system should not exceed about 20% of the building, unless there is a need for large amounts of light for natural lighting, sunbathing, etc. To provide the additional area of the glasses, either the Trump wall or the solar space is used (Table 4).

Table 4: Thermal mass of building materials

Surface area per square foot	**Thickness (inches)**	**Thermal mass**
1	6 to 10	Clay (dry soil)
1	10 to 16	Concrete with bricks
2	8 or more	Water

Solar Space

A solar space is a room designed to collect heat for the main part of the building and as a secondary living space. Through the tables related to sunny days, we can obtain the amount of solar energy that shines on different levels with different angles and directions. The optimal angle with respect to the bodies, latitude, sunrise time, and distance from the sun is obtained. In a location, which is determined based on the latitude, intensity, and position of the sun; it is possible to determine the intensity of the sun. After that, we have to calculate the number of sunny days per year. In many parts of the world, the percentage of solar radiation that reaches the earth each year is much less than what we should receive 365 days a year. Many factors such as smoke from factories, cloudy weather, suspended particles, fog, etc. reduce the percentage of sunlight from 40 to 90% only in terms of theoretical calculations because the temperature in the solar space is allowed to fluctuate from a maximum of 32.2 °C on a sunny day to a minimum of 10 °C during the winter night. This system can be considered as an additional living space (Table 5).

Table 5: Comparison of the three main static solar heating systems by listing the advantages and disadvantages of each approach

Disadvantages	Advantages	System
Too bright, which can cause glare and color fading. Heat storage floors should not be covered with carpets. Only small paintings can be hung on walls with thermal mass. If no precautions are taken, there may be a flare-up. Relatively large fluctuations in temperature must be tolerated.	The use of large windows facilitates the view to the landscape. The lowest cost Most efficient It can make good use of row windows and ceiling skylights. Natural lighting and heating can be combined, so this system will be very suitable for schools and small offices. Great flexibility and the best option when the overall area of the skylight is small.	Direct absorption
Much more expensive than direct absorption There are few skylights to see for natural lighting. It is not suitable for cloudy weather.	It creates a high level of thermal comfort In combination with the direct absorption system, it is very suitable for limiting the amount of illumination. It is easy to mount it on the existing wall. Balanced cost Suitable for large heating loads	Trump Wall

Conclusion

The aim of the present study is to identify and investigate the amount of thermal comfort indicators and planning, sustainable development, climatic design of architecture, and the use of renewable resources in the design of the training center with climatic data and to investigate energy saving in the design of the oil and gas industry safety training center with the view of using renewable resources. All buildings should be energy efficient buildings. Such buildings usually have a lower initial cost because their heating and cooling equipment is smaller and their operational cost is definitely lower because their energy bills will be much lower. Costs not spent on energy or mechanical equipment are free to be applied to architectural elements. Preventing the loss of thermal energy is the best reason to design the external volume of the building and its external form simply. This discussion about the techniques of keeping warm and staying cool in part of heating, cooling and lighting, which is basically in the field of architecture ends. The costs that are not spent on energy or mechanical equipment and preventing the loss of thermal energy are the best reasons for designing the external volume of the building and its external form. This discussion about the techniques of keeping warm and staying cool ends the part of heating, cooling and lighting, which is basically in the field of architecture. The results of the study showed that the use of pipes with a high thermal coefficient, thermal insulations suggested according to the study, thermal packages with renewable energies, and also adhesives with a thermal conductivity coefficient higher than 0.375 are very effective. Likewise, the present study showed that the use of wastewater distribution and recycling of the resulting water to the environment using international standards saves water consumption by 29%.

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HOW TO CITE THIS ARTICLE

Maryam Zamani Motlagh, Maral Amiri, Investigating Energy Saving in the Design of the Oil and Gas Industry Safety Training Center with the Perspective of Using Renewable Resources. *Chem. Methodol.*, 2024, 8(4) 241-256

DOI: https://doi.org/10.48309/CHEMM.2024.441854.1762

URL: https://www.chemmethod.com/article_192870.html