ABSTRACT

“The first law of thermodynamics says that the total quantity of energy in the universe remains constant. This is the principle of the conservation of energy. The second law of thermodynamics, which is controlled by the concept of entropy, states that the quality of this energy is degraded irreversibly. It is the principle of the degradation of energy.” (Rosnay 1998).

Based on the above, and making use of the opportunities provided by the era of liberation, and due to the predominant lack of public awareness of energy saving (see figure 2), this study aims at preserving buildings by conserving energy that has deteriorated. This deterioration has been caused by negligence, abandonment and absence of maintenance due to the long-term occupation of South Lebanon. The advantages of energy conservation in existing buildings are financial, social and physical.

The process of preservation can be achieved by:

a. Analysis of the existing state of buildings.

b. Analyzing the deterioration of energy in buildings and the identifying the seven levels of intervention.

c. Defining environmental comfort.

d. Proposing guidelines for improving energy efficiency.

e. Proposing guidelines for the conservation of materials.

f. Proposing the appropriate methods for cleaning structures.

In conclusion, it is to be emphasized that preservation is to be implemented by subjecting each building and each component of a building to detailed examination. The nature of such scrutiny shall be to define and identify the appropriate remedial measure to be adopted.
INTRODUCTION

This paper will deal solely with existing structures in South Lebanon which fall under two categories of structures: vernacular architecture, and modern architecture (Ragette, 1974). These two categories provide the ideal environment for applying the premises advocated in this paper by:

a. Undertaking further advanced studies based on previous supportive research efforts (conference of the Engineering Order).

b. Countering the lack of awareness among the Lebanese about energy saving by encouraging them to become energy conscious through emphasis of its importance and the opportunities offered by technology.

c. Intervention in existing structures in South Lebanon, which is considered to be at the early stages of development and therefore lends itself to disciplined and controlled improvement,

d. Showing the economical advantages of already existing energy saving structures, and

e. Encouraging such trends in development by tax incentives and government support.

BUILDING ANALYSIS IN ITS EXISTING STATE

Introduction.

Our principal aim is to optimize the efficiency of existing buildings in terms of energy consumption by means of case studies of individual houses or buildings, after grouping them under different classifications taking into account geography, topography and other environmental factors that will have a bearing on their performance.

Historical Analysis

A primary task will be to evaluate the impact of war years on the state of the built environment. Attention will be focused separately on what is to be characterized as vernacular architecture and on buildings erected after the introduction of reinforced concrete. In both cases, it will be necessary to place the buildings in their respective historical perspectives by establishing the date of construction, name of original owners, their initial intended use, any subsequent alterations they may have undergone until the present date, the techniques and materials of construction and to what extent do the building components satisfy energy – consumption parameters, and what spatial potential do they provide for the addition of new energy systems.

Figure 2. Energy Awareness - Vernacular Builders have to make sure that their structures are highly efficient. They could only use local materials and construction techniques that make economic sense. The running cost of their structures, especially, energy consumption has to be low because of the limited resources available. (Behling 1996)
Contextual Analysis
The given building should be studied not only as an independent element but as a part of a
given fabric consisting of streets and neighborhoods. The architectural elevations, which are
part of an overall streetscape, are also very important to consider.

Functional Analysis
The function or functions that the building has performed, also play an important role in defining
the nature of the study to be undertaken.

ENERGY IN BUILDINGS
Introduction: Thermodynamics law (entropy law)
Energy can be neither created nor destroyed. This is the First Law of Thermodynamics. The
Second Law states that there is a theoretical maximum to the efficiency of all processes
involving the transformation of heat; i.e. every closed system deteriorates to its lowest form,
ENTROPY LAW. By applying these laws, it is determined that energy has changed to another
form, a less useful form, and somehow must be replaced. But the Second Law of
Thermodynamics states that deterioration never stops but a change of energy levels occurs.
Therefore the structure undergoes energy loss. The factor that is important here is time. Can
the life span of sound, efficient and healthy structures be extended? If yes, how? The cheapest
method is proper and consistent maintenance (Figure 3).

"Energy can neither be created nor destroyed." When an existing  building deteriorates only the
levels of energy change. But in order to maintain our heritage and cultural significance of these
existing structures, it is important to bring back the level of energy to its original state through
intervention.

Factors of deterioration
The causes that affect the deterioration of materials consist of external and internal factors. The
external factors include the sun which, with its ultraviolet rays discolors materials, increases the
level of heat and has a primary role in the freeze thaw cycle and temperature variation during all
daily, seasonal and annual alterations. On the other hand precipitation, whether snow, hail,
sleet, rain, freezing rain, fog, etc..., brings water and moisture very close to the building material
and cause extensive damage by penetrating into any accessible opening (Nashed, 1996).
Gravity is another major cause of energy loss just as biological forces such as birds, rats,
fungus, vegetation, etc. The uncontrollable factors causing energy loss are the natural disasters
such as high winds, tornadoes, earthquakes, hurricanes, etc. And finally the major cause of
energy loss is man. Some of the factors inflicted by man are unnecessary alterations, neglect,
war, vandalism, environmental pollution (acid rain) and theft.
As for the internal factors of deterioration, moisture is the most detrimental to building elements.
Other causes of internal decay are contaminated air, neglect and man.
**Seven levels of intervention**

*Introduction*

The remedial intervention currently practiced is through the vague concept of ‘tarmim’, which in fact is a malpractice that fails to identify the specific nature and extent of the damages and dilapidation that have to be addressed in any effort intended at restoring a building. By means of an actual survey of prevailing site conditions it is a must to select and prescribe one of the following levels of intervention, before adopting adequate remedial measures.

*Listing of the Seven Levels of Intervention*

Since time is of major importance in the continued use of a structure, certain degrees of intervention can replace the energy lost with a new level of energy. Keeping in mind that intervention always involves some loss of “value” in the cultural property and/or character. Determined by the physical condition, by the causes of deterioration and anticipated future environment of the property under treatment, conservation involves making interventions at various scales and levels of intensity (Feilden, 1982). The seven degrees of intervention are:

1. **Prevention of Deterioration** (or indirect conservation) entails protecting cultural property by controlling its environment. Therefore, prevention includes control of internal humidity, temperature and light, as well as measures to prevent fire, arson, theft and vandalism, and provision for cleaning schedules, good overall housekeeping, maintenance and proper management (Feilden, 1982).

2. **Preservation** deals directly with cultural property. Its objective is to keep it in its existing state. Repairs must be carried out when necessary to prevent further decay (Feilden, 1982).

3. **Consolidation** (or direct conservation) is the physical addition or application of adhesive or supportive materials into the actual fabric of cultural property, in order to ensure its continued durability or structural integrity. Preservation of the building material is just as important a function of conservation as preservation of original materials (Feilden, 1982).

4. **Restoration**. The objective of restoration is to revive the original concept or legibility of the object. Restoration by anastylosis, using original material, is justified when supported by firm archaeological evidence and when it makes a ruin more comprehensible, allowing the spatial volumes to be visualized more easily (Feilden, 1982).

5. **Rehabilitation**. The best way of preserving buildings as opposed to objects is to keep them in use. The original use is generally the best for conservation of the fabric, as it means fewer changes. (Feilden, 1982)

6. **Reconstruction** of historic buildings and historic centers using new materials may be necessitated by disasters such as fire, earthquake or war. As in restoration, reconstruction must be based upon accurate documentation and evidence, never upon conjecture. (Feilden, 1982)

7. **Reproduction** entails copying an extant artifact, often in order to replace some missing or decayed parts, generally decorative, to maintain its aesthetic harmony (Feilden, 1982).
ENVIRONMENTAL COMFORT

Introduction

Historic buildings relied upon passive design concepts that yielded comfort to a great extent. But applying these passive measures today may not meet the requirements of certain regulations, codes or even comfort zones. Therefore a new system of active measures may have to be introduced to support and compliment the existing system.

Technology, whether in historic times or today, is continuously developing; new techniques, new methods of application and new materials are all aimed at comforting the human being. With the increase of technological discoveries, man seems more and more isolated from his environment, relying on synthetic fuels for heat and ventilation in order to maintain a certain comfort zone. This has led to costly heating and cooling expenses in addition to a reduction of efficiency of the structure. The goal to create a comfort zone within the confines of the energy components of an existing building remains constant. It is technology that must be adjusted when new standards and certain regulation codes are created. To make buildings comfortable they should be kept within a suitable temperature range not as wide as that in an uncontrolled external environment (Thomas, 1996). Therefore it is important to consider the existing system as well as the existing energy components in an existing building in order to determine the new technology to be introduced, which should complement the existing system rather than work independently or be isolated from it.

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Table 1. This table shows the advantages (+) and disadvantages (-) of introducing new environmental systems within existing structures.

Definition of Thermal Comfort

The human body has constant body temperature and has no means of storing heat so that any heat generated by it has to be dissipated. A person’s feeling of thermal comfort is optimal when the production of internal heat is equal to the thermal losses from the body. Balancing these two depends on seven parameters: three of them related to the individual: metabolism, clothing and skin temperature; and four linked to the surrounding environment: room temperature, relative humidity, surface temperature of walls and air velocity (Batsford, 1993).

Definition of Visual Comfort

Visual comfort is achieved when excessive differences in light and shade are avoided. The distribution of light should however provide enough contrast so that the relief of each object is brought out. Window openings and artificial light sources should be placed in such a way that glare is minimized. Glare is the sensation produced by luminents within the visual field that is sufficiently greater than the luminents to which the eye is adapted (Moore, 1993). Furthermore, the quality of light should be compliant with the function that will be performed in a particular space.
GUIDELINES FOR IMPROVING ENERGY EFFICIENCY IN EXISTING BUILDINGS

Introduction
As stated earlier in the section “building analysis in its existing state”, the different existing systems (structure, environment, function and energy) should be analyzed to have a clear data base for the given structure before studying the strategy to be implemented. Since the energy components of an existing structure remain the same, it is important to make use of these components within the new interventions rather than deleting them.

Strategy
Certain existing elements that should be considered prior to suggesting any solution are orientation, roof, overhangs, openings, porches and landscaping.

Sources of Waste
Tests have proven that the greatest sources of heat loss in an old two stories high house, that has undergone no treatment for heat conservation, are as follows:
- 50% loss at doors and windows
- 25%, loss through ceiling, attic and roof
- 18% loss through walls
- 7% loss through floor and basement. (National Trust. 1981)

Heat Transfer
Heat flows from masses of higher temperature to masses of lower temperature. According to Ching (1991), the transmission of heat is done by:
- Conduction – transmission of heat from a warm body directly to a cooler body.
- Convection – transmission of heat from a warm surface to the surrounding air.
- Radiation – transmission of thermal energy through space from a warm surface to a cool surface.

Methods of Reducing Heat Loss:
Air Infiltration: Do not reduce infiltration to the point where the building is completely sealed and moisture migration is prevented. (Smith. 1978)

Thermal Insulation: Insulation is designed primarily to combat the transfer of heat through conduction, by placing barriers of material with a low heat conductance between the conditioned space and the outside. Note that the state of zero heat loss can never be achieved and all moisture must be expelled before the insulation is fully effective. (National Trust. 1981)

The different types of thermal insulation are batts and blankets, poured insulation, blown insulation, foamed insulation and rigid insulation (National Trust. 1981). It is important to note that the blown insulation, in the course of time, tends to pack down at the bottom of the space. The result is compacted insulation at the bottom and air space at the top, both resulting in loss of insulation value (Lion. 1982).

Vapor Barrier: The purpose of a vapor barrier is to prevent moisture from moving through a building element. It is important to note that a material with an integral vapor barrier should have a ventilated air space adjacent to it. The vapor barrier should always be adjacent to the conditioned space (example a vapor barrier paint). The space above or behind the insulation must be adequately ventilated to the outside to allow the escape of moisture and the vapor barrier should at all times be continuous and never interrupted. (National Trust. 1981)

Other systems or areas that require the attention of thermal insulation are attics, false ceilings, sloped roofs, storm windows, basement and crawl spaces, ducts and pipes, replacement windows with modern panes, and walls.

Illumination: Another source of heat waste is over-illuminated spaces by artificial lighting. A 100-watt bulb consumes 67% more electric power than a 60-watt bulb. (National Trust. 1981)

Humidity: Comfort is ideal when the relative humidity is about 50%. If the relative humidity is increased from 40% to 50%, the apparent temperature may be increased several degrees, thereby saving fuel. A word of caution is that the interior relative humidity should not be raised to the point that water condenses on cool surfaces. (National Trust. 1981)
PRESERVATION GUIDELINES FOR MATERIALS
Concrete

Characteristics of Concrete:
Reinforced concrete, with all the deterioration factors working against it, relies heavily on its initial state in mixing, proportioning, placing, and curing, for its durability and lasting life. Unlike other material, reinforced concrete does not have a certain technique to follow for conservation purposes (Fitch. 1982).

Reinforced Concrete
Concrete is considered to be a material that is hard, brittle, and a poor conductor of heat and electricity while steel, on the contrary, is ductile and a good conductor of heat and electricity. As the concrete dries and shrinks, a steel reinforcing bar embedded in concrete is subjected to stress, which restrains the concrete from shortening and therefore it is subjected to tensile strain and stress. When the stress reaches the ultimate strength of the concrete, at that age, the concrete cracks. There is a race between the increase in strength of the concrete over time and the increase in shrinkage strain as it dries. Prolonged curing periods, during which the concrete can gather strength as it slowly shrinks, is considered a major advantage in preventing the appearance of cracks. Steel reinforcement changed this situation by attempting to hold the two sides, of the crack together and therefore is subject to tensile stresses. But deformation is distributed along the length of the bar resulting in local bond slippage or "creep" between the steel and the concrete on each side of the crack (Wilson. 1984).

KINDS OF CRACKS: 1. Cracks could be long vertical cracks found in retaining walls, which are the result of the initial shrinkage due to the drying of concrete (Powter. 1978).
2. Temperature or shrinkage cracks are usually clean cracks which extend in a fairly straight line across the concrete, with the exception where cracks may run horizontally or diagonally along a plane of weakness (Powter. 1978).
3. Radial cracking is usually caused by earth tremors, frost heave or settlement. Internal stress, due to temperature expansion and contraction is also a likely cause, as is the use of incompatible material (Powter. 1978).
4. A sudden change in concrete quality at the crack, is the cause of irregular or diagonal cracks in walls. The change in quality could be due to a change of cement, different hardening times, or variations in the water content of the mix (Powter. 1978).
5. A less common type is horizontal cracks, occurring at formwork lift-lines when the plane of weakness at the interface of two separate pours of concrete has been forced open by freeze-thaw cycles (Powter. 1978). The freezing of water within pores of concrete can be destructive in two ways: (1) through the direct expansion that occurs on freezing, and (2) through the growth of ice crystals previously formed by processes involving migration of moisture through the concrete to the frozen layer (Timmons. 1976).
6. One last form of cracks is caused by the pressure of tree roots and varies in pattern.

SPALLING. The cycle of freezing and thawing is the most serious cause of spalling. Freeze-thaw cycles will also cause spalling at poorly keyed joints between cold joints, exterior edges, renders and floor slabs which are subject to ponding (Powter. 1978).

Another source of spalling is the rusting of reinforcement accompanied by rust staining. Finally soluble salts within the ingredients of the concrete when mixed, exert internal stresses when crystallization occurs as concrete dries under normal conditions (Powter. 1978).

DISINTEGRATION. Disintegrated concrete is loose and crumbly and breaks away in pieces when handled because it has lost all cohesive strength. The usual causes of disintegration are exposure to heavy chemical attack, inferior concrete materials, or extremely harsh climatic conditions (i.e., freezing-thaw cycles in situations where water content approaches critical saturation). Concrete, which has disintegrated, might have been proportioned within too much aggregate, particularly fine, for the amount of cement in the mix. Consequently the cement matrix is too thin to bond the aggregate together firmly enough to resist the stresses of freeze-thaw expansion and contraction. The result is the same as if weak cement is used in an exposed location (Powter. 1978).

LIME DEPOSITS. This efflorescence consists of white crystalline deposits that take two forms: (1) it appears as a white powdery deposit on the surface of the concrete which appears to have run out of a crack, or (2) where it builds up and forms a hard calcareous deposit similar to that found in damp limestone caves. The process of leaching is very slow and seldom causes serious structural damage, but it can widen cracks by leaving pieces of aggregate unsupported, and it removes the corrosion protection from steel reinforcement (Powter. 1978).
STAINS usually encountered on existing concrete are iron rust, copper, bronze, petroleum oils, bitumen, paint, atmospheric dirt, and discoloration from plants and micro-organisms. Some stains soak into the porous concrete surface while others react chemically with the hydrated cement or the aggregate, making their removal difficult (Powter. 1978).

ABRASION is an external condition only but can cause substantial loss of material, thereby affecting the stability of the structure. Abrasion can also expose aggregate and the cement-aggregate interface to the weathering effects of moisture. Abrasion damage often provides useful evidence of the long term use of a part of the structure (Powter. 1978).

ETCHING is caused by the reaction of acid in runoff water (acid rain, plant growth, etc.) with the alkali cement. This leaves the aggregate protruding beyond the surface and gives the concrete a rough texture. It is usually so slow that the effects are masked by other forms of weathering (Powter. 1978).

CONSERVATION OF REINFORCED CONCRETE
It is often difficult to achieve a concrete repair, which satisfies many of the criteria for sensitive handling of existing structures. A few considerations must be mentioned:
1. Unlike masonry and timber, concrete has not had the benefits of a long history of maintenance, repair, and even debate which has led to the development of a number of techniques with which conservators can feel comfortable and confident (Powter. 1978).
2. Conservators are accustomed to working with elemental materials (sticks, stones, bricks) rather than monolithic materials (Powter. 1978).
3. Construction methods used in the existing structures were often not appropriate to the properties and characteristics of the material (Powter. 1978).

TECHNIQUES FOR CONSERVATION of existing concrete structures are available but have not been the subject of long-term experimentation and assessment. They range from crack injection and application of membranes to area patching and recasting. Common sense and compromise are necessary in selecting a procedure and in deciding the extent of the work in concrete conservation. A few general points are particularly important (Powter. 1978).
1. The necessity for the repair should be evaluated and the cause of the deterioration identified.
2. The purpose of the required repair should be established.
3. Repaired concrete is seldom as good as a monolithic mass of sound concrete.
4. In all repairs necessary steps should be taken to minimize shrinkage, to use compatible materials, and to ensure workmanship of the highest standard.
5. Experiments should be carried out with all techniques and mixes before a repair is executed.
6. After drains, overgrowth and debris have been cleared a policy of nonintervention and judicious neglect should always be considered.

Masonry
Characteristics of Masonry

The common denominator in masonry systems is that there is always a thickness of a wall involved. The wall creates an envelope with modular units that should be handled by at least one person. These modular dry units are laid out in repetition and connected by a different material to make it function as one system. The goal of masonry systems is to produce large surface or area. Masonry structures are limited in that they cannot exceed a certain height and when it comes to vernacular architecture, masonry systems use up a substantial percentage with respect to the total gross area.

Load bearing, durable and acting as thermal protectors, masonry systems function and achieve ultimate performance when they are allowed to breathe. A large amount of moisture could be trapped inside if a waterproofing or sealant is applied to the masonry surface. On the other hand maintenance free fabrics, as advertised in modern construction, such as aluminum, plastics, etc. are only a cover to the problem but do not solve the problem itself. They could also act as a moisture barrier trapping moisture between the fabric and the masonry building causing deterioration.
The two elements composing masonry systems are the modular units and the bonding substance or mortar. Having spoke of the modular systems above, identifying the characteristics of mortar follows: mortar should provide a cushion for the modules. It should ensure the bonding and tying of the modular units as well as protecting the whole system from moisture penetration. The bonding mortars should be flexible and softer (weaker) than the modules themselves (Mack, 1980). And finally the mixture of the mortar depends on the type of modular units and the components are lime, sand, water and Portland cement. It is important to note that Portland cement must be controlled and used with caution when applied to masonry structures. Of the two, lime produces a mortar that meets nearly all the requirements for a good mortar for historic buildings, while Portland cement produces a mortar that does not perform as well (see figure 11). High lime mortar is soft, porous, and changes little in volume during temperature fluctuations. In addition, lime mortar is slightly water soluble and thus is able to reseal any hairline cracks that may develop during the life of the mortar. Portland cement, on the other hand, can be extremely hard, is resistant to movement of water, shrinks upon setting, and undergoes relatively large thermal movements. The use of a high lime mortar, therefore, is recommended for nearly all repointing projects.

In matching the repointing mortar, the new mortar should match the unweathered interior portions of the existing mortar (Mack, 1980).

Wood

Characteristics of Wood

Wood is an organic living organism that goes through the cycle of life: birth, growth, aging & decay, and death. Thus, wood has a propensity to deteriorate when conditions favor it. In the absence of favorable conditions, the deterioration rate of wood is so substantially reduced that the wood remains essentially inert and unchanged.

To the touch, wood is a substantially solid material. Yet only 20 to 40 percent of the total volume of air-dried wood is composed of actual wood substance. The remaining 60 to 80 percent consists of air-filled spaces or cells. Wood is, therefore, a porous material, possessing excellent insulating and working qualities. However, because of the highly variable communication capabilities between cells, the permeability of wood varies greatly. Strength, elastic and swelling properties are different in the three directions. Depending on how the wood is cut, boards with different properties are obtained (Timmons. 1976).

Wood absorbs and releases moisture in response to changes in relative humidity. The average moisture content of wood used in interiors shows seasonal variations. As a consequence, the volume of wood changes with atmospheric conditions. This change produces significant directional effects, which can produce adverse weathering problems (Timmons. 1976).
DETERIORATION AND PROTECTION OF WOOD: Certain external agents promote the deterioration of wood under varying environmental conditions. Certain hints of warnings to failing systems could be nails popping out, pealing paint (not the alligator effect), bleeding, rusting of nails and surface mold or rot under the paint.

Liquid Water
The penetration of liquid water into wood is facilitated by capillarity or wicking. On subsequent rapid drying, surface areas dry first. Shrinkage in these areas is opposed by water-swollen tissues located deeper in the wood. These rapid interchanges of moisture on surface areas contribute to the type of deterioration known as weathering (Timmons. 1976). The moisture content is acceptable in wood in the range of 10 to 15%. It should be monitored when it is between 15 to 20%, becomes alarming when exceeds 20% and creates major problems at saturation level of 25%. The moisture content depends on species of wood, time of day, relative humidity and temperature.

Rapid wetting of wood can be prevented by applying coatings or finishes, which also protect the wood against ultraviolet radiation. The importance of proper selection and maintenance of coatings cannot be overstated. Water repellents are another means of protecting wood against penetration by liquid water. The solvent should be allowed to evaporate from the wood before the joint is assembled to provide a good base for a coating of paint (Timmons. 1976).

Ultraviolet Radiation
Ultraviolet radiation leads to severe embrittlement and loss of wood substance (Timmons. 1976).

Decay Fungi & Wood-staining Fungi
Decay fungi are serious wood-destroying agents. They enter wood as spores and develop long strands that penetrate to great depths. They change the physical characteristics of wood, resulting in decay. There are three requirements for the growth of fungi: a temperature, relative humidity and moisture content. The wood staining fungi have no serious effect on wood, but they produce blue or other colored stains on wooden surfaces with high moisture content. The remedy, obviously, is to provide ventilation and to remove the cause of water accumulation (Timmons. 1976).

Insects
Damage caused by insects to wood in use is more erratic than that caused by fungi. Under damp conditions, the decay of wood is unavoidable. Infestation with insects, however, occurs only if female insects can deposit their eggs in the wood. Each insect requires its own treatment. Wood can be protected from attack by insects by providing proper sanitation and avoiding the introduction of infested wood (Timmons. 1976).

CLEANING STRUCTURES

Abrasives / non-abrasive cleanings
A common practice in Lebanon is that whenever a structure needs cleaning, “new look”, the abrasive sandblasting method seems to be the only method and technique applied. Even though the technique may show a contrast of results, it is not necessarily clear that this end result creates a much harsher environment for the fabric.

Another concern that should be mentioned with regards to cleaning structures, is that many people frequently apply waterproofing coatings to structures fear of moisture penetration as well as to deter dirt and pollutants from collecting on the surface of buildings thus reducing the need for further cleaning. All this is done with disregard to the consequences of such actions. Moisture penetration to the interior usually is caused by deteriorated gutters (rain water drainage), deteriorated mortars, capillary action (rising damp) from the ground or by condensation which always occurs on the warmer side. These waterproofing coatings may cause an acceleration of deterioration since the moisture is being trapped within the masonry system and the evaporation of moisture will be retarded and sometimes prevented thus causing greater deterioration than caused by the pollutants themselves. (Mack. 1975).

Some pollutants and elements that require cleaning are airborne dust, bird deposits (highly toxic), carbon in all forms (airborne), oils - in small particles (airborne), paint as cover-up, salts / acids (airborne), and rust (Mack. 1975).
The two methods of cleaning structures are abrasive (remove a certain % from the fabric) and non-abrasive (doesn’t create destructive results). Each of the two methods could be applied in wet or dry methods. The wet methods use the spray / mist, water under pressure, water / temperature and steam methods. Chemical methods are introduced within the wet methods. While the dry method usually are the blasting particles at high pressures on a surface. The abrasive methods always result in some loss of fabric and make the cleaned structure more susceptible and exposed to the unresolved pollutants. An example of sand blasting is that it causes the neatly cut stone edges of masonry buildings to become rounded which will lead to a wider mortar joint and thus changing the visual character of the original masonry structure (see figure 13). The blasting and chemical methods should never be used on wood (Grimmer 1979).

General Rules of Cleaning Structures:

Universal Rules:
1. Always start from the top and go down to the bottom.
2. Identify all materials on the structure with their properties.
3. List all potential methods for each material.
4. Select the least harmful method for the most sensitive material.
5. Test the best options - test patch no more than 25x25 cm. Compare different tests.
6. Schedule the time to minimize the harmful effect whether economic, climatic, environmental, etc.

Process Rules:
7. Repoint before anything
8. Make sure that the building is tight
9. Seal and isolate areas that need different treatment
10. Start with the least abrasive harmful method
11. Use collectors to control all materials whether in the dry or wet methods

Why clean a building? Do we want buildings clean so they look like when they were first built? Or do we want a partial cleaning to keep the historic atmosphere or touch? Some answers may be for visual perception, precautionary measures, presence of destructive agents and aid for restorations (Mack. 1975).

CONCLUSION
The purpose of this paper has been to consider South Lebanon as a model case where it will be possible to apply energy-saving strategies for the preservation of existing buildings. Specific evaluations and practical applications of appropriate techniques shall be devised after a case study of individual buildings, which may help to set South Lebanon as a model case particularly that it is still at an early state of development. While the suggestions are to be applied in South Lebanon, they are at the same time possibilities for other similar situations. Following certain systematic procedures could be the only solution available before the real work is done and tested. The following are some safe practical guidelines:

1. Determining the style of the building, when was it built, what purpose was it built for, who was the owner at the time of construction. What alternations happened to the structure and when, and what purpose does it serve today?
2. Analyzing the type of construction of the historic building and how the components connect and relate to each other.
3. Determining the geographical location of the building with respect to seasonal climatic conditions.
4. Determining the change of the environment throughout the building’s history, whether new construction, demolition or even vegetation growth have effected it’s environment.

5. Determining the environmental system used in the historic building, whether passive or active, and how it relates to the elements of the building and to the environment.

Such a procedure will help establish what specifically applies to conditions in South Lebanon, and will facilitate the determination of factors that in turn will allow classifying existing buildings in South Lebanon into three categories, namely:

1. Inhabited buildings;
2. Unfinished structures where construction has stopped due to war, occupation or other economic factors;
3. Buildings abandoned due to war and exile.

Each of these cases will then be subjected to a thorough investigation and analysis in order to find out if a particular building can or cannot accommodate new environmental systems installations, with or without modifying its function.

Once a building is considered adequate for further environmental improvement, it then becomes necessary to:

1. Determine the modifications needed for the historic system to be utilized today (If need be).
2. Break down energy components of the building, and determine how each individual element contributes to the structure’s original energy plan, such elements being windows, roofs, thermal mass, solar path, wind patterns, auxiliary devices, skylights, and landscaping.
3. Determine the most attractive and significant features of the building and how do they relate to the existing energy components.
4. Locate potential spaces of utilization for new modification of the energy system.
5. Develop a program for the new building use and determine areas of most occupancy during the different intervals of the day, and areas of highest energy consumption.
6. Determine the most recent energy systems available and study their output and efficiency with respect to a specific building.
7. Take into account the volume of the new system and the space available in the existing structure.
8. Consider the distribution and return means and their placement and size so that there will be no significant alterations in the structure.
9. Weigh out the advantages and disadvantages of each new system with respect to the historic significance of the building.

In the attempt to secure a controlled environment, the appropriate technologies should be selected in terms of the economic context. It is hoped that this paper will be a stepping-stone initiating further research about increased efficiency in the comfort of the built environment and legislation for the elaboration of new regulations and bylaws. And finally it is our aim to promote public and professional awareness in considering energy consciousness as a significant factor of the design process.
REFERENCES


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