OLD BUILDINGS, NEW ASPIRATIONS: THE FUTURE OF HERITAGE IN THE ERA OF SUSTAINABILITY-THE SCENARIO IN RAJASTHAN

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ABSTRACT

Current national and international imperatives to curb energy consumption in buildings and to further reduce greenhouse-gas emissions across the world have triggered intensive efforts to formulate guidelines for energy efficient buildings. Concerning achieving energy efficiency goals, the contribution of historic buildings cannot be overlooked owing to their significant share in the architectural fabric of India and especially for states like Rajasthan. Buildings built during the last 100-200 years hold a critical position among the stock of historic buildings considering their extensive use as public buildings for varied purposes even today. Various studies acknowledge the climatically adapted and thermally comfortable design strategies of historic buildings all across the world.

The paper advocates a parametric analysis for energy efficiency assessment of Indo-Saracenic buildings under public use in Jaipur city as a pilot project. The investigation is aimed to understand the influence of building design parameters on the energy consumption patterns taking into consideration the present use of these buildings. The study further aims to add value to the existent heritage built stock suggest adaptive reuse or improve usage of the buildings and also formulate design guidelines as learning from history towards achieving energy efficiency for existing and new public buildings in Rajasthan.

Keywords**:** energy efficiency assessment, historic buildings, Rajasthan, design parameters

1. THE INDO-SARACENIC BUILT STOCK

India has been a host to several cultures of the world since ancient times; all of which have added to the richness of her architectural heritage by the suitable amalgamation of styles, adaptations to the local climate, introduction of new building materials, varied display of technical know-how and numerous interpretations of the native craft skills.

For India, along with their kings and rulers, foreigners like Islamic rulers, the Mughals, Portuguese as well as the British have given mesmerizing structures to the country's skyline, amalgamating the local style and adding newer elements to the existent architectural fabric of the place. An accretive character permeates Indian architecture throughout the recognized periods in history and each period has seen a conscious mixing of styles and the creation of new hybrid architecture. One such initiative, the search for the "picturesque, cherished with individual expressions of the British officers, seeking for designs free from the rigidities of Neoclassicism of Europe as well as competing with the more celebrated and native Hindu and Mughal architectural styles in India, gave birth to the Indo-Saracenic Architecture style.

Along with a new aesthetic language, the Indo-Saracenic architecture also introduced a new building typology of public use buildings like hospitals, state administration offices, educational institutes, theatres, public libraries,

museums and town halls to the Indian society. Most of these Indo-Saracenic buildings are still functional and can be categorized as 'The living heritage' of the country. Owing to their present status, of being used as buildings of everyday use and not only as monuments of historical importance the inter-relationship of social, cultural, climatic parameters and architectural character of these buildings becomes even more complicated. Thus energy performance evaluation of these buildings becomes an intriguing subject of study.

Indian Saracenic is a term coined by the British upon a mixed architecture, of Hindu, Mughal and their own, and has been defined by various historians, architects, and writers with their perspectives. "The British indiscriminately called all architecture of Muslim countries, from Moorish Spain where Europeans first encountered an Islamic society to Mughal India, "Saracenic."

The architectural period beginning in the late 1870s and lasting, despite competing for revivalist ideologies, until Independence and after that, in attitude if not in the name was the Indo Saracenic era (Watt, Mann 2011).

Many administrative office buildings, town halls, museums, educational institutes, hospitals and railway architecture designed and built during British rule and more specifically during the late nineteenth and early twentieth century are identified examples of Indo-Saracenic Architecture across the country. Most of these buildings are still under public domain being used for the same purposes or with some modified uses as per present context.

Figure 1. Major concentration of Indo-Saracenic buildings.

Important cities and locations are having major stock of Indo-Saracenic buildings across the country as shown in Figure 1, illustrate significant concentration of these buildings in North and Central region of the country and major port cities.

The need to study these buildings because the case is critical since all these buildings are not monuments and not even the contemporary one, but are considered and treated as contemporary buildings and hence they need to preserved and maintained.

2. THE ENERGY-EFFICIENCY INITIATIVES

Research works and studies on energy efficiency for historic buildings are being made across the world. Various studies demonstrate that the efficiency of these buildings can further be improved by understanding the behavior and contribution of individual building elements towards energy consumption and by retrofitting them using renewable energy sources. Further, these studies are instrumental in planning integrated preservation and conservation processes and contemporary usage of these buildings.

In India, Indo-Saracenic style, iconic to the public buildings around form an integral part of the cultural and material resource of the country. These buildings, mostly under government ownership need to be managed carefully for the benefit of present and future generations. At the same time being buildings of public usage, used by many people, they demand a considerable part of societal energy use. Thus, stands a need to find ways to balance the needs of building preservation and energy conservation in these buildings simultaneously.

Adoption of energy efficiency methods and technologies in buildings vary according to geographical location, climate, building type and materials used. Also, the developed and developing countries use different technologies for energy savings. There is a difference in rating procedures for existing and new buildings. In all cases, different standards are followed for assessing and enhancing building energy performance. Therefore, countries have adopted different energy codes for implementing and enhancing building energy efficiency. Various organizations and countries have given guidelines and regulations governing energy efficiency in historic buildings. Some notified examples are discussed in this section.

- The International Scientific Committee on Energy & Sustainability (ISCES) was established by The International Council on Monuments and Sites (ICOMOS) in 2012 to further improve the conservation and protection of heritage places through the soundly-based application of energy conservation and sustainable development principles to heritage places.

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is working to provide guidance on historic buildings while striving to improve its existing information and materials related to existing buildings. These efforts include proposed Guideline 34P, Energy Guideline for Historical Buildings and Structures.

  As stated by ASHRAE handbook, the methodology for assessing and achieving energy efficiency in historic buildings should be based on an interdisciplinary approach. The main steps of which include:

  - Following the general principles and the concepts of renovation and conservation;
  - An analysis of the plant engineering systems;
  - Measuring the environmental quality and
  - Determining the risks to historical buildings (including the identification of the proposed intervention as it relates to the building and the system) (Livio de Santoli, 2014).

3. THE WORKDONE SO FAR

European countries with an extensive historical built stock have been working intensively in the field and have produced various regulations and guidelines for improving the energy performance of historic buildings. In Europe, the Scandinavian countries were the first to introduce thermal building requirements to improve energy efficiency and comfort in Historic Buildings. Since the Energy Performance of Buildings Directive (EPBD) in 2002, all member States of the EU were required to introduce a general framework and to set a building energy

code requirements based on the global building approach (Laustsen, 2008; Annunziata et al., 2013). These requirements cover building energy performance, harmonized calculation methodology, energy certification, and HVAC systems inspection.

Recently, Green building certification GBC Historic Building® has been launched by LEED for Italy, applicable specifically to the building stock constructed before 1945, the year that saw the beginning of the post-war reconstruction activity and the rise of the industrialization of the building process in Europe. The protocol was released in 2015, and it is currently undergoing a pilot period for its validation through the application to real case studies in Italy, which will contribute to the tool's implementation for the local market (Paola Boarin et al., 2014).

In general, all these certifications and labels, even if they have different methodologies, energy assessment tools, and calculation methods, tend to target one or another building energy concepts like Low Energy Buildings, Passive Houses, Zero Energy Buildings, Zero Carbon Buildings, and Positive Energy Buildings.

In Asia, rapidly developing economies, essentially India and China, look to reduce the dramatic increase in energy consumption in buildings due to the fast urbanization rate. In India, to promote energy efficiency, various policy instruments have been in place since the 1970s. Bureau of Energy Efficiency (BEE), Government of India in association with The United States Agency for International Development USAID has developed Energy conservation building code (ECBC) to improve energy efficiency in buildings.

Thus it can be understood, that in recent years, it has been well identified and efforts are made towards exploring and achieving energy efficiency in historic buildings. In the Indian context, the energy consumption and production trends are even more demanding and thus a more sincere effort to achieve energy efficiency in all sectors especially buildings is needed.

Cultural heritage preservation and energy saving are both important issues for the country, and a robust and coordinated action plan at the government levels is required. Until now, the focus of the nation has been towards identifying the historic built stock and for defining the kind of renovation works the building needs to undergo; but with the current initiatives towards improving our built stock to achieve energy efficiency, stands a need to coordinate the conservation and preservation processes with the various energy efficiency programs in action all across the country.

India is a massive reservoir of historic buildings. Its entire built heritage, listed or not, is a witness to the country's vast history and the development of its social and constructional practices. It adds significantly to the quality and charm of the built environment of the country and ensures an added value to many cities as well as the countryside. Even today the buildings form an integral part of the social, commercial and cultural fabric of many cities like Chennai, Kolkata, Mumbai, Hyderabad, and Jaipur. These cities boast of their unique architectural heritage reflecting the rich past and peculiar climatic adaptations of the place and add significantly to the tourist interests and thus economy of the state.

Aspects related to Historic buildings in India making them a special case for studying energy efficiency can be summarized as:

- Old Town areas or the historic cores play an important role in the recognition and growth of many cities in the country like Hyderabad, Jaipur, Agra, Lucknow, Mumbai, etc. The Historic buildings are the trademarks of these cities, contributing vastly to their economic benefits and tourist interests, thus studying them for contemporary building standards and their up gradation forms an essential aspect of these societies.
- Present usage of these historic buildings is as identified administrative and public zones which constitute a significant portion of the cities' total energy demand. Therefore, a need to understand the energy efficiency aspects of these buildings. With improved energy efficient mechanisms they can significantly contribute towards

controlling the amount of CO2 emissions in the heart of these cities and can further act as carbon sinks for the busy, crowded and polluted city centers.

- The specific characteristics of the building elements of these historic buildings constructed in different eras and as per then available technological inputs and climatic conditions, pose specific issues and aspects to their study. Further, when it comes to their structure, these buildings were not constructed using the contemporary acclaimed available materials and technologies explicitly used for achieving higher energy efficiency. Also, the heritage laws for protection play an important role when the interventions involve the original appearance of the buildings.

- Furthermore, the historically valuable buildings, not already listed (i.e., not officially protected) are equated to existing contemporary buildings and subjected to their energy efficiency requirements. In the current state of art standards and codes, there is a lack of a specific protocol aimed at providing well-balanced solutions for energy efficiency improvement in historical buildings. On the other hand, the directives as laid for existing contemporary buildings on energy efficiency, materials, and other items may strongly affect the architectural heritage conservation.

- Various vernacular and traditional buildings from different regions of the country have been studiedfor their heritage values, climatic adaptations, and passive design strategies. Recently acknowledged field of achieving energy efficiency in buildings and thus reducing environmental impact have not yet been greatly explored by scholars working on historic Indian architecture. Also, there stands a need for a holistic quantitative study where with the help of detailed analysis and energy consumption studies the judicious use of these buildings for contemporary purposes can be framed and further enhanced.

  Further, towards achieving energy efficiency goals, in May 2007, the Bureau of Energy Efficiency (BEE), working under Ministry of Power, Government of India proposed an Energy Conservation Building Code (ECBC) that sets minimum energy performance standards for buildings in the country. The first stand-alone thermal code for new buildings was adopted in 2007 which targeted exclusively large commercial buildings that have, at least, a connected load of 500 kW or a contract demand of 600 kVA (Tulsyana et al.2013). It consists of prescriptive energy performance methods and sets requirements for different building components such as air conditioning, artificial lighting, envelope, water heating, etc. The ECBC is based on the ASHRAE code and the Californian building code and was launched in 2001 by the Energy Conservation Act, 2001. The project has carried out some activities ranging from developing an institutional framework for capacity building to benchmarking and demonstration projects all across the country.

4. THE NEED OF STUDY FOR RAJASTHAN

Rajasthan has an exclusive architecture and is well-known for its architecture all over the nation. Rajasthan's architecture is chiefly based on the Rajput school of architecture which was an assortment of the Mughal and the Hindu structural plan.

The Rajputs were great designers and builders and constructed some of the finest examples of forts, palaces and religious buildings across the state.

The Various Rajput rulers across the state were friendly with the British and entered into alliance treaty with them around 1820. The influence of British and establishment of PWD in the state-supported the construction of many public buildings across the state from 1840-1930.

These buildings had vivid Indo-Saracenic characteristics and produced buildings with elements having characteristics of Rajput and European architecture. The buildings incorporate elements of Rajput Architecture like Jahrokha, Jaali, Chattri and courtyards with the spatial organization and built form of European buildings.

Some of the finest examples of the style are Mayo College, Ajmer, Jubilee Court buildings, Jodhpur, Lalgarh Palace, Bikaner, Umaid Bhawan Palace, Kota and Albert Hall Jaipur.

At that time, in Rajasthan mostly every district have headquarters, even today they are being used for the same purpose. Rajasthan is the home of some of the most excellent example of Indo-Saracenic buildings.

Hence there is a need of study in Rajasthan as there is an abundance of these buildings which will help us in an intensive and detailed study of this style and could give us inputs for what changes and alteration could be done in new buildings to make them ECBC compliant.

The ECBC, however, is currently not mandatory across the country due to some challenges such as lack of appropriate knowledge and capacities at various government and private levels, limited availability of trained designers and architects, and the absence of suitable energy-efficient materials and equipment in the local market. (ICEEB Compendium, 2015).

Table i. List of some Indo-Saracenic Buildings in Rajasthan

Jaipur			Jodhpur			Ajmer		
Name of Building	**Year of completion**	**Present use**	**Name of Building**	**Year of completion**	**Present use**	**Name of Building**	**Year of completion**	**Present use**
Albert hall	1887	Museum	Jubilee court buildings	1896	Court buildings	Mayo college	1882	Institutional
Ram Prakash Theatre	1879	Closed for renovation	Umaid Bhawan palace	1943	Royal residence and hotel	Government college	1868	Institutional
Maharaja Library	1866	Library	Jaswant Thada	1899	Public place	Railway workshop	1879	Workshop
School of Arts	1866	Institutional	Government museum	1936	Museum	Railway general office	1884	Administrative office
Maharaja College	1844	Institutional	Clock Tower	1911	Public place	Bhagchand ki kothi	1887	Hotel

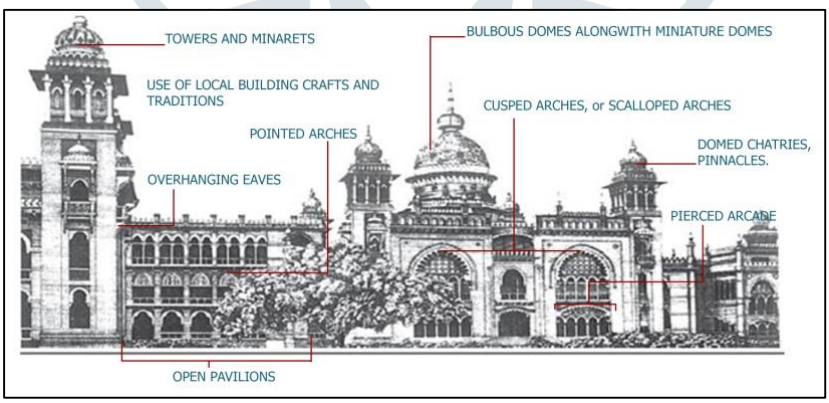

Figure 2. Madras law court, an example of Indo-saracenic architecture in India with important features

i. Umaid bhawan palace, Jodhpur

ii. Albert hall, Jaipur

iii. Mayo College, Ajmer

Figure 3. Some Indo-Saracenic Buildings in Rajasthan

5. CHALLENGES FACED AND THE BENEFITS OF STUDY

CHALLENGES-

- Earlier studies related to Indian subcontinent are qualitative. Though all studies have identified passive techniques, building facade elements, materials used and technologies used in Historic structures as green and contributing to energy efficiency, not manyefforts have been made to conduct a quantitative analysis of the same further.
- Authentic drawings of these buildings are not available.
- Permission for the case study is not easily permitted as the authorities of these buildings are not engaged with only one agency.
- Information about the building material is not documented precisely.

LEARNING FROM HISTORY

Perhaps, the most important challenge that architectural education faces today, perhaps even more serious than responding to the technological development of computer-based design and drafting ,is there cognition of the fact that next to the 'global', 'universal' 'knowledge' of architecture–or 'core' as it is often called – there is 'local' knowledge that corresponds to each of the many regions of the world and that this 'local', 'regional' knowledge has to be taken into account in architectural practice and in architectural education.
Architecture of Regionalism in the Age of Globalisation, LIANE LEFAIVRE,ALEXANDER TZONIS, 2012.

Sustainable development studies recommend that architects and engineers must seek solutions from vernacular buildings for the design of low energy consumption, environmental friendly and localized identities while utilizing modern materials and techniques (Paul Oliver 1997)

By looking at theory, policy, and practice on energy efficiency in heritage buildings through an interdisciplinary lens, policies can become useful, and practices can become more relevant and pragmatic (Kalliopi Fouseki et al.2014).

Despite being a symbol of colonialism Indo-Saracenic architecture was" modern" and incorporated much of the taste of its time. Owing to their present status, of being used as public buildings of everyday use and not only as monuments of historical importance has the inter-relationship of have social, cultural, climatic parameters and architectural character of these buildings become evened more complicated. Thus energy performance evaluation of these buildings becomes an intriguing subject of study.

As identified by various studies, it is more likely to achieve energy efficiency benchmarks in historic buildings of tropical climates as most of the energy use is for cooling the indoor air; owing to their huge built mass and design characteristics (in terms of spatial arrangement of spaces, s/v ratio in walls, size and location of openings , sun shading devices, etc.) these buildings provide more comfortable indoor environment , especially during the long summer months.

Further, planning an integrated preservation or conservation process and achieving energy efficiency for the contemporary use of these buildings offers several opportunities for detailed study like

- A more attractive use and better occupation of these buildings by assuring a reduced energy bill,
- An improvement of the indoor climate (and reduction of fluctuations in temperature and air humidity) would enhance the conservation of the building, its structure, finishing materials, interior decoration and collections, and
- A contribution to the reduction of greenhouse gas emissions by this collection of buildings would add value to their existence and make their presence more sustainable.

Hence, it provides scope to explore how building design in the pasthas directly or indirectly through interaction with other variables made these buildings thermally comfortable and well adapted to climatic changes across the year; leading to making them energy efficient.

In many states of India including Rajasthan, the formulation of regulations regarding energy compliance are under process there is a need and scope to study the historical buildings which form an integral part of many cities and towns in the country.

The paper proposes the need to critically examine the Indo-Saracenic public buildings to obtain insightful knowledge on the influence rendered by climate, materials used, and peculiar building elements on the energy efficiency of these historic assets. The proposed study will contribute to preparing the ground for the emergence of new projects on this topic and for addressing areas of much needed further research in the domain.