

# AN ANALYSIS OF CURRENT REGULATORY REGIMES FOR ENERGY EFFICIENCY LIVING AND THE WAY FORWARD: A CASE STUDY FROM PAKISTAN

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## ABSTRACT

Pakistan is currently facing acute energy shortages. The local energy production is inadequate to meet domestic needs and support economic growth which has decelerated the pace of economic development and industrialisation of the country. The residential sector consumes a significant chunk of the total energy resource available in the country. In this context there is a need to look for avenues where energy savings can be realised. The concept of energy efficient homes and sustainable dwellings is at the centre of energy saving debate but is still in its early stages of development in Pakistan. The main instruments to realise energy savings in any energy management regime stem from legal and regulatory frameworks, institutional and individual delivery capacity and enforcement mechanisms employed by the concerned authorities. This study looks into these regimes at national, regional and local levels and analyses their adequacy as to the objectives of their development and institution. The paper starts by detailing the prevailing situation with respect to (total) energy consumption and energy efficient living in Pakistan in the first part. Next, it analyses energy efficiency provisions for residential sector within the current legal and regulatory frameworks and identifies the challenges to such developments. The research method involves content analysis of policy, legal and regulatory provisions in Pakistan and institutional response through a dichotomous awareness survey about the existence and use of Building Energy Code of Pakistan, which is complementary to the main methodology. The research finds that there is need to adopt a holistic approach to improve the prevailing legal and regulatory regimes, which are weak

and poorly defined. The capacity, enforcement mechanisms and environmental performance of these regimes are also important issues. The outcomes of this study are recommendations for the necessary policy responses to better enable Energy Efficient Homes in Pakistan.

**Keywords:** Efficiency, Passive, Design, Legal and Regulatory, Capacity

## 1. INTRODUCTION

*“A low energy path is the best way towards a sustainable future”* (WCED, 1987). This path reflects a paradigm shift from energy intensive to energy efficient developments whilst ensuring a balanced interaction among environmental, social and economic concerns (Bell and Morse, 2003). The concept of sustainable development has gained momentum and significant recognition in order to avoid expected threats of climate change and fuel poverty across the globe. However, policy makers, planners and environmentalists, especially in the least developed and developing countries still need to go a long way to achieve the desired objectives of sustainable developments to improve the quality of life for current and future generations (Khator and Fairchild, 2006). Currently, the world is confronted with the challenges of higher energy consumption, CO<sub>2</sub> emissions and unsustainable development in the housing sector. The intentions of nations around the globe are quite evident from their policies, legal and regulatory frameworks, research and development initiatives and international commitments to engage in efforts to conserve energy. Globally, a number of initiatives, policies and plans have been adopted not only to conserve energy

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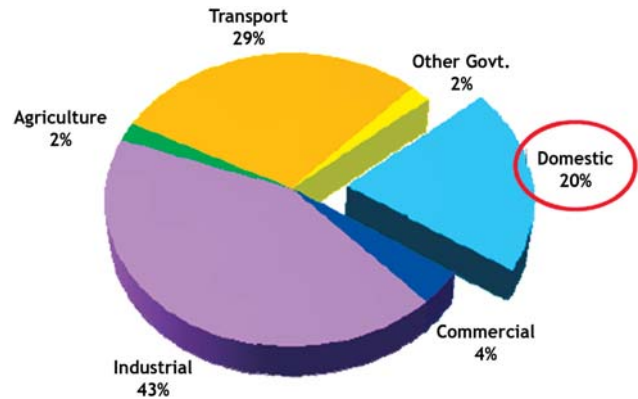
but also to safe guard the environment from the severe impacts of climate change. The focus of any sustainable economic development is to ensure the planning, development and management of a nation's limited resources in an energy efficient and environment responsible way.

Pakistan is facing the challenges of acute energy shortages (Raja et al., 1996). The local energy production is insufficient for its needs and the country is heavily dependent on the import of fossil fuels. The intermittent electricity supply and unplanned load shedding have become a culture in Pakistan whilst domestic activities and economic growth demand continuous supply of energy. The total installed power generation capacity in Pakistan is 19560 MW (CCP, 2010). The Water and Power Development Authority (WAPDA), Pakistan Electric Power Company (PEPCO), Pakistan Atomic Energy Commission (PAEC) and Karachi Electric Supply Corporation (KESC) are federal energy agencies responsible for power generation, transmission and distribution. About 31 % of the installed capacity is generated by Independent Power Producers (IPPs) (CCP, 2010).

Continuous and adequate energy supply is a pre-requisite to ensure sustainable economic growth in any country. Currently, only 65-70% of the total population in Pakistan has access to electricity and the country is facing serious power shortages of up to 6000 MW (CCP, 2010), intermittent gas supplies and costly imported fuel. The big gap between the demand and supply of energy has decelerated the pace of economic development and industrialisation in the country. To ensure sustainable economic growth and better quality of life, there is a need to exploit not only innovative, environmental friendly, sustainable and renewable sources of power production (Raja et al., 1996) but also develop an energy efficient culture of energy consumption in all sectors.

For clarity, this paper uses the concept of 'total energy consumption' that incorporates electricity, gas, oil and energy from other primary commodities for domestic and commercial activities. The domestic sector in Pakistan is responsible for a substantial portion of total energy consumption. Figure-1 shows that the Domestic sector utilises 20% of total energy as compared to Transport 29%, Industrial 43%, Agriculture 2%, Commercial 4% and other consumption 2% (ADB, 2009). (see Figure-1)

However, if we look at consumption by the type of energy then domestic sector's share of electricity use (a major component in total energy) is 46%. (Alter and Syed, 2011 & Economic Survey of Pakistan 2009-10). Currently per capita energy consumption in Pakistan is 500 kilowatt hours



**Figure-1:** Energy Consumption by Sector FY 2008.  
Source: Pakistan Sustainable Energy Efficiency Development Programme (ADB, 2009).

per year which is still very low as compared to the global average of 2500 kilowatt hours per year (Pasternak, 2000 and EEIU, 2011). These figures are expected to increase with the increase in the country's economic growth.

Given the current energy supply crisis in Pakistan as noted above, increases in domestic energy use must be counteracted by improvements in the regulations of building energy use and their enforcement. The absence of passive energy means, utilisation of poor building materials, urban design challenges and energy intensive sources for thermal comfort which are allowed within the current legal and regulatory framework challenge the sustainable development initiatives in the country. The concept of energy efficient homes and energy conservation is at the early stage of its development despite the fact that the traditional buildings constructed centuries ago are more energy efficient than today's modern developments in the cities of Pakistan (Qureshi, 2008).

This study aims to analyse energy efficiency provisions for domestic buildings within the current legal and regulatory framework that further leads to the identification of the challenges to such developments. The outcomes of this study are policy recommendations for Energy Efficient Homes (EEH) in Pakistan.

## 2. BUILDING PRACTICES IN PAKISTAN

The built environment is responsible for huge energy consumption and CO<sub>2</sub> emissions where buildings are the major part and have a substantial share in the total energy consumption in Pakistan and across the globe. According to the International Energy Agency (2005), "30-40 per cent of the worldwide primary energy is being used in buildings.

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*Up to 90 per cent of the energy is utilised during the operational stage of buildings, for the purposes of heating, cooling, and lighting” (UNEP, 2007 and Soharwardi, 2009).* In Pakistan attention is not being paid to a sustainable design for energy efficiency and environmental performance of buildings. The main drivers for a building design include layout, aesthetics, capital cost, novelty and market resale value, whereas energy efficiency, environmental and higher operational costs are totally ignored at the planning, design, construction and operational life of the buildings (Mathur, 2007). Modern building design in Pakistan lacks energy efficiency measures although traditional architecture utilises solar passive means, thermal mass, shared shading, central courtyard and even street patterns to achieve thermal comfort levels both in the winter and summer (Alamgir, 2008). Sustainability features such as location, function, layout, materials, daylighting, waste, water consumption, energy efficient appliances, energy resources, adaptability and compatibility with the surrounding environment play a significant role towards energy conservation and carbon reductions during the whole life cycle of the buildings (Younger et al., 2008). Some of these considerations may cost more initially, but offer long-term savings (Younger et al., 2008) and better quality of life for current and future generations.

Legal and regulatory frameworks and city planning practices with effective energy efficient considerations in the housing not only facilitates energy conservation but also sustainable urban development in the broader context. However, energy efficiency and conservation concepts are not well adopted in the Pakistan’s real estate market despite *“strong relationship between energy and planning components such as land-use, buildings, built form, transportation, urban form, and infrastructure systems”*(Duvarci and Kutluca, 2008).

### **3. ENERGY EFFICIENCY POTENTIAL IN THE HOUSING SECTOR**

Pakistan is facing energy shortages due to poor planning, low production and inefficient consumption. The intermittent, unreliable and poor quality of energy supply culture in the country is influencing economic growth of the country and hindering foreign direct investment. Moreover, higher cost of energy production through conventional methods with the technologies utilised by IPPs are responsible for considerable investment in the energy sector. Such

investments in technologies utilising expensive imported fossil fuels e.g. oil have ensured the deceleration of economic development. In this context, energy conservation in the domestic sector is one of the options to reduce overall current and future energy deficits. The adoption of energy efficiency and conservation measures can make available substantial capital resources for social and economic development of the society along with environmental benefits (US Congress, 1992).

The residential sector comprises 24 million households in Pakistan (ADB, 2009) with a 30%\* overall energy efficiency potential in the housing sector (ENERCON, 2008 <http://www.enercon.gov.pk/>). The energy consumption distribution in the residential sector is on average 59% natural gas, 34%, electricity, 2% Oil and 5% LPG. This distribution is dominated by two main sources of energy consumption i.e. electricity and natural gas. Electricity is mainly used to run home appliances such as lighting, fans, motors, refrigerators and air conditioners whereas natural gas is being use for space and water heating and cooking. Electricity consumption in domestic sector is 33,704 GWh/year (ADB, 2009) and power consumption for 9.8 million electric home appliances is 3530 MW (ENERCON, 2008 <http://www.enercon.gov.pk/>). Energy efficient appliances offset their initial relatively higher cost during their operational life. According to the Pakistan Energy Yearbook 2008, there is at least 10% potential to save energy by introducing energy efficient appliances (ADB, 2009 and ENERCON, 2008). Moreover, significant amounts (approximately 1085 MW) of energy can be conserved by replacing Incandescent light Bulbs (IBs 37% of the total residential points i.e. 117.4 million) with Compact Fluorescent Lamps (CFLs) (ADB, 2009).

The energy efficiency potential in cooking, water and space heating appliances with gas is 40%, 30% and 36 % respectively (ADB, 2009). This can be achieved by replacement of older systems, retrofitting/upgrading newer appliances and encouraging more efficient appliance use, especially in new residential developments (Byambasaikhan et al. 2009). All gas based appliances in the residential sector are expected to contribute substantially to energy security and economical energy supplies for future sustainable developments.

Energy savings can be achieved by improving building

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\* 30% energy efficiency potential refers opportunities to conserve energy out of domestic share through energy efficient building designs, materials, appliances, water and waste management and retrofitting / modifying the existing buildings.

materials, wall insulation, double or triple glazed windows, orientation (new developments), water consumption, waste management and proper roof insulation in existing buildings and new developments. According to the ADB report on Sustainable Energy Efficiency Development Programme of Pakistan, roof insulation can reduce up to 20% of electricity demand for thermal comfort in summer (ADB, 2009).

New developments to accommodate current and future housing demands are expected to play a significant role not only to provide shelter but also substantial energy efficiency and conservation in the housing sector. The estimated housing demand in 2008 was 570,000 units, with the annual supply of 300,000 units and a shortfall of 270,000 units per year (NHP, 2001). With the introduction of energy efficiency measures, these 300,000 new housing units have the potential to save 297000 MWh/year.

#### 4. METHODOLOGY

The research method adopted in this study is that of descriptive evaluation, which involves both theoretical and practical considerations to strengthen analysis and research outcomes. This three-step methodology takes input from three components (i.e. legal and regulatory arrangements, Building Energy Code of Pakistan and the extent of the institutional response judged through an awareness survey of existence and use of Building Energy Code of Pakistan). The first stage involves the content analysis of legal, regulatory and policy arrangements for energy efficiency, environmental performance in the housing sector at federal, provincial and local level, and Building Energy Code of Pakistan. The results from the content analysis of the policies, laws, rules, regulations and standards relating to energy efficiency, environmental performance and sustainable developments, identify gaps, poor dissemination of federal policies into provincial plans and local legislation. Moreover, challenges to the Building Energy Code of Pakistan have also been identified. (see Figure-2)

The second stage of the research consists of analysing institutional response through a simple dichotomous survey to identify level of awareness of the Building Energy Code of Pakistan and its application in the real estate development. The method of enquiry is based on an enumeration survey that followed a structured format and asked a closed-end question from the participants from three different organizations. The organizations surveyed are: the Urban Unit; City and Regional Planning Department, University of Engineering and Technology Lahore; and Lahore Development Authority. The participants are involved in

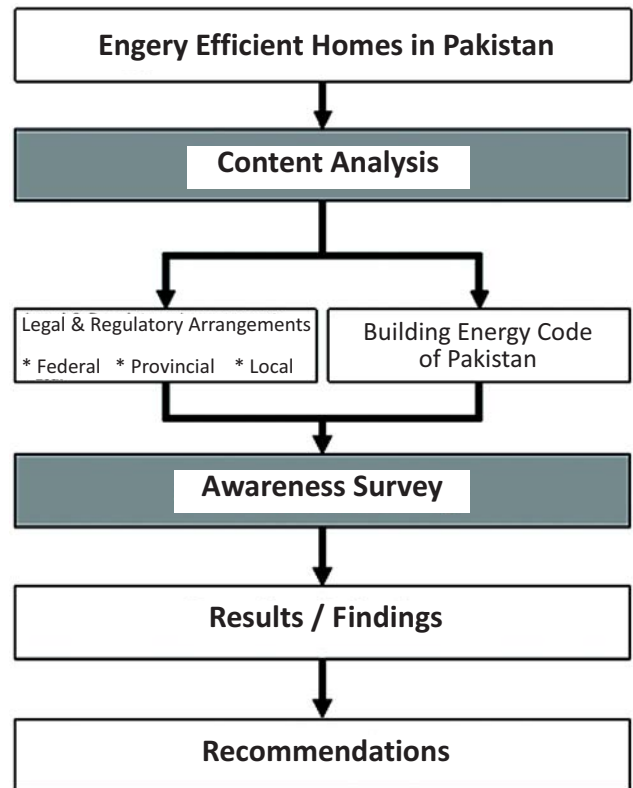


Figure-2: Research Methodology.

policy planning, capacity building and professional growth, development and management activities in the housing sector. It needs to be clarified and emphasized here that this survey is: quite limited in its scope and coverage as it surveyed planning professionals only in one of many big urban centres who were asked only one question; not a main focus of this research; and is complementary in nature and has been used to verify or otherwise the inferences obtained from content analysis which is the main methodological component of this research. Thus, it provides generalised information about the dissemination of the building energy code of Pakistan from Federal to Local level.

The final step of the methodology analyses the results from the content analysis and awareness survey, which leads to the research findings. The outcomes of this study are a set of policy recommendations for energy efficient culture in the housing sector in Pakistan.

## 5. ENERGY EFFICIENCY LEGAL AND REGULATORY FRAMEWORK IN PAKISTAN

The legal and regulatory framework for energy efficient homes, like other developing nations, is in transition in Pakistan. To achieve the objective of energy conservation in the housing sector, environmental protection, integrated land use planning, development and management nationwide broad principles, policies and laws have been established at the federal level in Pakistan through acts, ordinances, national policy, planning manuals and codes. (see Figure-3)

The federal policies and acts set a broad framework for devising provincial level policies and regional development plans. Provincial level policies and plans are legally “binding” for large, medium, small towns and villages for planning, development, management and decisions making. Consequently, whenever District Governments wish to prepare or modify any of its land use or development plan, they are legally bound to follow the provisions of provincial policies and plans at the provincial and local level. It is obvious that the main instrument and the driving force for energy efficiency, conservation and improvements in the housing sector will be legislation and enforcement (Clarke, et al., 2008).

## 6. LEGAL AND REGULATORY ARRANGEMENT

The Pakistani government is struggling to introduce energy efficient homes due to fragmentary legislative provisions. Although the Building Energy Code of Pakistan was initially launched in 1990, it could not achieve expected energy efficiency targets in the housing sector. A brief analysis of legal and regulatory provisions with a focus on energy efficiency, environmental performance, energy conservation measures, quality of life and overall sustainable development in the housing sector at federal, provincial (Punjab) and local levels has been described in Annex-1. The evaluation of the legal, regulatory and policy arrangements at the federal level including the National Conservation Strategy, National Reference Manual, Environmental Protection Act 1997, National Housing Policy 2001 and the National Environmental Policy, cover a wide range of environmental concerns such as industrial pollution, transport pollution, hazardous substances and sustainable development but no specific measures are adopted for energy efficient and environment friendly sustainable developments in the housing sector. Similarly, at the provincial level the legislative provisions focus on devolution plan, environmental control, urban design, passive means of energy, indoor environment,

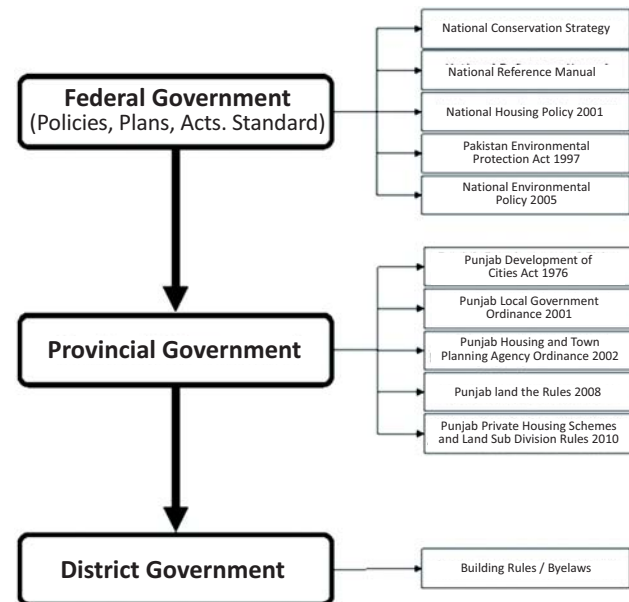


Figure-3: Legal and Regulatory Framework in Pakistan  
Source: The Urban Unit, P&D Punjab (Syeda and Akbar, 2007)

ecological balance, beautification of administrative areas, implementation of rules and bye-laws, provision of shelter and cost effectiveness issues rather energy efficiency and conservation. Moreover, the federal and provincial legal provisions provide an opportunity under different sections to make rules and Bye-laws to carry out the purposes of the concerned law. Unfortunately subordinate legislations have not been framed to provide an enabling environment for energy efficient homes.

## 7. BUILDING ENERGY CODE OF PAKISTAN

The Building Energy Code of Pakistan 1990 was initially prepared by National Energy Conservation Centre (ENERCON), Planning and Development Division and Ministry of Housing and Works Environment and Urban Affairs Division. The Code aimed to provide energy efficient design and construction of buildings for optimum thermal comfort levels and lower domestic energy consumption. Initially Code was considered as the postscript of Building Code of Pakistan with minimum performance standards for building walls, roofs, windows and openings, heat, ventilation and air conditioning (HVAC) equipment and lighting. These HVAC arrangements were based on American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) standards. The code was non mandatory at that time but was expected to be the part of mandatory requirements with the dissemination from federal to local

**Table-1: Energy Efficiency Awareness Survey**

SR.NO	ORGANISATION	LEVEL	PROFESSIONAL PLANNERS	ANSWERED	YES	NO
1	Lahore Development Authority	Local	33	22	3	19
2	CRP Department, UET Lahore	Provincial	13	10	3	7
3	The Urban Unit, P&D Punjab	Provincial	5	5	3	2

levels, gradual improvement in the federal, provincial and local legislations, continuous capacity building and research and development activities. However after 20 years, including research and development by ENERCON, Pakistan is still far from achieving optimum energy efficiency and environmental performance of the buildings. Currently, ENERCON is updating the Code according to the contemporary building requirements. A draft document, based on the previous Code, has already been prepared in 2009. The Code has divided the whole country in five different climatic zones. The Code facilitates *new buildings and portions of existing buildings, new systems and equipments and change in use of buildings* (BECP, 1990). The factors covered in the code for energy efficient homes mainly include, “*building envelopes, building mechanical systems and equipment, including heating, ventilating, and air conditioning (HVAC), service water heating, lighting and electrical power and motors* (BECP, 1990).

The Code provides a basis to sustainable building standards in Pakistan. It was introduced as non statutory standard in 1990 (still having non mandatory status) and could not disseminate to local levels due to legal, institutional, political, financial, awareness, delivery capacity and coordination barriers between federal and local levels. The Code is the first step to ensure energy efficiency, thermal comfort with minimum energy consumption, carbon reductions and sustainability of new and existing buildings.

## **8. ENERGY EFFICIENCY AWARENESS SURVEY**

The energy efficiency awareness survey conducted in 2010 evaluated the level of awareness and dissemination of Pakistan Building Energy Code from the federal to local level during the last 20 years. The survey was simply based on a dichotomous question, whereas Yes/No question was used to separate professional town planners familiar with the Pakistan Building Energy Code for energy efficiency, conservation and improved environmental performance of the buildings. The fieldwork for the survey was performed by the professional town planners (co-authors) in the three organisations.

Three organisations namely The Urban Unit, P&D Department (Provincial); City & Regional Planning Department, UET Lahore (Academia); and Lahore Development Authority (local development agency) were selected for the survey. The selection of these three different organisations is based on their functions and unique role in planning, development and management measures at different levels within existing legal framework.

The survey aimed to determine the existing level of awareness among the town planning professionals involved in policy planning and establishment of legal and regulatory arrangements at provincial level (The Urban Unit); academia involved in education and training of the professional qualified town planning graduates (City and Regional Planning Department) and Professional town planners involved in the implementation and enforcement of the Building Regulations and all development activities (Lahore Development Authority). All professional Town planners across three organizations were contacted to evaluate the level of awareness about the Pakistan Building Energy Code. (see Table-1).

The results from the energy efficiency awareness survey clearly depict very low level of awareness about the existing non statutory Building Energy Code of Pakistan. This indicates poor networking between federal, provincial and local academic, planning and development agencies, lack of trained professionals, individual and institutional capacity building. The lack of professional awareness impedes public awareness about energy efficiency standards, renewable technologies, orientation consideration, building materials, international best practices, water consumption and energy conservation at large. The low level of dissemination of energy efficiency measures during the last two decades is the real dilemma for future sustainable new developments and refurbishments in Pakistan.

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## 9. ANALYSIS

Energy efficiency and conservation measures in the domestic sector have great potential not only to reduce energy deficit, financial benefits to the general public and better quality of life but also considerable capital resources for other economic development activities. The energy efficiency potential in the domestic sector in Pakistan can be exploited by the introduction of sustainable designs, materials, insulations, efficient electrical appliances, gas heaters and cookers. For instance, there is potential for realising 10% reduction in electricity use by using better electrical home appliances, which is equivalent to saving 353 MW of electricity. Whereas total production from PAEC is only 462 MW. Moreover, substantial saving in electricity consumptions can be achieved by introducing CFLs instead of IBs and 30 to 40% savings can be achieved in cooking, water and space heating appliances with gas (ADB, 2009).

The review of legal and regulatory provisions at federal, provincial (Punjab) and local level for energy efficiency, housing, urban planning and development reveals a poor and deficient policy framework for energy efficiency and energy conservation in the housing sector in Pakistan. It does not provide the enabling environment to support and disseminate energy efficiency measures in the building practices. These existing laws do provide broad statements about energy efficiency, conservation, GHG reductions, environmental impacts and overall better quality of life but broad provisions under different sections have not been trickled down to subordinate legislation and standards for real applications, dissemination and enforcement. The current situation depicts a lack of enabling laws and regulations at local levels to support and integrate energy efficiency initiatives in the current building practices in different parts of Pakistan. This deficiency also reflects in near-total lack of international best practices such as Leadership in Environmental and Energy Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM) and Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB) rated developments; inadequate energy efficiency standards under the current legal umbrella; lack of energy efficient labelled appliances and goods for thermal comfort, energy conservation and other domestic operational activities along with substantial reduction in the carbon emissions.

Laws and legal provisions have always been an effective instrument to strengthen and provide strong foundation to institutional structures to enforce and achieve short and long term development targets. Due to poorly defined legal and

regulatory frameworks in Pakistan, the institutional arrangement to strengthen energy efficiency initiatives is also facing challenges. One of the major challenges is the lack of substantial financing in this sector whilst a wide range of energy efficient building materials, sustainable technologies and equipment has already been integrated in the construction industry in developed and developing countries. Currently, Pakistan is at the early stage of development in the domestic sector and penetration of energy efficiency, energy conservation measures and sustainable technologies is almost negligible. Financial institution, established financial companies, government development agencies, real estate developers are reluctant to invest in this sector and exploit the social, economic and environmental potentials of energy efficient homes in Pakistan.

The relatively high energy consumption in the housing sector seems a potential for energy efficient refurbishment and new developments. Current culture of higher energy consumption, lack of motivation, resistance to adopt contemporary tested energy conservation measures and sustainable technologies are upfront challenges. Four major players namely government (federal, provincial and local), private sector (investors, real estate developers etc.), civil society (NGOs, CBOs etc.) and general public (Individual household) need to play active role from policy framework at federal level to on ground development at the individual dwelling unit. Government influential and pro-active role towards energy efficient developments in terms of comprehensive energy efficiency policy framework, legal and regulatory arrangements, benchmarking for short term and long term targets, performance based financial allocations, subsidies and coordination among policy institutions and development agencies, is inevitable to enhance motivation and energy efficiency culture in Pakistan. Private sector including national and international financial institutions, real estate developers and business communities are merely paying attention to integrate energy efficiency measures and renewable sources of energy in the housing sector. New developments are simply swallowing Greenfields in the name of high tech infrastructure provisions for economic benefits with little attention to social needs and virtually no attention to energy efficiency, conservation and environmental concerns at overall development and individual dwelling unit levels. The private sector needs to play a model role for the energy efficiency initiatives in the housing sector in Pakistan with the introduction of innovative design solutions, materials, ecological and management measures and contemporary sustainable technologies. This will lead to sustainable development with more economic benefits and market acceptability due to consumer and environmental

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considerations. Civil society organization including Non-governmental Organisations (NGOs) and Community-based Organisations are expected to play a significant role in terms of capacity building, localise standards, model sustainable developments and mass awareness of energy efficiency, conservation and environmental issues in the housing sector. The common people need to adopt such initiatives not only for their own social, economic and environmental benefits but also for future generations. The private sector needs to stimulate indigenous industries developing the necessary low cost materials to enable a low carbon building to be constructed. Moreover, the role of academia must be realised and strengthened for professional and general capacity building at large.

The Pakistan Building Energy Code covers minimum energy efficiency, energy conservation and other features of sustainable developments for existing and new buildings in Pakistan. The Code is facing technical, legal and regulatory, economic, social and cultural and capacity issues in the delivery of Energy Efficient Homes in Pakistan. These challenges include;

- Non-statutory and voluntary status of Code not only causing poor usability but also poor dissemination of energy efficiency measures at lower tier legislations.
- Insufficient incorporation of energy efficiency measures in Building Regulations and Bye-Laws as envisaged in the Code according to five different climatic zones of Pakistan.
- The code covers new buildings and refurbishments (all building types are being covered). No specific energy efficiency measures have been incorporated for different land uses such as residential, offices, shops, schools, hotels, government buildings etc.
- No minimum acceptable level for energy efficient homes based on energy efficiency and sustainability features in any particular building, although there are specific standard requirements for individual components of the building such as roof, windows and HVAC etc.
- No standard parameters have been incorporated to assess and evaluate energy efficiency and environmental performance during design, construction and operation period of building life.
- No specific standards have been elaborated for efficient building materials, equipments and appliances.

- The Code does not talk about other sustainability factors such as water consumption, surface water runoff, location, appliances, cooking system, heating system, waste management, daylighting, ecological impact etc.
- Proper attention has not been paid to the ecological factors and enhancement of the site before and after the construction.
- Lack of established institutions at provincial levels to translate federal policies to provincial and local plans. More over poor coordination and culture of isolation in federal, provincial and local bodies is also a dilemma for such initiatives in Pakistan
- Exemptions such as buildings without electricity or fossil fuel utilisation, minimum use of electricity and gas and equipment and portions of building systems that use energy primarily for manufacturing industry and processes, warehouses, storage and agriculture need to be rectified.
- Lack of awareness among the professionals and general public which lead to poor or no interest toward energy efficient homes.
- No consideration to integrate gradually sustainable renewable technologies in the housing sector
- Lack of individual and institutional capacity and implementation framework and feedback
- Poor consideration towards international best practice sustainable development initiatives.

The Pakistan Building Energy Code is just the first step towards sustainability and energy efficient sustainable homes in Pakistan. The real challenge is the awareness, market acceptability, appreciation and fully adoption of these measures. Moreover, gradual contemporary improvements, preparation of technical guides and manuals, practical sheets, educational curriculum, training manuals, professional certifications and adoption of international best practices are demanding fronts for mainstreaming energy efficiency in the housing sector in Pakistan.

## 10. KEY FINDINGS

The descriptive analysis of legal and regulatory framework, Building Energy Code of Pakistan and results from the awareness survey reveals that;



- Domestic sector has about 30% energy efficiency potential that needs to be exploited not only for social, economic and environmental benefits but also better quality of life at large.
- Lack of enabling environment at the federal, provincial and local levels has resulted in a fragmented and voluntary energy efficiency, legal, regulatory and policy framework
- Lack of awareness about energy efficiency, conservation and environmental performance measures among the professionals in particular the academia and professional government agencies.
- Lack of institutional arrangements and poor coordination among existing federal, provincial and local government departments and agencies.
- Individual and Institutional capacity constraints to enforce energy efficiency provisions under the existing legal framework.
- Limited Research and Development initiatives by professional bodies, research institutions, government agencies and international organizations.
- Limited professional and technical expertise across Pakistan to evaluate energy consumption and performance of buildings, equipments and appliances.
- Lack of substantial financing in the domestic energy sector due to weak legal and policy framework, market acceptability, confidence and adoption issues.
- Poor market acceptability due lower per capita income and higher capital cost of energy efficient products, materials, equipments and appliances. This shows limited awareness about low operational cost, economic and environmental benefits over the life time of these.
- Low level of awareness regarding international best practices on energy efficiency.
- No concept of subsidies and incentives for energy efficiency in the housing sector to achieve social, economic and environmental benefits in the broader context.

## 11. CONCLUSIONS AND RECOMMENDATIONS

Major Challenges in disintegrating energy efficiency parameters in the housing sector and city planning system in Pakistan include; inadequate and inefficient federal and

provincial policies, mismanagement and poor dissemination of federal government initiatives into provincial plans; poor institutional arrangement and delivery capacity at local level; lack of awareness and interest of all the stakeholders (Professionals, Public, Government and Developers) and lack of financing due to weak legal framework. There is a pressing need to adopt a holistic approach to instituting of an enabling environment and energy efficiency culture in Pakistan. Following recommendations are an effort to support future legal, regulatory and policy reforms to enhance energy efficiency and sustainability performance in the built environment.

### Recommendation 1

*Development and adoption of overarching legal, regulatory and policy frameworks for energy efficient homes and sustainable developments in Pakistan.*

The Government intends to enact the Pakistan Energy Efficiency and Conservation Bill, which will provide a legal framework and a regulator role to National Energy Conservation Centre (ENERCON) to coordinate and implement national energy conservation and energy efficiency initiatives and policies. This will also provide a legal support to Building Energy Code of Pakistan because under its statutory authority ENERCON will be able to develop such standards and energy efficiency parameters. The integration of these standards and measures with the provincial and subordinate legislations especially Building Regulations (BR) and Bye Laws is the pre-requisite of Energy Efficient Homes in Pakistan. There is need to have clear and doable energy conservation and carbon reduction targets with a comprehensive road map. This road map will enable all enforcing authorities to gradually improve BR and Bye Laws in order to comply with energy efficiency and environmental performance of the buildings.

### Recommendation 2

*Establishment of a comprehensive institutional framework with explicit role and responsibilities from federal to local level.*

This framework will enable provincial government / departments to translate federal policies into provincial plans and legal binding for the local governments to incorporate energy efficiency measures and achieve set targets of energy conservation at household level.

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### **Recommendation 3**

*Standardisation and labelling schemes for equipment and appliances such as refrigerators, air conditioners, gas heaters, gas stoves, washing machines, driers etc.*

### **Recommendation 4**

*Continuous research and development, training and capacity building of provincial and local government departments and authorities.*

The role of educational and research institutions (academia) is strongly recommended for such trainings through R&D activities for energy efficient sustainable developments. Development of case studies and demonstration sites modelled on constructability parameters for energy efficient living will help in furthering general awareness of the energy efficiency issues and in understanding the practical implications of such endeavours, and will ultimately contribute to sustainable development.

### **Recommendation 5**

*Review and incorporate other sustainability factors such as water consumption, waste water, waste management,*

*renewable source of energy, local materials, location, ecological consideration etc. in the Building Energy Code of Pakistan.*

However, there is a need to establish a robust process to review and update energy efficiency performance indicators and criteria.

### **Recommendation 6**

*Prepare technical guides, and manuals, training manuals, educational curriculum, software and institute professional certifications for professional planners, architects, engineers, and other code practising officials.*

### **Recommendation 7**

*Development of a robust database for existing and new buildings for better energy efficiency solution and record.*

### **Recommendation 8**

*Introduction of subsidies against substantial improvements in the energy efficiency and environmental performance of the individual building.*

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## ANNEX 1

### A.1 FEDERAL LEVEL

#### A.1.1 National Conservation Strategy

The Pakistan National Conservation Strategy (NCS) was adopted in 1992 with the challenges of protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and sustainable development. The NCS targeted fourteen core areas along with three operating principles. These principles include “*Public partnership in development and management; integration of environment and economics in decision making and improvements in the quality of life*” (Hanson et al., 2000). The derived implementation mechanism involved seven key stakeholders/partners from government (federal, provincial, district) and the society in order to achieve the objectives of sustainable development. Increasing Energy Efficiency, one of the core areas, targeted energy efficiency in building, retrofits and appliances and identified policies such as development of alternative energy sources and efficient use of energy only. Moreover, practical measures such as use of fuel efficient cookers, introduction of private sector for commercial development of local energy sources and solar water heaters were suggested in the NCS (Sohaib and Athar, 2002). The Strategy covered wide range of areas and sectors instead of more focused and doable road map towards sustainable development. It put great emphasis on NEQS, EIAs, public awareness about environmental issues, Institutional strengthening and protection of natural resources for better quality of life. However it could not focus properly the “*Macro-economic and sectoral economic policies,*” and housing sector in particular (Hanson et al., 2000).

#### A.1.2 National Reference Manual on Planning and Infrastructure Standards

The National Reference Manual is the only reference document for planning and infrastructure provisions for development activities in Pakistan. The concept of energy efficient homes has not been dealt with in the manual. No specific measures have been suggested to adopt energy efficiency and environmental performance of the buildings. The Physical Planning Process has briefly incorporated environment and orientation considerations to exploit wind and solar energy. General guidelines cover planning and designing of lots in a layout plan at a neighbourhood level according to different climatic zones (cold composite, cool composite, normal composite, warm composite, extra dry cool, extra dry hot, inland maritime and maritime) and climatic effects in different regions of Pakistan. These guidelines comprise plot dimensions, building lines, plot relationship and arrangement for effective and efficient use of passive means (NRM, 1986). The basic design and layout considerations have been incorporated in the Manual but these standards are not legally bindings for the professionals and developers in the housing industry. Even development schemes by the federal and provincial governments and registered developers during the last two decades have not considered these passive considerations as guiding principles to enhance energy efficiency and environmental performance of buildings at individual and neighbourhood level. Moreover, the Manual has not been reviewed and updated since 1986 to meet the requirements of contemporary energy efficient homes, environmental performance and carbon reductions.

#### A.1.3 National Housing Policy 2001

The National Housing Policy 2001 highlighted the government’s role to exploit resources whilst facilitating and regulating development initiatives to enhance economic activity (Rizvi, 2001). The policy has put great emphasis on “*resource mobilisation, land availability, incentives for home ownership, incentives to developers and constructors and promotion of research and development activities to make construction cost effective*” (Ali et al. 2010 and NHP, 2001). The objective was contributing affordability and cost effectiveness instead of energy efficiency, thermal comfort and environmental performance of buildings. Key considerations of the Housing Policy include revision and improvement of planning and building regulations, codes and standards, building materials, construction technology, capacity building, coordination among different development agencies at federal, provincial and local levels (NHP, 2001).

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#### **A.1.4 Pakistan Environmental Protection Act 1997**

The Pakistan Environmental Protection Act 1997 was enacted to strengthen Environmental Protection Agency created under 1983 ordinance for the protection, conservation, rehabilitation and improvement of the environment. The Act mainly focused on the implementation of Council's policies (established under section 3 of the act), delegation of powers to government agencies, enforcement of NEQS, introduction of EIA / IEE review procedures, regulatory regime for hazardous wastes, resource generation through establishment of provincial sustainable development fund, pollution charges and providing an appeals process for environmental cases (PEPA, 1997). The environmental concerns in terms of transport pollution, hazardous substances and industry related issues, were covered thoroughly but no specific arrangement had been ensured for energy efficient and environment friendly sustainable developments in the housing sector.

#### **A.1.5 National Environmental Policy 2005**

The National Environmental Policy 2005 focused on energy security and to achieve energy efficient, environmentally friendly and sustainable arrangements for the future. The policy aimed *“to protect, conserve and restore environment to improve quality of life through sustainable development”* (NEP, 2005). The policy challenged different strategic issues such as sustainable development, cost effective and energy efficient measures to improve economic productivity and poverty alleviation, reduction in CO<sub>2</sub> and Green House Gas emissions, gender mainstreaming and energy supply to rural areas. The policy provides broad general, sectoral and cross sectoral guidelines to federal, provincial and local district governments to address environmental issues. The policy provides strategic direction under section 3(7) (Energy Efficiency and Renewables) of the sectoral guidelines to adopt energy efficiency and conservation measures leading to sustainable developments. No doubt the policy has covered a wide range of sectoral and cross sectoral areas with a long shopping list of initiatives and measures. These guidelines describe what is required for short term and long term sustainable development activities but the questions are how to do (road map, system and systematic legal and regulatory arrangement, transformation of federal policies and legislation to provincial and local rules and regulations, integration of renewable technologies) and who will do (individual and institutional capacity, enforcement mechanism with rational bench marking).

### **A.2 PROVINCIAL LEVEL**

#### **A.2.1 Punjab Development of Cities Act, 1976**

The Punjab Development of Cities Act 1976 was promulgated to improve quality of life in the cities of Punjab through a systematised planning and development. The act emphasised on *“an integrated development approach and a continuing process of planning and development, to ensure optimum utilization of resources, economical and effective utilization of land and to evolve policies and programmes, relating to the improvement of the environment of housing, industrial development, traffic, transportation, health, education, water supply, sewerage, drainage, solid waste disposal and related issues”* (PDCA, 1976). The Punjab development of Cities Act does not highlight energy efficient buildings, domestic energy conservation and environmental performance of the buildings. However, section 7(2) and 2(v) identifies few measures for environmental improvements, development control and beautification of the areas rather energy efficient sustainable developments.

#### **A.2.2 Punjab Local Government Ordinance 2001**

The Punjab Local Government Ordinance 2001 was promulgated to *“devolve political power and decentralise administrative and financial authority to accountable local governments for good governance, effective delivery of services and transparent decision making through institutionalised participation of the people at grass-roots level”* (PLGO, 2001). The Ordinance provides a comprehensive legal and administrative arrangement for the devolution plan but energy conservation and energy efficiency in the housing sector has not been specifically entertained. However, Section (40) and 6<sup>th</sup> Schedule Section (27) describes environmental control, urban design, passive means of energy, indoor environment, ecological balance, beautification of administrative areas and implementation of rules and bye-laws. Moreover, Sections 191 and 192 facilitate the Councils to make rules and Bye-laws to carry out the purposes of the Ordinance. But subordinate legislations have not been framed

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to provide an enabling environment for energy efficient homes across the whole province.

### **A.2.3 The Punjab Housing and Town Planning Agency Ordinance, 2002**

The Punjab Housing and Town Planning Agency Ordinance 2002 was enacted to establish Punjab Housing and Town-Planning Agency. The main functions of the Agency, as envisaged in the ordinance, are to provide shelter and to establish a comprehensive system of town planning at provincial, district, Tehsil and union council levels. The Ordinance describes few functions and powers of the agency to adopt environment friendly measures in the housing sector. The Section 4(2)(i)(ii)(iii) and (vii) clearly facilitate to *“develop indigenous and cost effective approaches; adopt parameters of the national housing policy; low cost housing; and promotion of environment for friendly and standardised construction activities”*(PHATA, 2002). Moreover, under Section 4 sub-section 2 (xviii)(xix) the agency may provide technical assistance to the District Governments and Tehsil Municipal Administrations and coordination with the federal government for housing and town planning development initiatives (PHATA, 2002). The main focus of the Ordinance is the provision of shelter and cost effectiveness rather energy conservation.

### **A.2.4 Punjab Land Use Rules 2008**

The Punjab Land Use (Classification, Reclassification and Redevelopment) Rules 2008 has been framed under section 191 of the Punjab Local Government Ordinance 2001 and section 44 and 43 of LDA Act 1975 and Punjab Development of Cities Act 1976 respectively. The main objective of the Rules is the classification, re-classification and redevelopment of the land uses in order to ensure sustainable, harmonious and compact development in the cities. The Rules provide comprehensive planning framework for different land uses and development activities in urban, peri-urban and agriculture areas. However, energy efficiency and environmental performance of existing housing stock and future dwellings has not been considered in these Rules (PLUR, 2008).

### **A.2.5 Punjab Private Housing Schemes and Land Sub-Division Rules 2010**

The Punjab Private Housing Schemes and Land Sub-Division Rules 2010 have been notified under the section 191 of the Punjab Local Government Ordinance 2001. These Rules define procedural criteria to sanction housing developments and planning standards for housing schemes and sub-divisions. These planning standards incorporate minimum standards for open spaces or park, graveyard, commercial area, public buildings, maximum size of residential plot, roads, solid waste management, provisions for low income groups, tube well location, site of grid station and green strips. There is nothing about energy efficiency, environmental performance, exploitation of passive means for sunlight and wind by systematic and innovative arrangement of streets and roads (PHS&LSR, 2001).

## **A.3 LOCAL LEVEL**

### **A.3.1 Building Regulations/Byelaws**

The Building Regulations and Byelaws adopted by Development Authorities and Local Governments in Punjab have incorporated environmental issues in the form of environmental impact assessment, considerations for flood plain areas and environmentally sensitive areas. Moreover, internal lighting and ventilation specification (such as external openings and internal wells), fire safety precautions, emergency exits and standard specifications for utility services such as water, drainage, sanitation, solid waste management and electricity have been comprehensively elaborated for individual and common development activities (BR, 2007). The concept of Energy Efficient Homes is missing in the Building Regulations and Byelaws. The limited environmental concerns in the Regulations are targeting better quality of life. Different features such as optimum utilisation of passive means, design considerations, materials, integration of contemporary renewable technologies, insulation, double or triple glazed windows, thermal bridging, embodied energy etc. contributing to energy efficiency, environmental performance of the buildings and energy conservation has not been incorporated in these Regulations.