

Building energy efficiency policies in Pakistan: Current Issues and Future Prospects



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Introduction

Energy usage and demand is increasing globally due to:

- Increasing urban population
- Use of latest devices and technologies
- Expansion in the user's net

Several countries including Pakistan are facing problems such as; energy shortage, distribution, demand and supply gap and line losses.

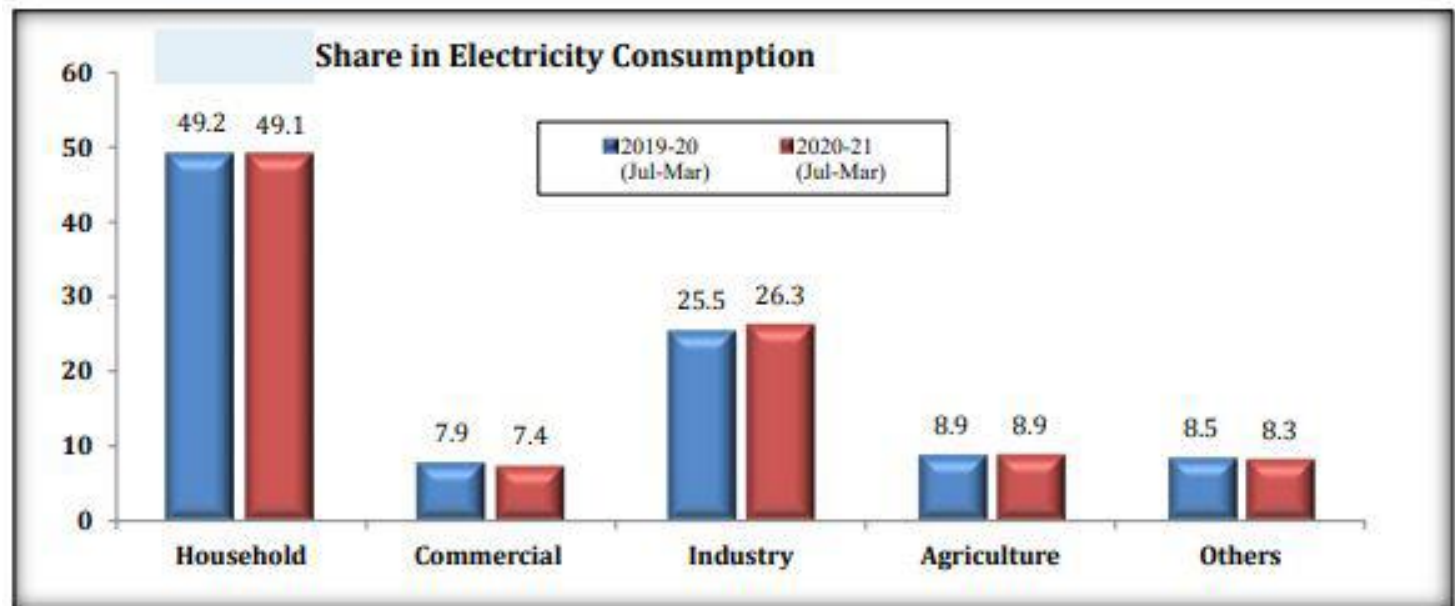
In Pakistan, urban population is increasing at the rate of 3% per annum which is highest in South Asia.

By 2025 nearly half of the population in Pakistan will live in urban areas (Kugelman, 2013).



Problem

- Household sector consumes nearly half of the electricity
- Most of the buildings are not designed according to climate considerations
- Use of concrete and single glazed glass is very common
- Considering the energy problems and rising energy prices there is a need to reduce the household energy consumption



Building Codes

Building Energy Code of Pakistan (BECP)

BECP was developed in 1990 by National Energy Conservation Centre (ENERCON)

It was an adapted version of ASHRAE standard 90.1

Five (5) climatic zones were identified based on minimum and maximum recorded temperatures

It provides minimum performance standard for:

- Buildings
- Windows and openings
- Lighting
- Heating, ventilation and air-conditioning (HVAC)



Building Codes

Building Energy Code of Pakistan (BECP)

- In 2008, new version of BECP was introduced without any provision for multifamily buildings
- It focuses on commercial buildings and do not follow ASHRAE standard 90.2
- There is no consideration for the use of local/ indigenous materials
- Problems related to the integration of Code with the local by-laws and building codes
- Code compliance was not mandatory for several years.
- A detailed analysis of housing requirements, local materials and construction techniques in relation with ASHRAE standard 90.2 is necessary before designing building codes and by-laws

Building Codes

Building Code of Pakistan (Energy Provisions-2011)

- BCP (EP-2011), are mainly adopted from ASHRAE standard 90.1-2004.
- Its section-4 “Building envelope” is developed based on local environment and energy codes of the regional countries
- It provides minimum standards for the energy efficient design and construction of buildings
- It emphasizes on the compliance and enforcement of the code by the local authority/ municipality
- EP-2011 can be changed, modified or updated after minimum 3 and maximum 5 years with the involvement of all stakeholders.

Building Codes

Building Code of Pakistan (Energy Provisions-2011)

The scope, application and limitations of BCP (EP-2011)

Scope		Building systems	Exemptions	Limitations
Load and area	Buildings			
<p>It applies to buildings and building clusters that have:</p> <ul style="list-style-type: none"> -A total connected load of 100kW or higher -Contract demand of 125 kVA or higher -Conditioned area of 900 m² or greater -Unconditioned buildings with covered area of 12,00 m² or greater 	<p>It is applicable to:</p> <ul style="list-style-type: none"> -New buildings and their systems -New portions of existing buildings and their systems if the connected load exceeds the mentioned limits -Increase in electricity load beyond the mentioned limits 	<p>Applicable building systems:</p> <ul style="list-style-type: none"> -Building envelope -Mechanical systems and equipment including HVAC -Service water heating -Lighting -Electric power and motors 	<p>Exempted buildings:</p> <ul style="list-style-type: none"> -Buildings that do not use electricity or fossil fuel -Government notified heritage buildings -Portion or equipment of building systems that use energy for manufacturing process 	<p>-In case of any conflict, relevant provisions of safety, health and environment codes will prevail</p>

Building Codes

Building Code of Pakistan (Energy Provisions-2011)

Mandatory requirements for the building systems mentioned in BCP (EP-2011)

Building Envelope	HVAC system	Service water heating	Lighting	Electric power and motors
<ul style="list-style-type: none"> -External walls and roof -Glass and framing -Air leakages and infiltration 	<ul style="list-style-type: none"> -Temperature control -Mechanical ventilation -Piping and ducting work -Air system balance -Voluntary adoptions (natural ventilation, alternate energy) 	<ul style="list-style-type: none"> -Piping insulation -Equipment efficiency -Swimming Pools 	<ul style="list-style-type: none"> - Lighting controls -Exit signs -Exterior building and ground lighting -Landscape lighting -Interior and exterior lighting power 	<ul style="list-style-type: none"> -Transformers -Energy efficiency motors -Power factor correction -Check metering -Power distribution systems

Building Codes

Building Code of Pakistan (BCP)

- BCP is a document with necessary guidelines for design, construction and safety of buildings.
- It was first published in 1986 by Ministry of Housing & Works, Govt. of Pakistan
- It was used as a reference and was not implemented at a mandatory requirement
- After Kashmir earthquake 2005, it was revised. Compliance and enforcement was made mandatory
- In 2013, Energy Provisions-2011 were included in BCP to make it useful for building energy and conservation practitioners and to implement energy efficiency and policies across the country

Building Codes

Building Code of Pakistan (BCP)

1. Building Code of Pakistan - Seismic Provisions-2007

- S.R.O. for "Application for Building Code of Pakistan" dated September 10, 2008

2. Building Code of Pakistan- Energy Provisions-2011

- S. R. O. 249 (I) for Building Code of Pakistan- Energy Provisions-2011

3. Pakistan Electric - Telecommunication Safety Code (PETSAC)-2014

- S. R. O. 716 (I) for Pakistan Electric & Telecommunication Safety Code (PETSAC) 2014
- S. R. O. 717 (I) for Pakistan Electric & Telecommunication Safety Code (PETSAC) 2014

4. Building Code of Pakistan- Fire Safety Provisions-2016

- S. R. O. 1073 (1) for Fire Safety Provisions-2016
- S.R.O. 1074 (1) for Fire Safety Provisions-2016

SRO: Statutory Regulatory Order

Energy Efficiency Policies

National Energy Efficiency and Conservation (NEEC) Policy-2022

The draft was introduced in Nov 2021

Barriers to EE and Conservation in Pakistan

- **Institutional and Regulatory Barriers**
- **Economic and Financial Barriers**
- **Technical and Operational Barriers**
- **Informational Barriers**

Energy Efficiency Policies

National Energy Efficiency and Conservation (NEEC) Policy-2022

Strategic Sectoral Measures

- Promoting EE design and measures: construction new buildings
- Promoting and implementing EE code: new construction and retrofitting existing buildings
- Collaboration for financing EE in buildings
- Evaluating materials and their characteristics for EE and climatic considerations
- Energy labelling of appliances

Institutional Framework



Pakistan Engineering Council (PEC)

- PEC is professional body and statutory federal institute established in 1976
- It is responsible for accreditation of engineering education, regulation of engineering profession, licensing of engineers and licensing of engineering firms and consultants
- PEC also assists federal and provincial governments
- It takes efforts to establish scientific standards for engineering innovation
- PEC is also responsible for the development of Building Code of Pakistan, its standards, implementation and enforcement at various levels.

Institutional Framework

National Energy Efficiency and Conservation Authority (NEECA)

In 2016, National Energy Conservation Centre (ENERCON) was transformed into National Energy Efficiency and Conservation Authority (NEECA). It is responsible for:

- Preparing energy conservation programs major energy sectors
- Development of energy conservation plans
- Drafting policy guidelines to support energy conservation activities
- Development of a data base on prospects for energy conservation
- Organizing and supporting training activities/ workshops
- Carrying out field research and experimental studies
- Implementation and monitoring of energy conservation programs

Beside that there is one authority in Punjab. The local authorities and municipal corporations are responsible for the implementation of plans in their jurisdiction.

Institutional Framework



**NATIONAL
ENERGY EFFICIENCY &
CONSERVATION AUTHORITY (NEECA)**

قومی اہتارٹی برائے تحفظ توانائی



Institutional Framework



PEECA, Punjab



Sindh



Pakhtunkhwa Energy
Development Organization



Energy Department,
Balochistan



AJ&K Electricity
Department

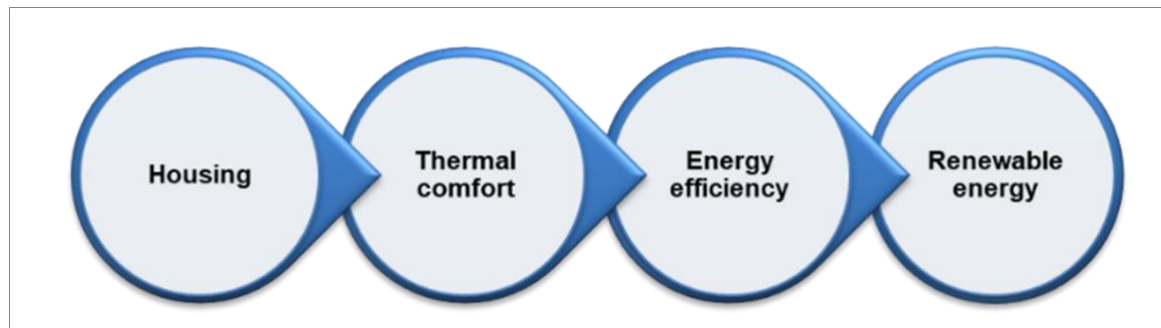


Water and Power
Department,
Gilgit-Baltistan

Key Issues

Housing shortage

- The estimated housing shortage in Pakistan is up to 10 million units (WB, 2015), and about 40 percent of which is in urban areas (IGC, 2016).
- In a study took place in 2015, it was mentioned that annual housing demand in Pakistan was 0.6 million units while only 0.37 million units were being built annually and mostly in urban areas (MoCC, 2015).
- Housing finance is particularly low in Pakistan, with a mortgage-finance-to-GDP ratio of 0.25 percent which is lowest in South Asia, whereas it is 3 percent in Bangladesh and 11 percent in India (IMF, 2015).



Housing paradigm shift model (Mahar et al., 2019)

Key Issues



Thermal comfort

- The indoor climate effects the human life, well-being and physical health.
- A building must provide comfortable indoor environment and must be energy-efficient.
- The indoor design temperatures in Pakistan mentioned in BECP are 21 °C in summer and 26 °C in winter irrespective of the location of the buildings across the country.
- In BCP (EP-2011) these limits are not less than 25 °C in summer and not more than 22 °C in winter for a building with HVAC system.
- Studies shows that majority of the residential buildings in Pakistan do not provide required comfort temperatures to the residents.

Key Issues

Thermal comfort

- A few of Thermal comfort studies in Pakistan

S. No.	Title	Main Author	Year	Building Type
1	Climate variation in comfortable temperatures: the Pakistan projects	Nicol, J. F.	1999	Office buildings
2	User comfort and energy efficiency in public buildings of hot composite climate of Multan, Pakistan	Kazmi, A. H.	2011	Traditional and contemporary buildings
3	Traditional havelies and sustainable thermal comfort	Khan, S. M.	2016	Traditional buildings
4	An investigation of thermal comfort of houses in dry and semi arid climates of Quetta, Pakistan	Mahar, W. A.	2019	Residential buildings
5	Comparative analysis of indoor environmental quality of architecture campus buildings' lecture halls and its' perception by building users, in Karachi, Pakistan	Bughio, M.	2020	Educational buildings

Key Issues

Energy efficiency, conservation and renewable energy

- HVAC systems in the housing consumes more energy specially in the extreme weather, and then the lighting, refrigeration and water heating.
- ENERCON identified several potential areas for energy efficiency & conservation in buildings. The most important is building envelope, with 40 percent energy conservation potential (ENERCON, 2013).
- The total energy produced on renewable sources during Jul '20-Apr '21 was only 2.2 percent (ESP, 2021).

Conservation areas	Saving potential
Building envelope	40%
Overall lighting	29%
High efficiency lighting (LEDs)	72%
Fluorescent tube light	83%
Lamp fixtures or luminaries	50%
Air conditioner	18%
Printer	19%
Heaters	17%
Copier	10%
Fan	5%
Computer	2%



Conclusion

- Most of us are living in inefficient and poorly designed houses and using active cooling and heating systems.
- These systems are expensive, need more energy and increase the overall energy costs which can be reduced by taking alternative measure, design interventions, changing building materials or using insulation, etc.
- Comfort is a basic need of for a nation dominated by youth, since comfortable environment provides healthy environment and increases the productivity.
- With energy efficiency and conservation, a good sum of energy can be saved which will bring long term economic and environmental benefits.
- The energy efficiency and conservation policies in Pakistan mainly focus on commercial buildings.

Recommendation

- Code and compliance for residential buildings (new and existing)
- Energy labelling of appliance, devices, fixtures
- Revision of the National Housing Policy 2001
- Revision of Energy Provisions-2011
- Active role and participation of PCATP, building experts and designers
- Establishment of material testing laboratories. Directory of EE materials
- Benchmarking, measurement, monitoring, assessment and auditing
- Financial incentives and subsidies for deep energy renovation
- Exemption of import duties for EE equipment and materials
- Research, innovation, promoting local industries and awareness programs

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Thank You

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