GBPN
Global Buildings Performance Network

Building Policies for a Better World

Executive Summaries

ROBUST BUILDING DATA: A DRIVER FOR POLICY DEVELOPMENT

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ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

3CSEP - Center for Climate Change and Sustainable Energy Policy
ACEEE – American Council for an Energy Efficient Economy
AEO - Annual Energy Outlook
AHS - American Housing Survey
BPIE – Building Performance Institute Europe
CBECS - Commercial Building Energy Consumption Survey
CEU - Central European University
CEUS - California End Use Survey
CO_2 - Carbon dioxide
CSEP - China Sustainable Energy Program
EC - European Commission
ECEEE – European Council for an Energy Efficient Economy
ECO-III - Energy Conservation and Commercialization Project - Phase-III
EED - Energy Efficiency Directive
EIA – Energy Information Administration
EJ – Exajoules
EPBC – Energy Performance Building Code
EPC - Energy Performance Certificates
EU – European Union
GBPN – Global Buildings Performance Network
GHG – greenhouse gas
Gt – Gigaton
HEB - High Efficiency Buildings
IEA – Internal Energy Agency
IGBC – India Green Building Council
IMT – Institute for Market Transformation
kW – Kilowatt
kWh - Kilowatt-hour
MOHURD - Ministry of Housing and Urban-Rural Development
Mt - Million-ton
Mtoe - Million ton of oil equivalent
NNEAP - National Energy Efficiency Action Plans
OECD - Organisation for Economic Co-operation and Development
RECS - Residential Energy Consumption Survey
SHAKTI - Shakti Sustainable Energy Foundation's Building Program
UNEP - United Nations Environment Programme
US -United States
USAID - United States Agency for International Development
WBCSD – World Business Council for Sustainable Development
WGBC – World Green Buildings Council

EXECUTIVE SUMMARY

The Importance of Building Performance Data

As buildings account for around a third of the global final energy use and 30 per cent of global energy-related carbon emissions, it is clear that this sector has the potential to bestow huge energy savings (Urge-Vorsatz et al., 2012, pp 3). For this reason the Global Buildings Performance Network's (GBPN) mission is to significantly reduce greenhouse gas (GHG) emissions associated with building energy use.

GBPN work in four priority regions – China, the European Union (EU), India and the United States (US) – together representing around 65% of global final building energy use in 2005 (ibid., pp 3). GBPN facilitates this action through regional Hubs and Partners in the four priority regions: China Partner - the China Sustainable Energy Program (CSEP); Europe Hub - Buildings Performance Institute Europe (BPIE); India Partner - Shakti Sustainable Energy Foundation's Building Program (SHAKTI); and the US Hub - Institute for Market Transformation (IMT). The regional Hubs and Partners provide the most up-to-date knowledge and data on building energy policies to decision-makers within their region.

It is estimated that by 2050, if we follow current policy trends the energy use from the building sector will increase by around a half of 2005 levels (ibid., pp 62). However, if current best practices were to become standard practice, it is possible to reduce global building final energy use by one third of 2005 levels (ibid, pp.62).

The focus of policy makers and building experts needs to be moving towards performance-based building codes and a more holistic approach to renovating existing buildings, rather than improving single building elements[1].
In order to accurately identify the potential energy savings in buildings and to design policies that target energy efficiency, data quality needs to be measured, David Eijadi with The Weidt Group says "to do better as a community of design professionals and as a society in making energy-efficient buildings, we need to know more than our current sets of data permit us to know" (NIBS, 2011, pp 10).

To build and renovate buildings that are energy efficient and sustainable, participants in the building sector must trust the data used to calculate the energy savings. To gain the confidence of policy-makers, builders, architects and all building sector stakeholders, the data must be both available (and storable) and credible (verifiable and transparent). Solid data cases provide known facts that can be used to influence decision-makers; therefore, it is essential that consensus be reached on the basis of credible data collection and its analysis. There is a need for a credible baseline and data series. The baseline is crucial for measuring impact and if objectives are being achieved.

Data Quality in the GBPN Regions

The quality of data around the world varies considerably; there are large data gaps, weaknesses and inaccessibility that preclude accuracy in modelling. This report presents a unique attempt to assess the quality of data of building types in each of the GBPN's regions (China, the EU, India and the US). The main aim of the report is to identify the omissions (or "white spots") in the data that prevent modelling and estimation of energy efficiency potentials in buildings. This will assist in the design of measures to improve the quality of data collection and in designing new policies that support a development towards low energy use in buildings. Strategies for overcoming these gaps are provided through advice and reasoned opinions from international experts.

[1] It is still important to maintain and gradually improve minimum energy performance requirements for individual building elements for cases of partial renovation, when for example a wall is replaced, or windows or floor insulation.

Methodology

This project has collected information on the quality of data that relates to the energy performance of buildings, the parameters considered for this study were floor area, number of buildings, energy use, heating, cooling, hot water, lighting / appliances, age profile, retrofit rates, urban / rural split, new building energy use, yearly construction, fuel mix, ownership (private / public) and tenure.

All data and information from this report was sourced directly from GBPN's hubs, partners, regional and global experts and modellers in the four regions and gathered in a data collection matrix. The structure of the matrix comprised of building types down the left hand column and performance data along the top row. GBPN's hubs and experts filled in the matrix by scoring each of the parameters with a quality rating between zero and five; see Table 1.1. At lease two unconnected parties, one global and one regional, filled in each region's data quality matrix.

ure 1.1. Data Quality Of 4 GBPN Regions
garding Residential Buildings

Figure 1.2. Data Quality Of 4 GBPN Regions
Regarding Their Commercial & Public

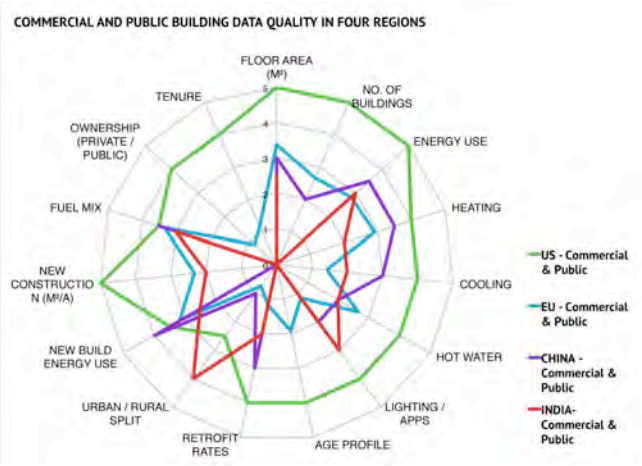
Table 1.1. Weighting: Accuracy Descriptions.

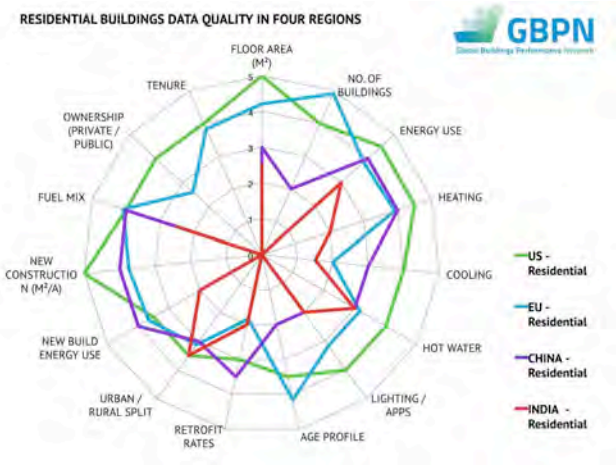
Weighting	To what degree is the data that you have used accurate?
5	Data source accurate and fully reliable - official verified document or more than one independent source giving similar information.
4	Good, trusted data source i.e. an official document
3	Data generally available, but from mixed sources
2	Partial Data - data available not very accurate
1	Weak Data - little available data / not accurate
0	No Evidence - guess

Data Quality Findings

The data quality matrices of the four regions give an accurate perspective of how strong or weak the current data quality is. As expected, the quality of data varies significantly between regions although there are some recurring trends. This results gathered in the matrix are presented in a graph below.

The graphed data quality "spider webs" below (Figures 1.1 and 1.2) show the data quality of the four GBPN regions with the different requested parameters for both residential and commercial and public buildings. Generally, the US has the higher scoring data quality for most of the parameters, followed by the EU then China then India.



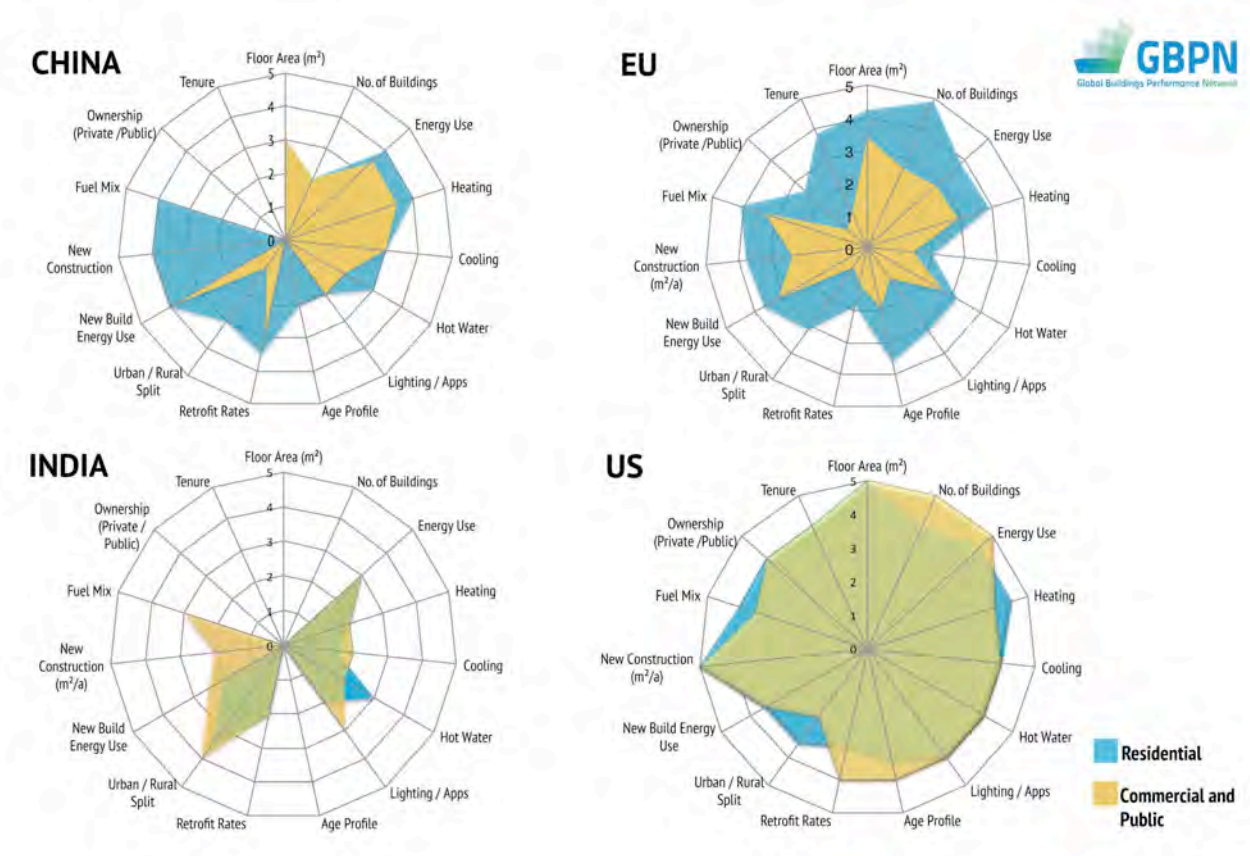


Regional Comparison

At a first glance it is clear that there are not enough available data in all four regions for accurately modelling building energy performance. It is also clear that the quality of data differs vastly across the regions. Overall on average the residential stock scored a rating of 0.5 higher than the commercial building stock (therefore it is 10% more available and accurate than the commercial and residential building stock). When comparing the two graphs the commercial graph presents more data gaps than the residential.

No region could be considered as having exceptional data as there were significant gaps and weakness found in each region's data set, even after allowing for fields that were not actively investigated by the modellers and experts to be discounted. Figure 1.3 below demonstrates the difference of the data qualities in the four regions.

ure 1.3. Residential vs. Commercial Data Quality in the Four GBPN Priority Regions.



Data in China

The residential building data in China scores on average 0.75 times higher than the commercial and public data. China's building performance data averages at around 2.5 in the valuation of the experts, which implies that there are either partial or available data, yet they are not always reliable.

The commercial and public building stock has the lower scoring data compared to the residential data in all the parameters except for seven that are equal. Six out of the fifteen parameters for the residential data are between 3.5 and 5, meaning that on average around a third of the data are deemed as being from a reliable and trustworthy source. The commercial and public building data have four parameters that fall into the "accurate / reliable" weighting category, this means a quarter of the data were weighted as being accurate. The rest of the data are not found to be accurate or even available.

Data in the European Union

Unlike the US, the EU does not have official data on the building sector as a whole region[2] and the quality of data varies significantly between the different states; therefore the EU results are taken from an average of 6 of the Member States – two countries that are below the EU "average", 2 average EU countries and two countries above the EU average, the countries used for this study were Austria, Germany, Poland, Spain, Sweden and the UK. The findings of the analysis found that the quality for both residential and commercial and public buildings in the EU is lower than the US.

The biggest difference between the quality of residential and commercial buildings is found in the EU; the average score of the residential sector was higher than the average commercial sector by just under 2, giving a 40% difference between the two sectors. In general, around two thirds of the residential data are deemed as being accurate (these parameters were found to be in the top two weighting categories). The commercial and public sector has the lower scoring data compared to the residential data in all the parameters. For almost half of commercial and public data there are sources available yet they are not deemed as being from a reliable or accurate source.

Data in India

The response of the experts and modellers in India showed that the data used for modelling are frequently inaccessible for the modellers of the survey. This could be due to data being difficult to locate or translate from the original language and it might be a result of the very diverse and regional structure of India. Although it was possible to estimate the existing residential and commercial building data to give an understanding of how energy use is split by end use, the experts weighted the accuracy of data on average as 1.7 out of 5 therefore they seem be unreliable.

The commercial and public stock has stronger data compared to the residential data in all the parameters except two that are equal and one that is higher. Only one of the parameters for both commercial and residential were scored as having accurate data, four out of the fifteen parameters from the commercial building sector have a score of 2.1-3.4, meaning that the majority of the data were deemed as being unavailable or inaccurate.

Data in the United States

On a scale of zero to five, the US commercial and public building data quality score on average 0.06 higher than residential data. The US has the strongest set of building energy data among the GBPN priority regions; this is supported by the Energy Information Administration's (EIA) national-level data surveys on the characteristics and energy use of commercial and residential buildings (EIA, 2013). However, the 2007 CBECS data was withheld due to survey design issues, and the 2011 survey was briefly postponed due to federal funding cuts, meaning the latest available data is over a decade old.

[2] BPIE, GBPN's EU Hub has been developing a comprehensive database for EU building performance, this is the first time in Europe such a database has been established. It is increasingly being used by public authorities, in the absence of anything more comprehensive.

Out of the four regions the residential and commercial data sets in the US were the closest together with a difference of 0.06. The commercial and public stock has the strongest data compared to the residential data in all the parameters except three. Eleven out of the fifteen parameters (for both commercial and public and residential buildings) have a weighting of 3.6 – 5, meaning that in general the US building data are available and often the source is trusted – the source is taken from an official or accurate place (in this case most of data are taken from official energy statistics retrieved from the from the US Government - the EIA).

Understanding the Differences in Data Quality

Collecting data in multiple regions with different cultures, languages and political contexts is complex. Regions vary in their laws, standards, definitions and values connecting to data collection. The main reason for the data varying widely across the four regions is due to the different political approaches to data collection.

The findings of this research show that that some regions data collection methodologies are more advanced than others. Some regions have taken the first steps towards assessing data by completing specific surveys and setting up collection frameworks, for other regions collecting data is more complex. The demand for data is still low in developing countries; this makes the collection process more difficult. Some regions collect data at a national level and some at a more local level, the differences in levels of create further difficulty in having consistency.

Main recommendations for better data collection practices

The GBPN has a group of international experts working in the field of building sector energy efficiency. Thirty of GBPN's experts in the field of building energy data contributed to the survey on data sources, availability and quality.

The survey provided a valuable opportunity to gather expert opinion on how to improve data quality and collection around the world, and more specifically, in the GBPN's four key regions. As well as allowing for a more comprehensive understanding of how we can collaboratively improve data, there were a number of recurring recommendations that became obvious when analysing the advice from the experts from all regions.

There is overwhelming emphasis on the need for a comprehensive data collection framework to ensure the consistency of data. Many experts also strongly advised that data collection definitions and guidelines should be harmonised and clarified. Repeatedly, the main themes included:

- The need for a comprehensive framework;
- The need for data collection definitions and guideline;
- A collaborative effort to share data and begin the provision of open source data;
- The need for a collection and analysis tool (comprehensive database);
- The need to make data collection mandatory;
- The need for incentives and funding; and
- A dissemination of data collection best practices and case studies.

What conclusions can be drawn from this report?

What is clear is that regionally there are large differences in data quality and that large data gaps exist, making it difficult to analyse the current state of play in each region. Substantial efforts need to be made to fill these data gaps and inaccuracies. Although data are not deemed as being accessible, it does not necessarily mean they are not available or cannot be found, for instance by local actors in this region, but it demonstrated a need for an improvement of data access for these modellers.

We must continuously advance our collection techniques to harmonise and improve access to secure building energy data, alike. There is a need to share available data more broadly. Initially, It is essential to prioritise our most pressing needs regarding the most crucial data required by modellers and policy makers.

Since no one group of experts can do everything, there is a need to work together in order to make a difference. A collaborative approach towards ensuring transparency of data must be adopted so that data collection, monitoring, reporting and evaluation leave no gaps and produce accurate and reliable data. Data collection should be harmonised so that national and regional data collection systems relating to the energy performance of buildings are consistent.

The GBPN calls for a collaborative effort in harmonising definitions and measurement templates concerning the energy performance of buildings. Furthermore, the GBPN recommends the establishment of a database that includes all energy-performance building data and the diverse requirements of the building stakeholders.

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About GBPN The Global Buildings Performance Network (GBPN) is a globally organised and regionally focused network whose mission is to advance best practice policies that can significantly reduce energy consumption and associated CO_2 emissions from buildings.