Silva, S. D. R. Y., Madhusanka, H. W. N. and Kahandawa, K. A. R. V. D., 2025. Building energy data management systems in the world – A review. In: Waidyasekara, K.G.A.S., Jayasena, H.S., Wimalaratne, P.L.I. and Tennakoon, G.A. (eds). *Proceedings of the 13th World Construction Symposium*, 15-16 August 2025, Sri Lanka. pp. 347-359. DOI: https://doi.org/10.31705/WCS.2025.26. Available from: https://ciobwcs.com/papers/

BUILDING ENERGY DATA MANAGEMENT SYSTEMS IN THE WORLD: A REVIEW

Silva, S.D.R.Y [1], Madhusanka, H.W.N[2] and Kahandawa, K.A.R.V.D.[3]

ABSTRACT

Due to the growing number of buildings with higher population and urbanisation, tracking energy consumption in buildings is essential in reducing global energy demand and carbon emissions. For that, governments and energy-related international bodies have created many databases to collect data on building energy consumption and provide energy statistics based on that. This paper focuses on reviewing building energy databases in the world to study their policy implications and applicability in reducing building energy consumption. The qualitative approach was used in this study, and highly reputed and highly cited 09 databases were selected for the review. Among them, 04 databases provide energy benchmarks for buildings under different types of categories, while 05 databases provide energy statistics only. These databases allow government authorities to monitor the energy performance of buildings, determine tax credits and incentives for energy performance, rate the buildings and prioritise low-performing buildings for setting action plans. In addition, some of those have led to revisions of building codes and received the direct involvement of the relevant stakeholders through mandatory disclosure of energy data. Organisations also use these databases for marketing purposes, highlighting their high performance and allowing them to identify performance gaps. All the databases have been developed along with energy policies at the national and international levels. Compared to developed countries, energy databases are lacking in managing energy consumption in the national building stock. Especially, there is no energy database for the Sri Lankan building sector.

Keywords: *Building Energy Consumption; Building Energy Databases; Building Energy Data Management Systems; Building Performance Databases.*

1. INTRODUCTION

With the rapid population growth, building energy consumption has dramatically increased, contributing a significant portion of the global energy supply and demand over the past few years (Ali et al., 2020; Marinakis, 2020; Sun et al., 2020). An increase in energy demand directly affects the global Green House Gas (GHG) emissions, which has a significant impact on global climate change. Buildings contribute to 30% of global final energy consumption while accounting for 26% of global energy-related emissions by 2025 (Delmastro & Chen, 2023). However, numerous opportunities exist in buildings to

[1] Temporary Lecturer, Department of Facilities Managament, University of Moratuwa, Sri Lanka, silvar@uom.lk

[2] Senior Lecturer, Department of Facilities Managament, University of Moratuwa, Sri Lanka, nandunm@uom.lk

[3] Lecturer, Schol of Built Environment, Massey University, New Zealand, R.Kahandawa@massey.ac.nz

reduce energy consumption in buildings promoting a sustainable built environment. According to the IEA, energy efficiency improvements of buildings can decrease up to 70% of the energy-related emissions by 2050, and buildings will be 40% more energy efficient by 2040 (Ali et al., 2020).

Currently, there is a global tendency for a shift towards global exchange of building energy data, energy performance analysis, and building energy efficiency policies (Ali et al., 2020). Due to the development of technology massive amount of energy data is being generated in every aspect of buildings, and building systems are being digitised rapidly (Marinakis et al., 2020). This accumulated data can be effectively utilised to optimize power generation, predict electricity demand, discover electricity consumption patterns, and develop dynamic pricing mechanisms (Li et al., 2023; Zhou et al., 2016). Thereby, the building sector can effectively manage energy consumption, and the government can regulate the energy supply and demand effectively because it integrates the demand side management and Demand Response (Kathirgamanathan et al., 2021).

Data-driven approaches in building energy management have gained higher popularity over the past few years (Ahmad et al., 2018; Amasyali & El-Gohary, 2018; Kathirgamanathan et al., 2021; Li et al., 2023; Marinakis et al., 2020; Sun et al., 2020; Wei et al., 2018; Zhou et al., 2016). Data-driven approaches enable the prediction of energy consumption, which is imperative for improved decision-making on reducing energy consumption and environmental emissions and estimating the economic feasibility of further energy conservation opportunities (Wei et al., 2018). In addition to that, according to Mathew et al. (2015), empirical energy data has a wide range of potential in energy efficiency, assessment of energy policies, energy management and energy planning. Further to the authors, comprehensive energy databases can consolidate data throughout the industry, reducing the data collection cost, creating new opportunities to analyse building energy data and accessing many stakeholders. Large-scale empirical building energy data provides benefits to the government, stakeholders in the energy industry, investors in energy efficiency and policymakers (Luo et al., 2021).

Therefore, empirical building energy databases play a key role in supporting national-level energy policy assessments. Some of the databases record asset data and in-depth energy use as a representative sample of different building stocks (Ye et al., 2019). Those databases aim to keep datasets for energy planning and forecasting purposes. However, they provide summary statistics of the national building stock. To reduce the energy consumption and environmental performance of the building stock, governments set energy and environmental policies (Shen et al., 2020). To make informed decisions in setting national building energy policies, some governments are monitoring the energy consumption of their building stock (Luo et al., 2021). It helps them to identify the effectiveness of the policies and initiatives to identify which policies provide more benefits, to invest wisely in implementing those policies and initiatives (Carnieletto et al., 2019).

However, there is a limitation in the literature focusing on the policy implications of building energy data management systems in the world. Therefore, this study focuses on reviewing existing building energy data management systems to assess how they have been used to achieve sustainable development goals and energy policies at the international level, regional level or country level. In this paper, existing energy databases are reviewed on the data collection methods, outcomes of the databases, applicable policies and national-level initiatives, and how they support to achievement of the intended outcomes of the energy policies. In addition to that, this paper discusses the level of usage of energy databases in achieving energy management policies in different countries.

2. METHODOLOGY

A qualitative, descriptive review approach was used in this study to evaluate existing building energy data management systems that have been implemented in different countries and global level. The main objective of this research is to review the structure of the database, types of energy data provided by the database, functionality, insights they produce, and the role of these systems in supporting organisational and national-level energy policies. Mainly, two primary sources were used for the data collection for this study. Google Scholar was used to access scholarly literature such as journal articles and conference papers that address specific energy data platforms and the policy implications of those data platforms. In addition to that, up-to-date information regarding building energy data platforms was collected from the official websites of the respective organisations.

Both technical details and real-world examples of system applications were provided by these sources, allowing to conduct a comprehensive review of the purpose, design, and output of each platform. When considering the selection criteria, energy data platforms, databases or systems that are publicly available or well-documented were selected for this study. Even though more than 50 building energy databases are available in the world, globally and regionally highly recognized and highly cited databases were selected for this study due to limitations in time and publicly available data. Only 09 databases were examined for this study. All the databases or platforms were reviewed to identify the type of energy data collected and displayed, such as electricity consumption, air pollution, energy performance etc, data sources used for the data collection, types of analytics or findings presented, target users and role in supporting energy policies at the national and international level.

Since the data was collected through publicly available content from websites and scholarly literature accessible through Google Scholar, some systems with restricted access or limited documentation may not be represented in this study. This study is based on the sample of energy databases at the international level, regional level or country level.

3. REVIEW OF EXISTING BUILDING ENERGY DATABASES

Due to the climate change impacts, governments are struggling to improve the lives of people while improving energy efficiency to reduce fuel poverty and fight climate change (Shen et al., 2020). Different governments, professional bodies, international organizations and interest parties in the energy industry have introduced more policies, initiatives, technologies and methods to improve energy efficiency to combat the climate change impact (Ye et al., 2019). However, it is important to identify the best solution that works best for each consumer by monitoring their consumption patterns closely (Buchanan et al., 2014). For that, different governments and international organizations have introduced databases to monitor the energy consumption of the building stock and provide benchmarks for energy performance in buildings.

Figure 1 shows the country-wise evolution of building energy databases. An upward trend can be identified in the building energy database development during the 2000-2025 period. In the early 2000s, a slow growth in energy database development in the building sector. At the initial stage required data for building energy policy formulation was collected through one-time national surveys and manual data collection methods due to limited digital integration. Energy performance certification mandates and energy performance benchmarking come into the picture slightly. However, there have been a few local pilot projects and academic databases. A significant policy-driven expansion can be identified during 2005-2010. Several government mandates were set with the requirement of standardisation and mandatory reporting. UK NEED (2006), Australia NABERS (2007) and ENERGY STAR Portfolio Manager (2009) are a few examples of databases that originated in this period. Web-based reporting was initially introduced in this period.

A digital and open data boom can be identified with the evolution of big data technology, system integration and research collaborations to enhance building energy performance to address climate change during 2010-2015. THE US BPD (2011), the EU Building Stock Observatory (2013), and China's National Monitoring System (2013) were developed in this period. In addition, a shift from surveys to real-time data can be identified during this period with the development of smart technologies and the Internet of Things (IoT). With the development of Artificial Intelligence (AI), Machine Learning (ML) and the concept of smart buildings, AI-driven analytics such as anomaly detection and load forecasting took place within the building sector during 2015-2020. Most advanced energy databases such as ASHRAE GEPIII (2019), Singapore Benchmarking Portal (2020) and Dubai DEWA (2020) were established in this period. Especially, private sector adaptation to use these databases for real estate ESG reporting has a positive impact of these data-driven approaches. With the real-time monitoring requirements and net-zero targets, more advanced data sharing platforms are being introduced after 2020. ISO 52120 was introduced in 2025 as the first global data exchange standard. Especially, real-time dashboards have replaced static reports.

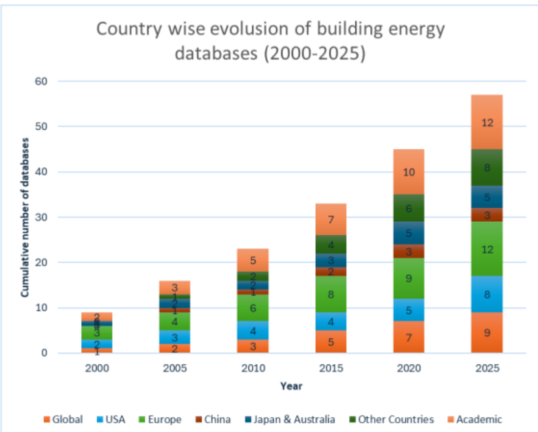

Figure 1: country wise evolution of building energy databases

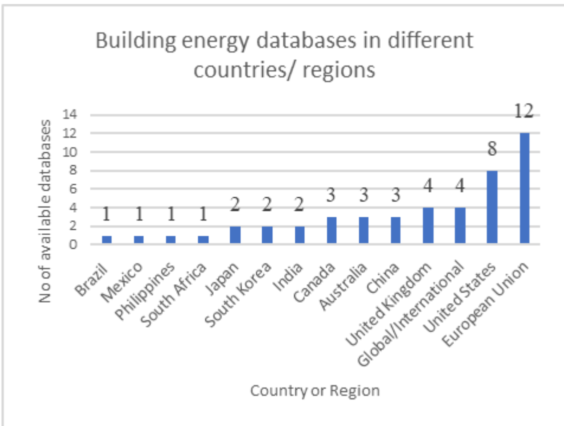

Figure 2: Building energy databases in different countries/ regions

Figure 2 shows the available building energy databases in different countries. According to Figure 2, the highest number of building energy databases is in the European Union, a result of the EU Energy Performance of Buildings Directive (EPBD) mandates and cross-border climate commitments, while the second heights number of databases is in the United States. The United Kingdom has 4 databases, and another 4 databases cover multiple countries in different regions. Canada, Australia, and China have 3 databases in each, while India, South Korea and Japan have 2 databases in each. According to Kumanayake and Luo (2018), the building sector contributes to 35% of the national energy consumption. However, in developing countries, there is a very small amount of energy databases covering their building stock due to limited funding for data infrastructure development, weak policy enforcement, and fragmented stakeholders lacking collaboration between governments, researchers, utility companies and building owners. Therefore, less popularity can be identified in building energy databases in developing countries.

Some of the leading and highly recognised energy databases are reviewed below.

- Energy in Buildings and Communities (EBC) Annex 70-International Energy Agency (IEA)

IEA has created a building energy database called Energy in Buildings and Communities (EBC) Annex 70, focusing on the analysis of energy use of buildings in 15 countries from 2017. It provides an international collaboration of governments, researchers and industry experts in the world working to develop methods to improve empirical data on the energy demand of the building stock. To study the energy demand of the building stock, Annex 70 collects data on features of buildings, energy consumption, characteristics of the occupancy, user behaviours, information on building systems and building morphology. The annex compares building energy data to address the energy performance gaps and assists businesses in the creation of low-energy and low-carbon solutions (Ruyssevelt & Hamilton, 2017).

- ENERGY STAR Portfolio Manager

ENERGY STAR Portfolio Manager collects benchmarking data in the United States and Canada buildings and assigns a rating for each building type. ENERGY STAR Portfolio Manager can be identified as a resource management tool which allows building users to benchmark the energy use of any type of building. Currently, more than 25% of US commercial buildings are being benchmarked in ENERGY STAR Portfolio Manager, which serves as the national benchmarking tool in Canada. Since every building type has been assigned a rating called the ENERGY STAR score, it compares the energy performance of the building with similar buildings nationwide, normalised for operating conditions and weather (Vaidya et al., 2009). To benchmark the buildings, only energy bills and basic information about the building are required. Apart from energy, ENERGY STAR Portfolio Manager allows benchmarking of water consumption, waste generation and GHG emissions.

- US Department of Energy-The Building Performance Database (BPD)

US BPD is one of the largest energy-related databases dedicated to commercial and residential buildings in the United States. It collects data from the government, energy efficiency programs, private companies and building owners. The collected energy data is available to the public (U. S. Department of Energy, 2025). It allows the users to explore the data across different real estate sectors and regions and compare operational conditions and various physical characteristics to clearly understand the performance patterns and conditions in the energy market (Ye et al., 2019). Users can develop and save custom peer group datasets using different types of variables such as building types, locations, sizes, ages, equipment, operational characteristics and more. Furthermore, any two peer groups can be compared by users using statistical or actuarial methods (Tian et al., 2021).

- Commercial Buildings Energy Consumption Survey

The Commercial Buildings Energy Consumption Survey is managed by the US Energy Information Administration (EIA) (*Regional dashboards and data*, 2015). It serves as a sample survey in the US that collects data about US commercial building stock, including building characteristics that affect energy consumption, and energy usage data such as consumption rates and energy charges (Ye et al., 2019). It covers all the commercial buildings and schools, religious buildings, and hospitals, which might not be considered commercial buildings, with conventional commercial buildings such as shops, warehouses, restaurants and office buildings. It offers open data sets to manipulate energy data within the US energy industry, interactive dashboards to provide energy statistics and energy forecasting tools. EIA provides energy statistics for energy production, consumption, pricing, etc., related to building energy data. Stakeholders in the energy industry and policymakers are allowed to use this data to make informed and data-driven decisions (Department of Energy, 2025).

- EU Building Stock Observatory

The EU Building Stock Observatory is a comprehensive database on energy performance in buildings European Union. The main objective of this database is to provide reliable and transparent data and information on energy usage in buildings in European countries. It helps to monitor the current energy policies and measures in the European Union and helps future policymaking in building energy management. Building Stock Observatory covers a wide range of energy-related topics and provides building-related information such as building stock, energy usage, building elements and technical systems installed in buildings, certificates on energy performance, renovation rates and zero-energy buildings, energy poverty and investments in energy-saving buildings (Gevorgian et al., 2021). The EU Building Stock Observatory was introduced in 2016 along with the Clean Energy for All Europeans package. It is also aligned with the LIFE Clean Energy Transition subprogramme. In addition to that, the EU Building Stock Observatory is part of a broader policy strategy to support the implementation of the Energy Performance of Buildings Directive (EU/2024/1275) and the Energy Efficiency Directive (EU/2023/1791) (European Commission, 2025).

- National Energy Efficiency Data Framework (NEED) – United Kingdom

The National Energy Efficiency Data Framework (NEED) was established to gain a greater understanding of energy use and efficiency in both residential and non-domestic facilities in Great Britain. It provides gas and electricity consumption data in domestic and non-domestic buildings. The important thing is that the information related to energy efficiency measures installed in buildings is collected along with the energy consumption data. In addition to that, data related to characteristics of the property, such as floor area, property age, property type, occupancy data, geography, and socio-demographic data are collected. Thereby, NEED evaluates the energy savings arising from the installation of energy-saving measures by comparing energy and gas consumption before and after the installation of the energy-saving measure. This database provides the largest available database to analyse gas and electricity consumption and the impacts of energy efficiency measures. After calculating the annual energy consumption, buildings are rated based on their efficiency of the buildings (Department for Energy Security and Net Zero, 2025).

- Australian NABERS (National Australian Built Environment Rating System)

NABERS is a voluntary performance-based rating system which evaluates the overall environmental performance during the operation of various types of buildings. This acts as a building rating and serves as the database in the building sector in Australia by storing data, providing valuable statistics from 1999. Further, it allows buildings to accurately measure, understand, and communicate the environmental performance of buildings while identifying areas for cost savings and future improvements. NABERS rates buildings from one to six stars for building efficiency categories such as energy, water, waste, and indoor environment. Building owners must submit their building data in an Excel spreadsheet provided on the NABERS website after creating a user account. NABERS provides a maximum amount of energy and water that buildings can use to achieve the desired rating. Benchmarks are updated every five years according to the updated data. Currently, this benchmarking tool and database have been launched in the United Kingdom and New Zealand as well (NABERS, 2025).

- India's Energy Efficiency Data Portal

The energy efficiency data portal of India was developed by the Bureau of Energy Efficiency under the aegis of the Ministry of Power in India to produce reliable energy data regarding the supply and demand of energy in different sectors within the country. Collected data is used to publish the National Energy Data Survey and Analysis report, covering both the supply and demand sides. In addition to that, it provides energy-saving and emission reduction statistics across the country by implementing energy-saving projects. There is a separate tab called BEEP stands for National Building Energy Efficiency Program. It provides a comprehensive database of the results of energy efficiency improvement projects across the country (Bureau of Energy Efficiency, 2023).

- TABULA and EPISCOPE

TABULA is a topology approach which has been created to assess the building stock energy, while EPISCOPE is an energy performance indicator tracking scheme for the continuation of the optimisation of the refurbishment process in the building stock in the European Union. Each topology consists of a classification scheme that groups the building stock according to their size, age and other parameters, and it gives a set of example buildings representing these building types. TABULA was funded by the European Commission's Intelligent Energy Europe (IEE) program, and EPISCOPE was established to follow up on the TABULA program to monitor renovation strategies. A reference building is created in TABULA for different building types in the participating countries. To create the reference building, construction characteristics, details related to geometry and layoutsand other related details of energy performance of retrofit scenarios are collected (Stein et al., 2016).

Table 1 shows the summary of the selected building energy databases.

Table 1: Summary of the building energy databases

Name of the Database	Aim of the database	Related policies and initiatives	Policy impact	Organizational impact
Energy in Buildings and Communities (EBC) Annex 70	Developing standardized methodologies to compare international building energy data to support evidence-based policymaking	EU Energy Performance of Buildings Directive (EPBD), Energy in Buildings and Communities Program	Supported energy-saving calculations for tax credits. Improved energy performance certification methodologies	Allows universities to harmonize global building energy datasets. Building automation service providers aligned their products with Annex 70's performance benchmarks.
ENERGY STAR Portfolio Manager	Enable benchmarking and tracking of energy/water use in buildings to drive market-based efficiency improvements.	Energy Policy Act of 2005 (EPAct 2005), Energy Independence and Security Act (EISA) of 2007	Used for mandatory energy benchmarking of buildings in 25 cities in the US. Became an industry standard for the real estate sector.	Some real estate companies used it for ESG reporting and lease agreements including clauses mandating ENERGY STAR scores. Some case studies show that Automated benchmarking reduced manual data entry by 40%.
Building Performance Database (BPD)	Collect performance data to identify retrofit opportunities and validate energy codes.	Energy Policy Act of 2005 (EPAct 2005), Energy Independence and Security Act (EISA) of 2007	Led to revisions of building codes. Adjusted tax credits for energy retrofits. Supported Chicago's Building Energy Use Reporting Ordinance.	Some companies use BPD to justify ROI calculations for clients. Sustainability authorities use BPD to audit compliance with Local regulations.
Commercial Buildings Energy Consumption Survey	Provide statistically representative data on US commercial building energy use for national policy and research.	Energy Policy Act of 2005 (EPAct 2005), Energy Independence and Security Act (EISA) of 2007	Started with the US Net-Zero Commercial Buildings goal and led to informed energy code updates. Supported design efficiency incentives for utilities.	Some architecture forms use this to validate energy models in the early design stage.
National Energy Efficiency Data	Link energy use data with socio-demographic factors to target fuel	Directly related to low-carbon policies in the UK	Identified households lack clean energy for subsidies. Targeted intervention using consumption patterns for smart meter installation.	Social Housing Providers used NEED to prioritize retrofits in residential buildings. Energy Suppliers developed targeted efficiency offers using poverty maps.

Name of the Database	Aim of the database	Related policies and initiatives	Policy impact	Organizational impact
Framework (NEED) – UK	poverty and efficiency programs.		Net-zero planning for 2050 decarbonization targets.	
EU Building Stock Observatory	Monitor the EU-wide building stock to track progress toward climate goals	Energy Performance of Buildings Directive (EU/2024/1275) and the Energy Efficiency Directive (EU/2023/1791)	Prioritized low-performing buildings for EU funding. Used to track progress towards 2030 energy targets. Used to map regional disparities in building energy efficiency.	Construction Companies have referenced it to market insulation products. City Governments used it to identify retrofit zones.
TABULA and EPISCOPE	Create standardized building typologies to simplify energy retrofit planning and cost-benefit analysis.	European Commission's Intelligent Energy Europe (IEE) program	Standardized building envelope design in EU buildings. Supported to establishment building energy roadmap policy in Germany and Vienna’s 2040 Climate Roadmap.	Retrofit companies use TABULA archetypes for modular facade solutions. Some banks have introduced loan schemes which require TABULA-based energy audits.
Australian NABERS	Rate buildings based on actual operational performance to drive market competition for efficiency	Supports to achievement of the net-zero energy targets by 2050	It became a mandatory disclosure. Higher added value for high-rate buildings. Used for national climate policy implementation.	Some companies increased asset values via NABERS-driven upgrades. Some companies automate NABERS compliance for 80% of rated buildings.
India’s Energy Efficiency Data Portal	Support compliance with India’s Energy Conservation Building Code (ECBC) and PAT scheme for industries	National Building Energy Efficiency Program	Supported building code revisions. Used for retrofit targets in several estates. Became an industry benchmarking program.	Some companies use portal data to comply with national energy regulations. Some manufacturers reference portal data for HVAC sizing tools.

According to the analysis of the different building energy databases, Energy in Buildings and Communities (EBC) Annex 70 serves several countries in different regions, while other databases serve only a specific country. Some of the databases such as BPD, Commercial Buildings Energy Consumption Survey, EU Building Stock Observatory and India's Energy Efficiency Data Portal provide merely statistics related to building energy while some of the databases such as Energy in Buildings and Communities (EBC) Annex 70, ENERGY STAR Portfolio Manager, TABULA and EPISCOPE, and Australian NABERS act as an energy benchmarking tool for building while providing energy statistics for building stock. By providing benchmarks, buildings are given performance targets and are measured for the energy performance of each building compared to similar types of buildings.

When considering the data collection method, some databases collect data from surveys such as the Commercial Buildings Energy Consumption Survey while others collect data from other national-level or regional-level databases. Energy in Buildings and Communities (EBC) Annex 70 collects data from universities and national-level institutes by creating a collaboration with multiple organizations representing each country.

Currently, most of the databases cover the effectiveness of energy-saving initiatives and energy retrofitting, along with recording energy generation, consumption and pricing. Energy in Buildings and Communities (EBC) Annex 70, National Energy Efficiency Data Framework (NEED) – UK and India's Energy Efficiency Data Portal are examples of those types of databases. It helps to identify the effectiveness of energy-saving measures and building retrofits for different types of buildings (Carnieletto et al., 2019). To achieve sustainable development goals by easy access to information, some databases have provided free access and publicly available datasets for parties who are interested. India's Energy Efficiency Data Portal, EU Building Stock Observatory and Commercial Buildings Energy Consumption Survey are some examples of freely accessible databases. However, some databases still require paying to get energy data and have taken actions to restrict unauthorized access to maintain data confidentiality. ENERGY STAR Portfolio Manager and Energy in Buildings and Communities (EBC) Annex 70 require user accounts to get datasets from the database.

All the above building energy databases aim to compare the energy performance of different buildings and to support evidence-based policy making. Furthermore, some databases such as NEED and ENERGY STAR Portfolio Manager aim to identify energy-saving potentials and retrofitting opportunities in buildings. Moreover, NEED links energy use data with socio-demographic factors to identify target groups with fuel poverty. Meanwhile BPD and Commercial Buildings Energy Consumption Survey aims to validate existing building codes and revise existing policies and mandates based on the statistical conclusions of the collected data. According to Table 1, diversified stakeholders are considered by every database, such as national and local governments, national and international organizations, researchers, building owners, utility companies, architects, engineers, energy auditors, financial companies, real estate companies, retrofitting companies, and the community.

When considering the policy implications, all the above databases are governed by government bodies or international energy authorities. They directly aligned the outputs given by the databases to verify the benefits of the policies and to measure how well organizations adopt those policies. In addition to that, these energy databases enable organizations to enhance their market value using benchmarks and comparing building energy data, such as ENERGY STAR Portfolio Manager and Building Performance Database. Some of the databases focus on the specific type of building stock, such as the National Energy Efficiency Data Framework (NEED) – UK, while other databases cover the entire building stock. However, they provide statistics for specific building types using collected data.

With the introduction of some of these databases, such as ENERGY STAR Portfolio Manager, Building Performance Database (BPD) and Australian NABERS, mandatory disclosure of energy data became an industry standard in the real estate sector. Energy in Buildings and Communities (EBC) Annex 70 and Building Performance Database (BPD) have been used to calculate the energy saving for tax credits. In addition to that, energy performance certification methodologies were improved with the use of collected data by Energy in Buildings and Communities (EBC) Annex 70. Building Performance Database (BPD), Commercial Buildings Energy Consumption Survey, India's Energy Efficiency Data Portal and Australian NABERS led to revisions of building codes. Specifically, NEED was used to identify the targeted groups with energy poverty to make required interventions and set decarbonization targets by 2050. Furthermore, the EU Building Stock Observatory identifies low-performing buildings for EU funding. It highlights the contribution of these databases in identifying energy performance gaps within the building industry. The EU Building Stock Observatory, TABULA and EPISCOPE, Australian NABERS, and India's Energy Efficiency Data Portal have directly supported to formulation of energy policies and climate policies. In addition to that, these databases have supported tracking the energy targets.

As a result of these databases, building service providers tend to align their products to meet industry benchmarks. Furthermore, real estate companies use these benchmarking and energy-related data for ESG reporting, and automated data platforms have reduced the manual paperwork in obtaining energy performance certification. Furthermore, utility providers have introduced efficiency offers for their customers based on reported data. In addition, these databases and mandatory reporting allow companies to identify performance gaps and retrofitting opportunities in their buildings to become more energy efficient.

Although the adaptability of building energy databases is becoming popular in developed countries, the usage of building energy databases is still fledgling in developing countries. Similarly, there is no dedicated energy database for buildings in Sri Lanka to monitor the building energy consumption to make informed decisions to create energy policies for buildings. Therefore, to achieve the intended outcomes of the national energy policy in Sri Lanka, a comprehensive building energy database is a key element that should be introduced to the building sector. Therefore, further research can be conducted on developing a building energy database in Sri Lanka.

4. CONCLUSION

Since buildings contribute a significant portion of total energy consumption, a higher consideration has been given to reducing building energy consumption by closely monitoring the adaptation of energy policies and initiatives by the governments. This study reviews the building energy databases in the world to identify their policy implications and applicability in reducing energy consumption in buildings. Nine building energy databases were studied. Among them, Energy in Buildings and Communities (EBC) Annex 70 covers multiple countries acting as an international building energy database, while other databases cover only a specific country or region. Four databases act as benchmarking tools, while 5 databases provide only energy statistics. Surveys and other energy databases are used as the data collection methods. There is a tendency to evaluate the efficiency of energy retrofitting in buildings; while monitoring energy consumption, all the databases collect data on energy-saving mechanisms that buildings use to reduce energy consumption. Currently, most of the databases allow users to access energy data freely to assist them in informed decision-making in building energy management. All the databases have been established along with a specific energy policy or an energy management program to measure and validate the effectiveness of the introduced policies. Even though there is a growing tendency to manage building energy databases at the national level in developed countries, a limited approach can be seen in developing countries in this context. A building energy database is still lacking in the Sri Lankan context, even though a proportion of the national energy is consumed by the building sector. Therefore, future researchers can focus on developing an energy database for buildings in Sri Lanka.

5. REFERENCES

Ahmad, T., Chen, H., Guo, Y., & Wang, J. (2018). A comprehensive overview on the data driven and large scale based approaches for forecasting of building energy demand: A review. *Energy and Buildings*, *165*, 301–320. https://doi.org/10.1016/j.enbuild.2018.01.017

Ali, U., Shamsi, M. H., Bohacek, M., Purcell, K., Hoare, C., Mangina, E., & O'Donnell, J. (2020). A data-driven approach for multi-scale GIS-based building energy modeling for analysis, planning and support decision making. *Applied Energy, 279*, 115834. https://doi.org/10.1016/j.apenergy.2020.115834

Amasyali, K., & El-Gohary, N. M. (2018). A review of data-driven building energy consumption prediction studies. *Renewable and Sustainable Energy Reviews, 81*, 1192–1205. https://doi.org/10.1016/j.rser.2017.04.095

Buchanan, K., Russo, R., & Anderson, B. (2014). Feeding back about eco-feedback: How do consumers use and respond to energy monitors?. *Energy Policy*, *73*, 138–146. https://doi.org/10.1016/J.ENPOL.2014.05.008

Bureau of Energy Efficiency (2023). Urja Dakshata Information Tool (UDTI). https://udit.beeindia.gov.in/

Carnieletto, L., Badenes, B., Belliardi, M., Bernardi, A., Graci, S., Emmi, G., Urchueguía, J. F., Zarrella, A., Di-Bella, A., Santa, G. D., Galgaro, A., Mezzasalma, G., & De Carli, M. (2019). A European database of building energy profiles to support the design of ground source heat pumps. *Energies,12, 2496*. https://doi.org/10.3390/EN12132496

Delmastro, C., & Chen, O. (2023, July 11). *Energy system: Buildings.* International Energy Agency (IEA). https://www.iea.org/energy-system/buildings

Department for Energy Security and Net Zero. (2025, June 26). *National energy efficiency data-framework (NEED).* GOV.UK. https://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework

Department of Energy. (2025). *U.S. Energy Information Administration (EIA).* https://www.energy.gov/us-energy-information-administration-eia

European Commission. (2025). *BSO - EU building stock observatory*. European Commission Website. https://building-stock-observatory.energy.ec.europa.eu/database/

Gevorgian, A., Pezzutto, S., Zambotti, S., Croce, S., Oberegger, U. F., Lollini, R., Kranzl, L., & Müller, A. (2021). *European building stock analysis: A country by country descriptive and comparative analysis of the energy performance of buildings*. Eurac Research Bolanzo. https://bia.unibz.it/esploro/outputs/book/European-Building-Stock-Analysis-a-country/991006646298701241

Kathirgamanathan, A., De Rosa, M., Mangina, E., & Finn, D. P. (2021). Data-driven predictive control for unlocking building energy flexibility: A review. *Renewable and Sustainable Energy Reviews*, *135*, 110120. https://doi.org/10.1016/j.rser.2020.110120

Kumanayake, R., & Luo, H. (2018). A tool for assessing life cycle CO2 emissions of buildings in Sri Lanka. *Building and Environment*, *128*, 272–286. https://doi.org/10.1016/J.BUILDENV.2017.11.042

Li, J., Herdem, M. S., Nathwani, J., & Wen, J. Z. (2023). Methods and applications for artificial intelligence, big data, internet of things, and blockchain in smart energy management. *Energy and AI*, *11*, 100208. https://doi.org/10.1016/j.egyai.2022.100208

Luo, N., Pritoni, M., & Hong, T. (2021). An overview of data tools for representing and managing building information and performance data. *Renewable and Sustainable Energy Reviews*, *147*, 111224. https://doi.org/10.1016/J.RSER.2021.111224

Marinakis, V. (2020). Big data for energy management and energy-efficient buildings. *Energies*, *13*(7), 1555. https://doi.org/10.3390/en13071555

Marinakis, V., Doukas, H., Tsapelas, J., Mouzakitis, S., Sicilia, Á., Madrazo, L., & Sgouridis, S. (2020). From big data to smart energy services: An application for intelligent energy management. *Future Generation Computer Systems*, *110*, 572–586. https://doi.org/10.1016/j.future.2018.04.062

Mathew, P. A., Dunn, L. N., Sohn, M. D., Mercado, A., Custudio, C., & Walter, T. (2015). Big-data for building energy performance: Lessons from assembling a very large national database of building energy use. *Applied Energy*, *140*, 85–93. https://doi.org/10.1016/j.apenergy.2014.11.042

NABERS. (2025). *What is NABERS?*. https://www.nabers.gov.au/about/what-nabers

Regional dashboards and data. (2015, July 09). U.S. Energy Information Administration. https://www.eia.gov/regional/

Ruyssevelt, P., & Hamilton, I. (2017, November). *IEA EBC annex 70 - Building energy epidemiology.* International Energy Agency (IEA). https://energyepidemiology.org/

Shen, C., Zhao, K., & Ge, J. (2020). An overview of the green building performance database. *Journal of Engineering*, *2020*(1), 3780595. https://doi.org/10.1155/2020/3780595

Stein, B., Loga, T., Diefenbach, N., Arcipowska, A., Marian, C., Zavrl, M.S., Rakuscek, A., Stegnar, G., Wittchen, K.B., Mavaddat, N.A., Summers, C., Hulme, J., Dascalaki, E., Balaras, C., Droutsa, P., Kontoyniannidis, S., Vandevelde, B., Cuypers, D., Corrado, V., ... Ignjatovic, D. (2016). *Monitor progress towards climate targets in European housing stocks: Main results of the EPISCOPE project – Final project report* (ISBN 978-3-941140-56-1). Institut Wohnen und Umwelt GmbH. https://episcope.eu/fileadmin/episcope/public/docs/reports/EPISCOPE_FinalReport.pdf

Sun, Y., Haghighat, F., & Fung, B. C. M. (2020). A review of the-state-of-the-art in data-driven approaches for building energy prediction. *Energy and Buildings*, *221*, 110022. https://doi.org/10.1016/j.enbuild.2020.110022

Tian, Z., Zhang, X., Wei, S., Du, S., & Shi, X. (2021). A review of data-driven building performance analysis and design on big on-site building performance data. *Journal of Building Engineering*, *41*, 102706. https://doi.org/10.1016/J.JOBE.2021.102706

US Department of Energy (2025). *Building performance database (BPD)*. https://www.energy.gov/eere/buildings/building-performance-database-bpd

Vaidya, R., Reymolds, A., Azulay, G., Barclay, D., & Tolkin, B. (2009). ENERGY STAR ® Portfolio manager and utility benchmarking programs: Effectiveness as a conduit to utility energy efficiency programs. In *2009 Energy Program Evaluation Conference* (pp. 738-750). https://www.energy.gov/sites/prod/files/2014/05/f15/1886526335.pdf

Wei, Y., Zhang, X., Shi, Y., Xia, L., Pan, S., Wu, J., Han, M., & Zhao, X. (2018). A review of data-driven approaches for prediction and classification of building energy consumption. *Renewable and Sustainable Energy Reviews, 82*, 1027–1047. https://doi.org/10.1016/j.rser.2017.09.108

Ye, Y., Zuo, W., & Wang, G. (2019). A comprehensive review of energy-related data for U.S. commercial buildings. *Energy and Buildings, 186*, 126–137. https://doi.org/10.1016/j.enbuild.2019.01.020

Zhou, K., Fu, C., & Yang, S. (2016). Big data driven smart energy management: From big data to big insights. *Renewable and Sustainable Energy Reviews*, *56*, 215–225. https://doi.org/10.1016/j.rser.2015.11.050