Building energy rating & benchmarking: understanding similarities and differences

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Abstract

Over the past five years, policies requiring building energy benchmarking have become increasingly prevalent around the world. Europe has mandated energy certification, while in other regions popular voluntary tools have become incorporated into mandatory policies requiring benchmarking and disclosure of energy consumption information. The Energy Star Portfolio Manager tool in the United States is the basis for mandatory public benchmarking policies in New York City and other large U.S. cities for various building types. Cities are leading the charge on the U.S. policy front while the national scope Portfolio Manager tool continues to expand its scope to additional building types, enabling broader benchmarking policies. In Australia, the NABERS system was originally developed for New South Wales and has now become the foundation for mandatory public benchmarking of offices across the country. Initial data from the first years of implementing these programs is now becoming available. This paper compares the programs, policies, and initial results from the public benchmarking policies in Europe, the United States and Australia. The paper documents the extensive similarities and nuanced differences among the tools, approaches, and policies in major countries and identifies key questions that must be answered in the coming years. The paper considers the policy dynamics of the city, state, and national roles in each country and identifies applicable lessons learned. The paper raises key questions and potential areas for alignment and exchange of best practices between the initiatives in various countries.

Introduction

Building energy usage benchmarking, meaning utilizing energy consumption data for the purposes of comparing a building to its peers, has expanded worldwide as a policy tool intended to encourage identification and reduction of energy waste. The benchmarking systems, programs, and policies have evolved significantly in the past few years as a result of continuous feedback, first from voluntary precursor programs and then from data collected from participating buildings. Across the United States, Europe, and Australia, mandatory benchmarking requirements and disclosure laws are creating additional data beyond the voluntary precursors. This paper collects the most recent updates from the programs in Europe, Australia, and the United States, and considers the implications of the new data for the evolution of the programs. Extensive similarities and nuanced differences among the tools, approaches, and policies are documented, and key question to be answered in the coming years are identified.

Policy Fundamentals

Building energy benchmarking is the act of collecting building energy use information and comparing that information to the energy use of other, similar buildings (real, averaged, or estimated) for the purposes of drawing conclusions about a building's energy efficiency. This act often translates into a building energy rating, which intends to both simplify the process of providing useful information and provide greater context on the applicability of the information.

There are a wide variety of building energy rating schemes. The ratings may be based on actual usage data (operational ratings) or physical building characteristics and assumed operations (asset ratings). This paper focuses solely on the energy

benchmarking of large buildings in the EU, United States and Australia.

Building benchmarking policies are often accompanied by requirements for the disclosure of the benchmark results at a point in time, either calendar-based (annually or less frequent) or event-based (lease or sale). The requirements are to provide the benchmark results to enable the interested parties to make some comparison to other buildings and understand the larger context of the energy use of the building and associated costs. The requirement may specify an energy intensity metric (energy per unit space) or a building energy rating.

A recent global review of building energy rating schemes (IPEEC 2014) identified several key differences between the major initiatives around world, which are highlighted in Figure 1.

Between different countries and regions, some terms about building benchmarking and rating have different meanings. Figure 2 describes how these terms are understood in different regions.

Progress in the United States, Australia, and European Union

The creation and evolution of building energy rating schemes has occurred principally within the past 20 years. Figure 3 provides a timeline of major events.

UNITED STATES

In the absence of federal policy, benchmarking laws are being rapidly adopted across the United States at the sub-national level, particularly by large cities. Since 2007, 13 U.S. states, cities and counties have created rules requiring energy benchmarking for privately owned commercial and/or multifamily residential property. Roughly half of these rules were adopted in the past 36 months, a bellwether for strong and sustained interest by policymakers. More than 10 additional U.S. states and cities are considering benchmarking policies that could be adopted in the next 24 months.

Adopted policies vary significantly in design, including policy scope (the types and sizes of buildings required to comply); compliance timeframes; benchmarking quality control measures; and information reporting and disclosure requirements.

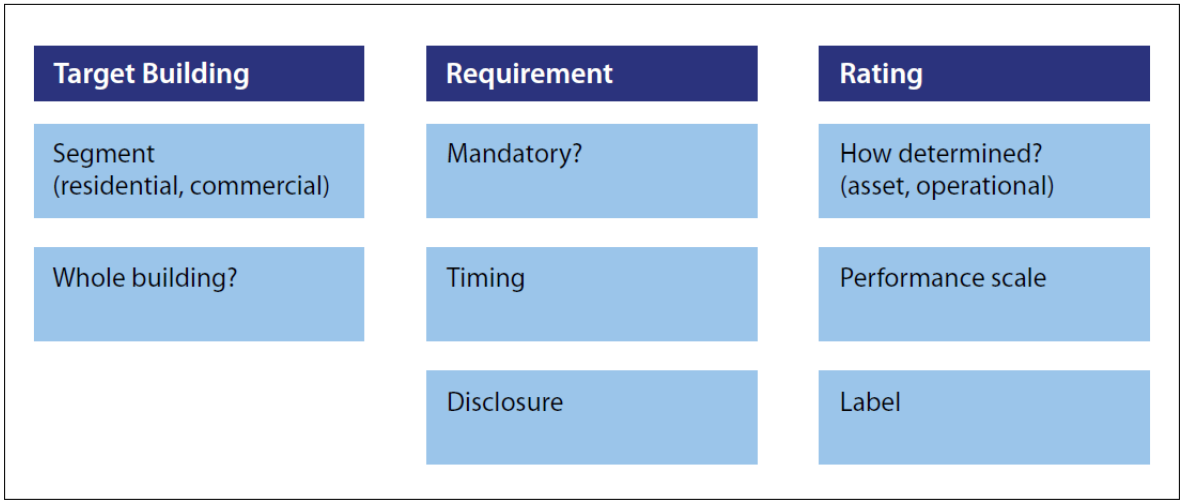

Figure 1. Key Distinctions between Rating Systems around the World.

	Australia	Canada	China	EU	US
Assessment system	Rating	Labeling; benchmarking	Rating	Certification	Benchmarking; Rating
Evaluation methodology	Rating	Rating	Rating	Rating	Rating; Rating
Results of evaluation	Rating; Score	Rating; Score	Rating	Class; Rating	Rating; Score
Physical product of assessment	Certificate	Label	Label	Label; Certificate	Label; Rating; Statement

Figure 2. Key Terminology in Rating Systems around the World.

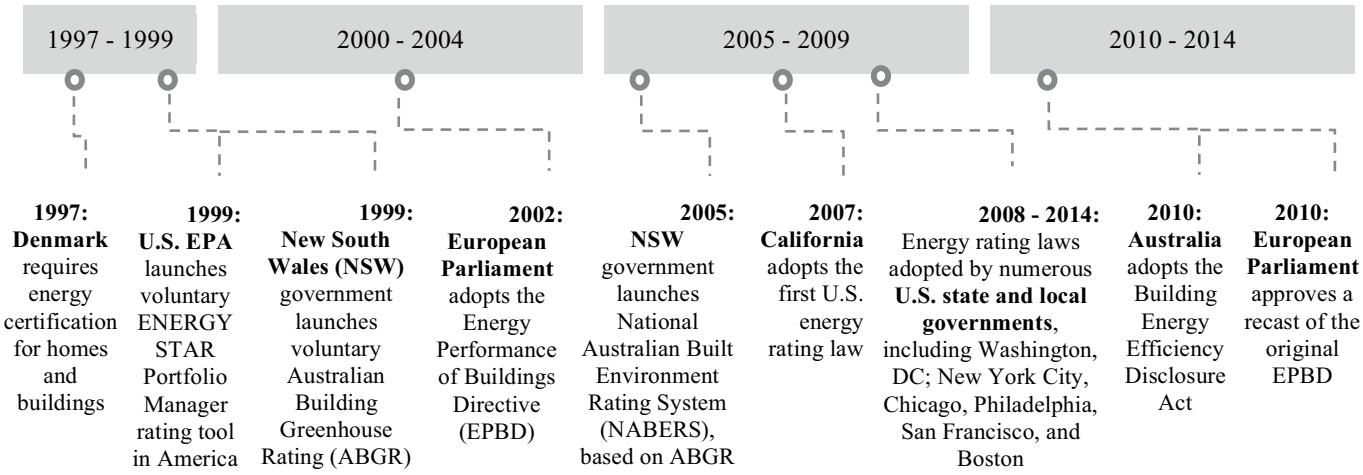

Figure 3. International Building Benchmarking Timeline.

Yet they also share core design elements that provide strong continuity across jurisdictions. All of the adopted policies require use of the Energy Star Portfolio Manager tool, and 11 of the 13 adopted policies require benchmarking to be conducted annually (the exceptions are the states of California and Washington).

Launched by the U.S. Environmental Protection Agency (EPA) in 1999, Portfolio Manager is a free, online energy benchmarking software tool. It calculates an energy efficiency rating of "1" to "100" for common commercial building types and multifamily buildings based on 12 months of energy usage data and basic information about building occupancy and operations. As of the end of 2012, it was used to benchmark more than 300,000 buildings totalling more than 30 billion square feet (approximately 2.8 billion square meters) of space (USEPA 2013), making it the most widely used benchmarking software tool in America. U.S. policymakers have consistently chosen to leverage Portfolio Manager in benchmarking laws in part because of its widespread, voluntary usage in the real estate marketplace.

Initial Results

The individual or collective impact of U.S. benchmarking policies on energy efficiency, carbon reduction, real estate valuation, and other areas is beginning to be analysed. A recent study by U.S. researchers suggested that the benchmarking policies of four cities resulted in a statistically significant 2 % reduction in utility expenditures per square foot (Palmer and Walls 2014). Previous analysis by the USEPA (Oct 2012) indicated that general use of Portfolio Manager is correlated with demonstrable energy savings in buildings over time.

U.S. Policy Briefs

The landscape of U.S. benchmarking policies is summarized below:

- The state of California adopted its benchmarking policy in 2007, the first such policy in the United States. It requires benchmarking for commercial buildings greater than 5,000 square feet (approximately 460 square meters) involved in a sale, financing, or full-building lease transaction. Benchmarking information must be reported to the State and disclosed to the prospective transaction counterparty. The state has delayed implementation of its policy several times, with the final phase of implementation scheduled for 2016.
- District of Columbia: The District of Columbia adopted its benchmarking policy in 2008. It was the first U.S. policy to require the public disclosure of benchmarking information. It requires annual benchmarking for commercial and residential buildings greater than 50,000 square feet (approximately 4,600 square meters). Benchmarking information must be reported annually to the District, which posts it on a public website. The rate of compliance is 83 %, according to a District report published in February 2014.
- New York, NY: The City of New York adopted its benchmarking policy in 2009. It requires annual benchmarking for residential and commercial buildings greater than 50,000 square feet. Benchmarking information must be reported annually to the City, which posts it on a public website. The rate of compliance is 84 %, according to a City report published in September 2014.
- Seattle, WA: The City of Seattle adopted its benchmarking policy in 2010. It originally required annual benchmarking for commercial buildings greater than 10,000 square feet (approximately 929 square meters) and multifamily residential buildings with 5 or more units, but was revised in 2012 to require annual benchmarking for commercial and residential buildings greater than 20,000 square feet (approximately 1,850 square meters). Benchmarking information must be reported annually to the City and disclosed to current tenants and prospective counterparties in a lease, sale, or financing transaction involving the building. The rate of compliance is 93 %, according to a City report published in January 2014.
- San Francisco, CA: The City of San Francisco adopted its benchmarking policy in 2011. It requires annual benchmarking for commercial buildings greater than 10,000 square feet. Benchmarking information must be reported annually to the

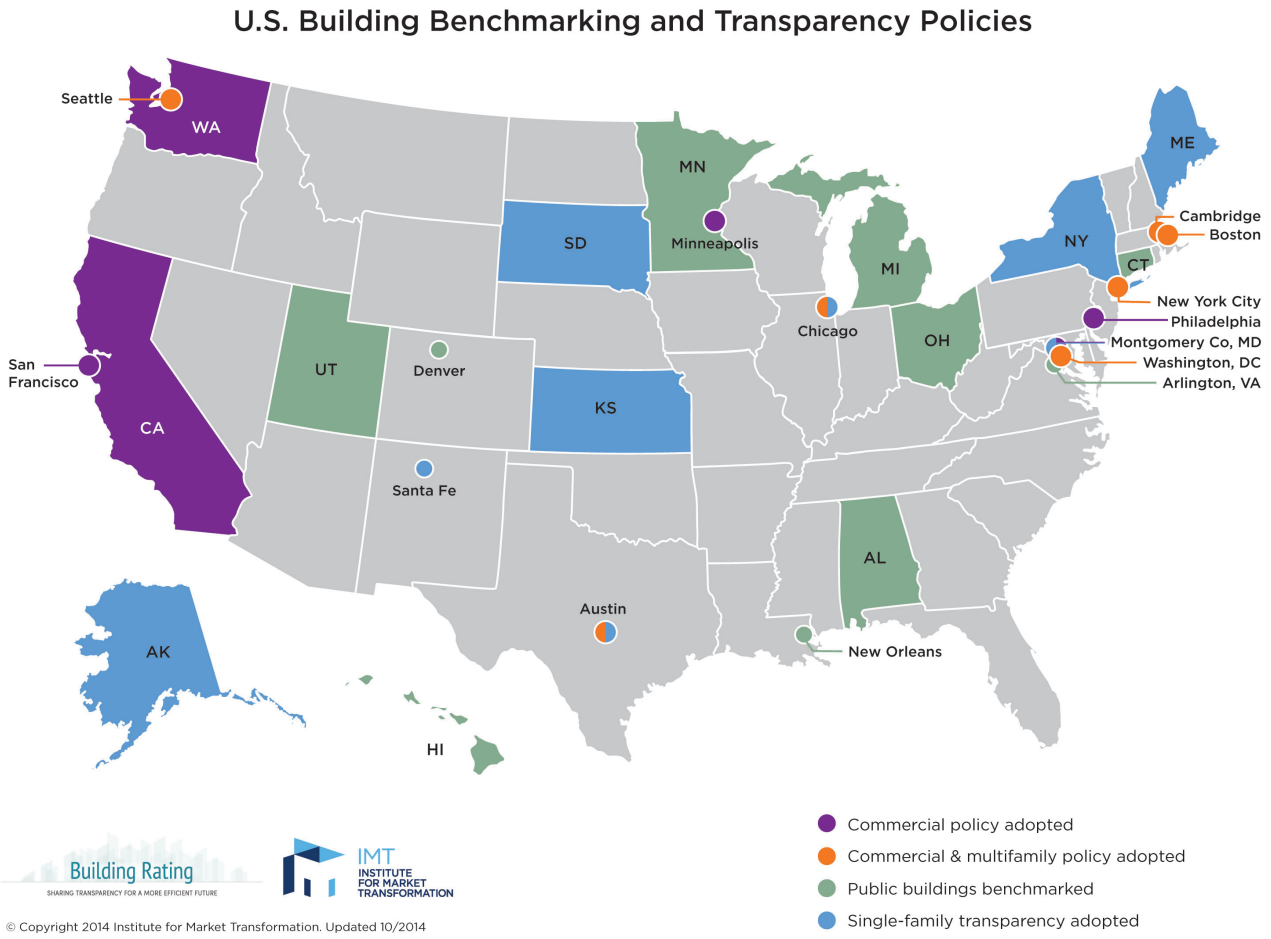

Figure 4. Benchmarking Policies and Programs in the United States (BuildingRating.org 2014).

City, which posts it on a public website. The City has not published policy compliance rates.

- Philadelphia, PA: The City of Philadelphia adopted its benchmarking policy in 2012. It requires annual benchmarking for commercial buildings greater than 50,000 square feet. Benchmarking information must be reported annually to the City, which posts it on a public website. The rate of compliance is greater than 90 %, according to a City report published in December 2014.
- Boston, MA: The City of Boston adopted its benchmarking policy in 2013. It requires annual benchmarking for residential and commercial buildings greater than 35,000 square feet (approximately 3,250 square meters). Benchmarking information must be reported annually to the City, which posts it on a public website. The rate of compliance is approximately 64 %, according to City records published in 2014.
- Chicago, IL: The City of Chicago adopted its benchmarking policy in 2013. It requires annual benchmarking for residential and commercial buildings greater than 50,000 square feet. Benchmarking information must be reported annually to the City, which posts it on a public website. The rate of compliance is greater than 90 %, according to a City report published in December 2014.
- Other cities, states and counties: Benchmarking policies have also been adopted by the City of Austin, TX (2008); the state of Washington (2009); the City of Minneapolis, MN (2013); the City of Cambridge, MA (2014); and Montgomery County, MD (2014).

AUSTRALIA

Australia requires benchmarking of commercial office buildings greater than 2,000 square meters and disclosure of the energy rating that results in the event of a sale or lease. Enacted in 2010 and named the Building Energy Efficiency Disclosure Act, the law created the Commercial Building Disclosure (CBD) program which requires the use of the NABERS (National Australian Built Environment Rating System) tool to for covered buildings.

NABERS was created by the New South Wales government in 2005 and evolved out of a predecessor program called the Australian Building Greenhouse Rating (ABGR) created six year earlier. Significant development effort on the system was expended when it was a voluntary program, and it reached a high market penetration among commercial offices, approximately 60 percent (Bannister, 2012). The tool produces a rating from "1" to "6" stars (initially five, and advanced levels of achievement have been added to distinguish the highest performers for office water and energy use). The rating is calcu-

lated from 12 months of performance data that is converted to greenhouse gas emissions, and accommodations are made for energy source, building size, type, and usage, and climate. The program is now managed by the NABERS National Administrator, in the NSW Office of Environment and Heritage.

NABERS is distinct worldwide in offering building ratings for whole buildings and tenancies, and base building ratings for the areas controlled by the landlord. The base building covers the common areas and central building systems, whereas the tenancy rating covers tenant-occupied spaces.

The NABERS tool has expanded in scope beyond offices to include shopping centers, homes, hotels, and data-centers, and can also benchmark water usage (whole building only) for most building types. In offices he program can also assess waste and indoor environment quality. It should be noted that the NABERS program is distinct from green building rating systems for new construction, such as the Green Star program from the Australia Green Building Council.

The CBD program requires the use of the NABERS tool to produce a Building Energy Efficiency Certificate. The Certificate contains a whole-building or base-building NABERS rating (NABERS provides for separate ratings for either the whole building, or just base building or tenant space), a tenancy lighting efficiency assessment, and general energy efficiency recommendations. CBD accredits assessors to produce the Certificates and submit them on behalf of building owners. The law requires the rating to cover the base building, unless it is impossible to distinguish the base building energy consumption from tenant-controlled consumption, in which case a whole-building rating is sufficient. The Certificates are valid for up to 12 months, or until the NABERS rating referenced expires.

Initial Results

The first-year results for the CBD program were released in 2013 and covered the period from November 2011 to November 2012. Because the requirements are triggered by sale or lease, compliance rates are not directly comparable to policies requiring annual reporting as in some U.S. jurisdictions, but some buildings do update their Certificates on a rolling basis (DoRET 2013). In the first year, 1,250 Certificates were issued covering 850 buildings. Eighty-nine percent of the net-lettable-area of the buildings rated was covered by a base building rating, leaving only 11 percent covered by a whole building rating (DoRET 2013).

Second Year Results

The second year of the program ending November 2013 resulted in 1,081 Certificates covering 862 buildings (DoI 2014). Interestingly the average star rating stayed nearly identical at 3.03 for the second year compared to 3.04 in the first. In the second year, 91 percent of the net-lettable-area received base building ratings and the remainder received whole building ratings (DoI 2014).

Dataset Release

In September 2013, the government released the data collected through the entirety of the CBD program. The dataset contained base building ratings for 899 buildings and whole building ratings for 297 buildings, as well as energy consumption and greenhouse gas intensity statistics. An analysis of the dataset done by Flux Consultants in 2014 found unexpected differences in similar buildings resulting from the normalization factors applied. and suggests many improvements to the

Table 1. Benchmarking and Transparency Policy Comparison.

Jurisdiction	Adopted	Trigger	Minimum Size (Commercial)	Minimum Size (MultiFamily)
California	2007	Transaction	5,000 SF (460 m^2)	N/A
Austin, TX	2008	Annual	10,000 SF (920 m^2)	5 units
Washington, DC	2008	Annual	50,000 SF (4600 m^2)	50,000 SF
Washington State	2009	Transaction	10,000 SF	N/A
New York City, NY	2009	Annual	50,000 SF	50,000 SF
Seattle, WA	2010	Annual	20,000 SF (1,840 m^2)	20,000 SF
San Francisco, CA	2011	Annual	10,000 SF	N/A
Philadelphia, PA	2012	Annual	10,000 SF	N/A
Minneapolis, MN	2013	Annual	50,000 SF	N/A
Boston, MA	2013	Annual	35,000 SF	35 units
Chicago, IL	2013	Annual	50,000 SF	50,000 SF
Montgomery Co., MD	2014	Annual	50,000 SF	N/A
Cambridge, MA	2014	Annual	25,000 SF	50 units

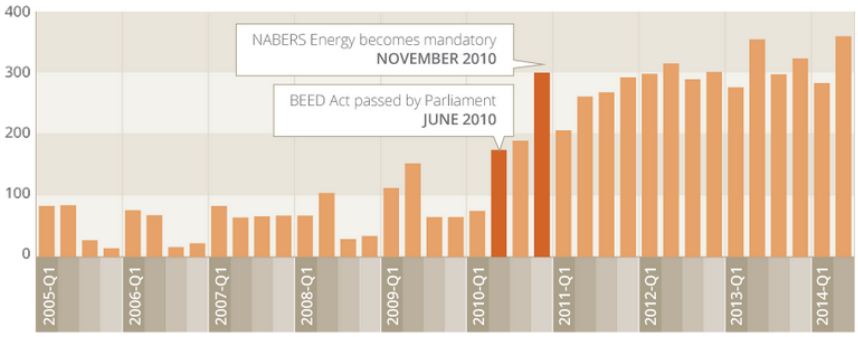

Figure 5. Quarterly Growth of Office Ratings in Australia (NABERS 2014).

technical underpinnings of the NABERS system. These suggestions would not have been possible without the feedback loop created by the data collection and release from the CBD program.

Uncertain Future

The CBD program is under review by the Abbot administration, which came into office in September 2013. A similar review led to the removal of the country's carbon tax. Preliminary findings of this review were scheduled for delivery in November 2014, and final results are expected in March 2015 (CBD.gov 2015). Early speculation among stakeholders seems to suggest that the energy benchmark and disclosure portion of the law will likely continue, while the lighting and other efficiency recommendations in the certification may be eliminated (Perinotto, 2014).

EUROPE

The Energy Performance of Buildings Directive (EPBD) was passed by the European Parliament in 2002, became effective in 2003, and dictates in Article 7 that energy performance certification be made available to an owner, buyer, or tenant when a building is constructed, sold, or rented (Directive 2002/91/EC). These requirements apply to residential and commercial buildings. Member states were required to introduce a certification scheme by the beginning of 2009. In the Netherlands and Denmark, certification systems existed, but most countries needed to create new programs (BPIE 2014). This differs significantly from the pre-policy conditions in the United States and Australia, where voluntary programs were refined over decades before being used to satisfy mandatory requirements. Not only were EU member states faced with the challenge of creating tools for mandatory usage immediately, but they also faced relatively wide variations in local conditions, cultural expectations, existing building regulatory and control systems, and building stocks that were not seen in the United States or Australia.

The EPBD was recast in 2010 to more specifically define effective implementation of energy performance certification schemes, adding requirements for quality assurance (Directive 2010/31/EU). At the time of the recast, 20 of 28 member states were in compliance with the original 2002 EPBD requirements (BPIE 2014).

The recast EPBD also included requirements for the public display of Energy Performance Certificates (EPCs) in the building and in advertisement media, as well as clarified that EPCs must be provided to buyers and tenants, not just made available. The provisions on display and advertisement are unique worldwide, as most benchmarking and disclosure requirements determine compliance through the use of a central reporting mechanism maintained in some way by the regulatory authority. The EPBD does not require central registries, but BPIE has documented that creation of such registries would aid the program and is occurring in 24 member states and Norway (BPIE 2014).

BPIE found that compliance with the requirements of the recast EPBD varied. The assessment determined that in 2014:

- Certifiers are required to pass a competency exam in 20 out of 28 member states.
- Mandatory training for certifiers is required in 14 of 28 member states.
- Independent control systems for EPCs have been implemented in all 28 member states and Norway, many very recently.
- 11 of 28 member states have established quality control for the input data for the calculation of EPCs.
- 19 of 28 member states have quality control for input parameters for the calculation of EPCs.
- Penalties are in place in "nearly all" member states with varying formats and enforcement rates.
- 12 member states allow public access to central registries containing EPCs, while 9 do not.

EU Policy Briefs (CA-EPBD 2013):

- Austria: Austria benefits from extensive experience with EPCs as a result of regional programs that existed before the original EPBD. Compliance with the EPC requirements at time of purchase or lease was approximately 20 percent, and as a result penalties for non-compliance were introduced in 2012.
- Belgium: As of the end of 2012, EPCs had been issued for 3 million square meters of office space in the Brussels/capital region, and compliance was estimated at 95 percent in the Flemish region for all buildings. In the Walloon region certificates are present for 10 percent of the total building stock.
- Denmark: Denmark has a long familiarity with EPCs as a result of systems that existed before the EPBD. In 2011,

Denmark modified its EPC rules to allow measured performance to inform the EPC for most large building types. Compliance is estimated to be high for large commercial buildings.

- France: In France, non-residential buildings use measured performance for EPCs. Five million EPCs were issued through the end of 2012 for all building types.
- Germany: Germany uses metered energy information for existing non-residential buildings to create a consumption certificate, while building characteristics are used to create an asset rating in a demand certificate.
- Ireland: Ireland uses an asset rating methodology for EPCs called Building Energy Ratings (BERs) and has issued about 11,000 BERs for non-domestic buildings through 2012. Display Energy Certificates (DECs) are for large public buildings and are based on measured energy use. By the end of 2012 there were 99 DECs.

Key Considerations

VOLUNTARY MARKET UPTAKE

In both the United States and Australia, the benchmarking infrastructure utilized for compliance with mandatory benchmarking requirements relies on voluntary tools that had established their use and credibility in real estate markets before the mandate. This is in contrast to the infrastructure in EU member states created to comply with the first EPBD and now being refined under the second. As a result, the compliance datasets resulting from initial operation of the EU programs are not directly comparable to that of current use of the U.S. and Australian program tools. The EU programs will benefit from the feedback provided through the required use of the benchmarking systems and may evolve more quickly than the U.S. and Australian tools did through voluntary use.

The current U.S. situation with Energy Star Portfolio Manager and the pre-mandatory use of the NABERS tool in Australia are comparable. In the United States, the number of buildings that are benchmarked is growing as a result of these benchmarking mandates. Currently, 20,000 buildings covering 278 million square meters have earned the Energy Star distinction, which represents a validated whole-building energy benchmark in the top 25th percentile nationally for energy consumption (USEPA, 2013). New York City is responsible for benchmarking 948 offices and 31 million square meters (Kontokosta, 2012). Sixty percent of Australian office space was benchmarked before it became mandatory (Bannister, 2012). At the equivalent time before the New York City law became effective, the U.S. benchmarked office space was somewhere between 40 to 50 percent (USEPA, 2012).

Key Question: As the EU benchmarking schemes are refined, will they evolve to become more similar to the U.S. and Australian systems?

Key Question: As familiarity with the EU systems grows, will growth in the benchmarked building stock follow a similar trajectory as in the United States and Australia?

LACK OF PHYSICAL BUILDING DATA

A documented barrier to further analysis is the lack of data on building characteristics. This affects the Australian and U.S. markets, and steps have been taken to address the barrier. The builders of the prediction model for the Council of Australian Governments (COAG) in 2012 identified that, despite the large sample of data on the actual energy performance of office

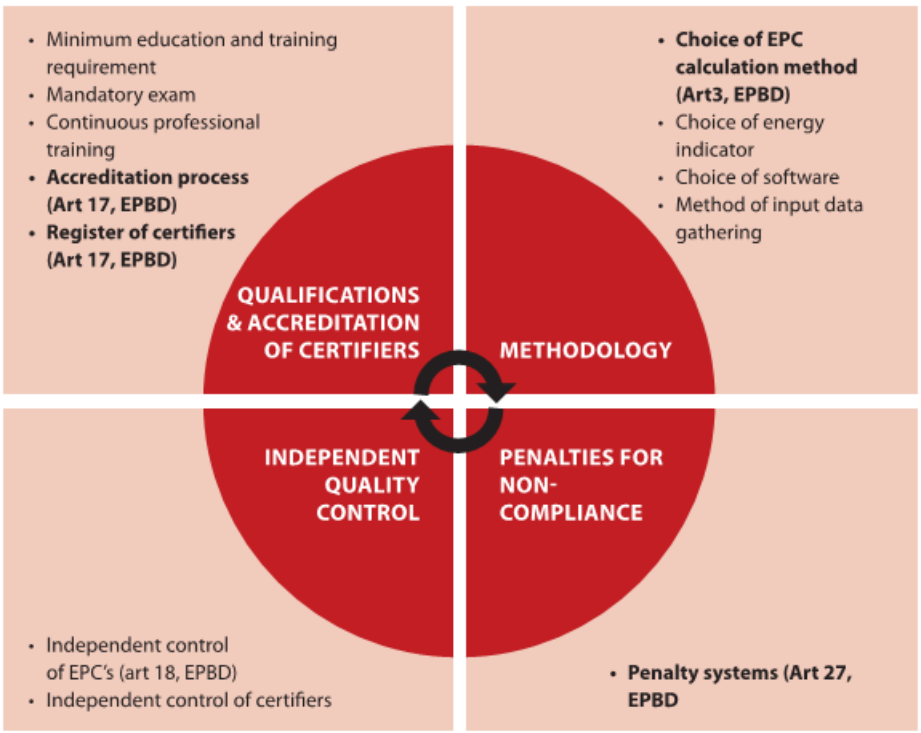

Figure 6. EPBD Recast requirements, from BPIE 2014.

buildings in Australia, the sample proved insufficient to produce a robust depiction by building sub-type, ownership type, year, state and territory, and other factors.

New York City cited a similar lack of building data when crafting its requirements, and as a result collects significantly more data than other programs.

The EU benchmarking schemes are not consistently operational in approach. as some are asset rating tools. Perhaps as a result, the availability of physical building data will not prove to be as large a barrier thanks to the collection of that information for the creation of the asset rating.

Key Question: Is there a policy solution, besides additional reporting requirements in benchmarking laws, to the lack of physical building data in the United States and Australia?

Key Question: Will the prevalence of asset ratings in the EU reduce this barrier as benchmarking becomes more common?

TRIGGERS OF REQUIREMENTS

Most American cities require annual reporting of building energy benchmarks. Australia and the EU trigger their requirements for existing buildings on sale or lease. In Australia, ratings are good for 12 months, while certification period varies in the EU and can be as high as 10 years (CA-EPBD 2013).

In the Flux assessment of the CBD, the increase in the number of building receiving multiple Certificates from first to second year of implementation, and the improvement on those certificates of 40 percent of the buildings, suggests that requiring annual certificates may be a logical next step for the CBD program, and may potentially drive improved ratings (Flux 2014). It must be noted, however, that because CBD does not standardize the period of reporting that perhaps some of the changes between Certificates issued to the same building could be caused by timing the certification with the period of best performance, from whatever cause.

Key Question: Will annual reporting of benchmarks provide a benefit to cities collecting the information and building operators to justify the additional effort in the United States?

EXPANDING SCOPE

Since its creation, NABERS has increased its scope to cover more than just energy consumption. Water benchmarking for offices was added in 2006, and waste and indoor environment were added in 2008. The tool expanded sector scope to hotels in 2008 and to shopping centers in 2009 and data centers in 2013. The Flux analysis of the CBD in Australia suggests that increasing the scope of the benchmarking program beyond offices and following New York City in adding building types may be a next step for the program (Flux 2014). It would seem the possible expansion of CBD would be limited to the sectors covered by NABERS.

The Energy Star Portfolio Manager tool covers 80 different property types, of which 20 are eligible for Energy Star certification as a result of data availability sufficient to generate the range of benchmark EUIs.

In the EU, the Certificates are already meant to cover all new and existing buildings, with additional requirements for public buildings or those visited by the public.

Key Question: Will the more ambitious requirements for all buildings, new and existing, in the EU eventually lead to a more effective regulatory scheme than the piecemeal, sector-by-sector approach pursued in the United States and Australia?

TENANT USABILITY

NABERS is distinct worldwide in offering building ratings for whole buildings, tenancies, and base building ratings for the areas controlled by the landlord. The UK has the "Landlord Energy Statement/Tenant Energy Review" or LES-TER tool, developed in 2005, to attempt to address the distinction between tenant and base building (IPEEC 2014). In the United States, interest in a similar tenant rating system within the Energy Star Portfolio Manager is evidenced by draft legislation in the U.S. Congress.

In the UK, the British Property Federation has been working with a variety of stakeholders to adapt the separate NABERS tenant and landlord ratings; part of this is driven by UK government announcements that will impact the rental of buildings with very low energy ratings after a certain date – the property owner community wishes to have the ratings based on what the owner can do, not have their property marketability driven by tenant energy use and behaviour.

The review by Flux suggests that there are inevitable consequences to the differentiation between base and tenant energy, noting that buildings with central services may be more efficient in reality but find their reported energy use higher depending on in which rating the central system consumption is accounted (Flux 2014).

Key Question: Does having separate information on landlord vs tenant usage give additional information that is changing the behaviour of each?

Key Question: Is the lack of "whole building" performance information a significant barrier to understanding real improvements in performance?

Key Question: Does the interaction between tenant and base building ratings provide avenues for gaming or unintended policy consequences, as identified as possible by Flux?

BENCHMARKING QUALITY ASSURANCE

Quality assurance has been an issue for benchmarking policies in both the EU and the United States. The EU has taken steps to ensure workforce training and competence, as well as data quality standards for the calculation of certificates. U.S. efforts have focused on the ability of governments to audit benchmarking data, although several laws now require periodic data verification by licensed professionals prior to benchmarking reporting.

Key Question: What quality assurance measures are relevant for both EU and U.S. policies?

Key Question: What combination of quality assurance measures is strong enough to provide market confidence in benchmarking policies without burdening industry?

DATA ACCESS

In the United States, access to tenant building energy information is a significant barrier to the creation of the energy rating. Because the Portfolio Manager tool only provides whole-building ratings, whole-building data must be used to create it. Data privacy is a larger issue in the United States (and certainly the other countries), but sometimes in the United States the data access issue gets grouped with broader concerns about erosion of privacy and the fifth amendment of the U.S. Constitution (the right to avoid self-incrimination).

Efforts to reduce this barrier are being undertaken nationally, through the Data Access and Transparency Alliance (DATA), and in localities directly with utilities. Benchmarking and disclosure requirements at the city level are often the impetus for finding solutions to the data access problem and creation of an access platform at the utility serving the municipality, though not always.

In Australia, Section 18 of the Building Energy Efficiency Disclosure Act gives an assessor the authority to collect the information, even if a tenant refuses. Financial penalties can be levied against the tenant, and exemptions can be granted to either the tenant or owner (CBD 2015).

> **Key Question**: Is the data access issue with respect to building benchmarking a uniquely American problem or is there a similar concern and consideration in the other countries?

SIMPLIFIED RATING VERSUS BENCHMARK OF INTENSITY

In the review of the CBD dataset in Australia, Flux Consultants found that the simplification to star rating can mask differences in underlying carbon intensity for similar properties due to the normalization factors applied by the NABERS system (Flux 2014). This is a relevant finding with implications for international programs seeking to reduce energy or carbon intensity. In most programs in the United States, the normalized energy intensity, energy use per unit area, is reported rather than the simplified Energy Star score, potentially avoiding this problem. This question requires further study in the United States. In Europe, it seems feasible that the existence of an asset and an operational rating would help identify any such biases.

> **Key Question**: Do European and American rating systems mask certain performance characteristics due to the normalization process or the use of a particular metric?

OPERATIONAL VERSUS ASSET RATING

The Energy Star rating tool and the Australian NABERS ratings are "operational" ratings and not asset ratings, which are more commonly used in European EPCs with options for operational ratings in certain situations.

Asset and operational ratings are not opposites and both are needed for different purposes. Asset ratings (sometimes called "calculated" or "modeled" ratings) focus on the theoretical energy use in a building as calculated under a set of defined, standardized conditions. Operational (or "measured") ratings focus on the actual energy use in a building based on energy bills and consumption. One way to think about the relationship between these two kinds of ratings is that asset ratings focus on rating the inherent properties of the building's components and systems, whereas operational ratings focus on the use of that building.

Effective asset and operational ratings can complement one another. A poor operational score usually shows that there is opportunity for improvement, but does not point out where to begin to make that improvement. A tailored asset rating, looking at what portions of the building's energy characteristics are efficient or lacking can direct building decision makers to those opportunities. If a jurisdiction chooses to use multiple types of ratings, it is important to not only clearly communicate what the difference in those ratings is to avoid confusing end-users, but also to ensure the internal consistency of those ratings. Otherwise, confusion raised by differences in results because of the variation in underlying methodologies can lead to negative perceptions of both of the rating systems and a loss of credibility.

Cost may also be an issue when considerating the application of operational versus asset ratings. There is often a higher cost to have a qualified professional collect the relavant physical building characteristics and quantify the asset rating, whereas the operational rating can be quantified by consumption or utility bill data, often using free tools (as in the case of NABERS and Portfolio Manager). The situational need defines which rating is more useful. In the case of changing occupancy and operational conditions, an asset rating provides useful information about the potential energy use of the building, whereas an operational rating can help evaluate the operation and occupancy conditions of a space (although this is blended with potentially changing asset conditions). Regardless, understanding the situational usefulness of each rating is how to maximize effectiveness for building owners or potential owners.

> **Key Question:** Can operational and asset ratings complement one another to affect more action in the market?

> **Key Question:** Does more than one rating for an individual building cause more market confusion that it is worth?

COMPLEMENTARY POLICIES

Real Estate Classification

The Property Council of Australia suggested a minimum NABERS office energy rating for Class A offices in 2011. This would seem to legitimize energy efficiency of asset and operations as a real consideration for real estate, and linked to property classification and ultimately to rental rates that can be attained on the market. This change would seem to build upon the availability of information thanks to the CBD and create a real financial interest in improving the rating rather than just producing one for compliance, if maintaining or improving the classification of a space is a goal. This effect is alluded to by the Flux assessment of the CBD, which points out that the market now "expects" energy efficiency in buildings.

Green Property Index

IPD (International Property Databank, Limited) has been publishing a green property index in Australia for years that tracks the investment performance of commercial office buildings that have attained Green Star, NABERS Energy and NABERS Water ratings and certifications. As a result, it has been shown that offices with high NABERS ratings financially outperformed comparable offices over a two year period (IPD 2011).

IPD is exploring the creation of additional indices in the UK and also released a green property index for Canada in late 2013. The FTSE, NAREIT, and USGBC announced their intentions to create a similar green REIT index in the United States in late 2012, but it is not yet publically available (FTSE Group 2012).

Advertising Requirements

While the U.S. cities and Australia have built in public access to building energy ratings as fundamentals within their policies, the EPBD has gone further and required the inclusion of the certificate in all advertising related to the property. This may significantly expand the exposure and impact of the rating with targeted audiences.

Key Questions: Will the European advertising requirements provide awareness benefits for building energy ratings beyond the websites and annual reports used in the United States and Australia?

Key Questions: Will the existence of building energy rating ranges in the real estate classification increase the efficiency of all real estate classifications in Australia? Will the ranges change over time?

Key Question: Will the green property index in Australia provide an incentive to all commercial real estate companies to prioritize the energy ratings of their properties?

Conclusions

The EU, United States and Australia have all taken very different approaches toward increasing the availability of information on the energy use of large buildings. The major questions about effectiveness and results are outstanding, but the differences in approach are clear. The most similarities are found between the United States and Australia, and between individual European countries, but the completely distinct evolution of rating tools and policies of Europe will provide an important source of learning for the United States and Australia.

Policies in all three areas are now generating significant new data on buildings and energy in unprecedented volume. As this data collection continues, it will provide invaluable year-over-year feedback, not just on the effectiveness of benchmarking and rating policies but also on other policies and programs seeking to drive energy efficiency improvements in the building stock, such as building energy codes and voluntary green building programs. The data may also enable unforeseeable entrepreneurial opportunities that will impact the market for these buildings and products and services within them.

It is interesting to note the distinction on overseeing authority between the three areas. Europe is undeniable national government led, while the Australian program has become national after the early leadership from New South Wales. The United States is city-driven and it seems there is little possibility of a national effort in the near future. Australia may also be reverting to state or city led policies as a result of the current administration's misgivings about the CBD and other environmental policies. In the longer term, will the United States eventually follow Australia and create a national program, or will Australia move toward localized initiatives?

The EU activity is driven by the EPBD mandate, while the U.S. and Australian efforts started with voluntary initiatives which reached a level of market maturation and acceptance, and only after that became mandatory requirements. The EU effort is also more ambitious in scope and coverage as a result. Will the EU effort successfully build the effective multi-country implementation infrastructure necessary to reach the ambitious goals? Will the U.S. and Australian programs continue to expand and come to resemble the full vision of the EU effort?

Another variable exists in the distinct cultural differences and expectations, and the very different building markets. Australia has a relatively new and homogenous building stock, while the United States has broader variety of climate zones and building types and a much wider diversity of building stock. The EU shares the American climatic challenges and the oldest building stock considered. How will these different initial conditions effect program success over time?

Building energy rating schemes are gaining traction throughout the world, with a growing number of jurisdictions mandating building performance rating as part of a comprehensive energy efficiency policy package. However, building energy performance rating is just one part of a comprehensive policy package to achieve energy efficiency policy objectives. A building energy rating scheme does not in and of itself improve building efficiency. Rather, the rating is essential for defining the existing energy performance of a building and enabling other policies geared at reducing building energy consumption. Time will tell if these policies will achieve their goals.

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