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TECHNICAL REPORT

Improving the Energy Performance of Buildings

Learning from the European Union
and Australia

Charles P. Ries, Joseph Jenkins, Oliver Wise

Supported by the Real Estate Roundtable and the Building Owners
and Managers Association



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Summary

More than a third of the primary energy used in developed countries is used to heat, cool, and light buildings or is utilized within buildings. Studies by the Intergovernmental Panel on Climate Change (IPCC), McKinsey & Company, and other organizations have found that opportunities to achieve substantial, relatively low-cost improvements in energy efficiency can be found in commercial real estate.

However, the buildings sector has unique characteristics that make design of energy efficiency policies particularly challenging. For example, real estate purchases or leases are relatively infrequent because of high capital and transaction costs, and the variability of design and siting makes it inherently difficult to compare energy efficiency of buildings. As a result, potential renters, buyers, or investors often do not have enough information to make rational choices about energy efficiency investments. Also, the buildings industry is characterized by small-scale firms, which may not have the technical expertise necessary to make significant improvements in energy efficiency design or technology. Finally, there is a “split-incentive” problem when owners must bear the cost of energy efficiency improvements, but the benefits of their investment accrue to the tenant, who enjoys lower utility bills.

In recent years, the European Union (EU) and its member nations and the Australian Commonwealth and some of its states and territories have pioneered policies to promote energy efficiency in buildings and to address these market failures. This study examines how these policies have worked and draws implications for the design of similar public policies for the United States.

The EU has focused on disclosing information about the energy efficiency of buildings. Its Energy Performance in Buildings Directive (EPBD), issued in 2002 and implemented throughout the EU in 2009, requires that upon the sale or lease of any building or building unit, an energy performance certificate (EPC) must be presented to the prospective buyer or lessee. The certificates contain information on either the building or unit’s energy efficiency *design* characteristics or its actual measured energy *usage*. The certificates are accompanied by benchmark values for comparable building types, to make them meaningful to users. As part of this system, EU member states have put in place inspection and rating systems and have made various decisions about the scope and content of certificates. The EPBD also requires that public buildings over a certain size have energy efficiency certificates posted in a prominent place where the general public can see them.

The EPBD is currently being adjusted in light of experience. The European Commission recently proposed amendments, because it believes the EPBD has been implemented inconsistently and additional energy efficiency gains can be made in the buildings sector.

These legislative efforts focus primarily on the energy used *by* a building in its standard operation (e.g., heating and cooling), not on energy used *within* a building by its occupants.

For example, the legislation might influence an owner to improve the performance of a new building by using better windows and insulation, but it would have no effect on the energy consumption of a tenant operating a restaurant with industrial ovens and refrigerators, because, absent “green leases” or other tenant energy-use tracking, tenants have little incentive (beyond minimizing their utility bills) to make investments to improve energy performance. This is a significant point, as the energy used by occupants typically accounts for a large percentage of the total energy used at a building site.

In Australia, a national program for rating the energy of residential buildings has been in place for several years, alongside voluntary rating systems similar to those used in the United States. Additionally, the states of New South Wales and Victoria have experimented with policies that allow building owners and other energy users to earn abatement certificates (“white certificates”) by installing specific types of equipment or fixtures that improve energy efficiency. Recently, similar white-certificate programs have been rolled out in France and Italy. In France, the vast majority of certificates have been earned by residential building owners. In Australia, as in the EU, policies are being revised.

Energy Efficiency Issues

Public policies in the EU and Australia to promote building energy efficiency have addressed many of the same issues. These include

- Building codes
- Energy efficiency certificates
- Promoting energy efficiency in public buildings
- Training and certification of experts
- White-certificate programs.

Building Codes

Building codes have been effective in improving energy efficiency in new buildings and in some buildings undergoing major refurbishments, because they are mandatory and generally quite specific about requirements. As a public policy tool, however, codes are slow to have an aggregate effect on energy use, because even in years of healthy economic growth, only about 3 percent of a nation’s building stock is newly built or renovated. The EU now requires all member countries to have energy efficiency elements in building codes, and the codes must be reviewed every five years (although there is no affirmative obligation to update them on review). Whether codes should be prescriptive or performance-based is a major decision. Most codes are highly prescriptive, which reduces inspection costs and allows building-materials manufacturers to standardize. The downside of prescriptive codes is that they can inhibit design innovation. Performance-based codes for energy efficiency are less common. Although such codes can inspire new design approaches, such as the use of building siting, passive features, and other non-materials-based efficiency improvements, they require more highly trained inspectors to certify compliance. Energy efficiency compliance with building codes often can be certified at the same time as other requirements, which reduces implementation costs. In some jurisdictions, particularly EU countries that are new users of building codes, compliance with code

requirements is an issue. In Bulgaria, a national energy efficiency agency has been established, partly to ensure compliance with energy aspects of building codes.

Certificates

The requirement to present a standardized rating of a building's energy characteristics before or at the time of sale or lease is a central aspect of the EU's approach. Some Australian states and the Australian Capital Territory (which comprises the national capital Canberra and its environs) also require energy efficiency certificates. It is assumed that buyers and sellers (or lessees and lessors) thus informed will value good energy performance. However, energy efficiency information is most effective if it is provided before the transaction, since at the time of transaction, most issues, including price, have already been agreed on, so the effect of energy efficiency information on decisions is lessened. For this reason, the European Commission in November 2008 proposed amending the EPBD to require energy ratings to be disclosed when properties are listed or advertised.

The ratings on energy efficiency certificates may be based on a building's design characteristics (asset rating) or measured energy performance (operational rating) or—as some jurisdictions have sought—both. The EU leaves this decision to the discretion of member states. A design-based approach is often the only alternative for new construction, and it facilitates cross-building comparisons by potential buyers and renters. It also recognizes that, in principle, many building owners have no control over tenant behavior (unless “green leases” are used). In contrast, energy-usage-based ratings convey information about the building or unit's measured energy use, can be prepared by a utility, and may be audited. However, in multi-tenant buildings, energy usage is mainly determined by tenant behavior, and tenants may not have an interest in the building's rating.

The use of benchmark buildings or standardized rating categories simplifies the comparison of ratings for consumers. However, incentives may be needed to improve the energy efficiency of older, poorly performing buildings. In many instances, making older buildings more efficient can achieve the greatest improvements in energy efficiency, but when the standards for the highest ratings are based on the most efficient new buildings, owners of older buildings may not be able to attain them, even with extensive renovation. The owners of such older buildings may therefore see little economic return at sale or rental from investments in improving energy efficiency.

Promoting Energy Efficiency in Public Buildings

The EU applies special disclosure obligations to “public buildings” that have more than 1,000 sq m of useful floor area. Member states can decide what qualifies as “public.” Although a few have written the definition broadly (to include, for example, malls or hospitals that are generally open to the public), most apply the requirements only to buildings owned or occupied by government entities. However “public” is defined, the EU requires that such buildings post display energy certificates (DECs) in a prominent place to inform visitors and occupants of the buildings' energy efficiency ratings. In Australia, several jurisdictions have policies that set a minimum “Green Star” voluntary rating for any building that is leased or purchased for government use. The market power of the state governments in Victoria and New South Wales (where an estimated 40 percent of the floor space in the central business district is leased to public entities) is such that these policies are said to establish a de facto minimum for new speculative office-space construction.

A requirement to display energy certificates in prominent places (where voters can see them) can serve as an incentive for public authorities to invest in energy efficiency for publicly owned or leased buildings. Yet some jurisdictions in Europe (particularly subnational jurisdictions) have resisted appraising and rating public buildings, because of the potentially significant costs involved, even before the cost of energy efficiency improvements is considered. Objective disclosure in ubiquitous public structures such as schools, post offices, and public-service offices could garner public support and understanding for improvement programs. Since public buildings are normally under the control of public authorities, it would generally be preferable to have the energy certificates of those buildings based on actual energy usage rather than on design criteria, or to include both indicators.

Training and Certification of Experts

The credibility and effectiveness of public policies to improve energy efficiency in buildings in the EU and Australia depend primarily on the quality and impartiality of the experts who review the designs, inspect completed buildings, and issue ratings certificates. Design or usage ratings should ideally be based on a case-by-case review of designs or as-built structures. Ratings can confer substantial market value to buildings—or can decrease value. It is therefore necessary to carefully train and certify a large number of experts to determine energy performance ratings and support white-certificate programs. The largest number of inspectors is generally needed at the initiation of a program, before a building is certified.

A shortage of trained experts led the EU to postpone the entry in force of the EPBD for three years. The European Commission's proposed amendments will require member states to put in place quality-assurance programs to maintain the credibility of the system. Roughly half of the EU member states allow inspectors to be employees of interested parties (e.g., building design firms or developers).

White-Certificate Programs

White certificates are tradable rights based on specified energy efficiency investments, such as investments in improving the energy efficiency of buildings. White-certificate programs have been instituted as part of energy efficiency and cap-and-trade programs in some Australian states and also in Italy and France. Two key challenges for white-certificate programs relate to the definition of “business as usual”: (1) determining the reduction in energy use to be imposed on an obligated party (typically a utility), and (2) verifying the consumer behavior that qualifies for certificate rights.

In New South Wales, Australia, under a white-certificate program aimed at carbon emissions, certificates could be earned by installing specified high-efficiency equipment. However, most of the certificates were in fact earned by firms that distributed low-cost equipment that improved energy efficiency (typically compact fluorescent bulbs and low-flow shower heads) to residential building owners. Such third-party aggregators sold corresponding white certificates to the utilities and large industrial users. Subsequent studies found a mixed record in installation of the equipment, and the program has ended. As a public policy approach to energy efficiency in buildings, white-certificate programs can provide incentives, but their effectiveness depends on the rigor of the efficiency gains required and the system of verification and enforcement.

One Australian group is proposing adoption of a buildings-only white-certificate program in which building owners can meet efficiency improvement obligations by investing in

energy savings or by purchasing white certificates from other buildings that can achieve better-than-required energy savings.

Assessment of Program Impacts

The EU and Australian policies reviewed in this study are too new to permit definitive assessments of their impact. Moreover, it is difficult to disaggregate the effects of aspects of public policies that are customarily implemented in bundles (i.e., with pricing, tax incentives, and other components). One study of residential building transactions in Denmark found no statistical relationship between energy use by households and the presentation of EPCs at sale. In contrast, a study in the Australian Capital Territory found a significant correlation between house energy rating and sales price, after controlling for other factors. A study of the office-building market in the United States found a significant relationship between average achieved rental income and vacancy rates of buildings that have (voluntary) energy efficiency design and that use energy ratings and those of comparable buildings in close proximity. However, more research is required to assess accurately the cost-effectiveness of policies to improve energy efficiency in buildings.

Lessons for the United States

The experiences of Europe and Australia suggest that effective policies to promote energy efficiency in buildings can be designed using information disclosure, building codes, financial incentives, and benchmarking. The rollout of such policies and their consistent implementation pose special challenges. Our preliminary review of the European and Australian record suggests that the following key insights should be taken into account as the United States considers analogous policy approaches:

- **Codes.** In the near term, at least regional (climatic zone) consistency in the energy efficiency requirements for building codes would be highly desirable. This would allow building-materials manufacturers to improve and standardize building components. Given the importance of tenant behavior in energy consumption, consideration should also be given to applying energy efficiency code requirements to tenant interior space adaptations, especially in office and retail buildings. For the longer term, performance codes should be considered, but in the short term, simpler-to-administer prescriptive codes are preferable. Any expanded use of building codes should be accompanied by aggressive training and quality-assurance programs for inspectors.
- **Certificates.** An information mechanism such as EPCs needs to be simple enough to be understandable yet meaningful enough to affect marketplace behavior. Benchmarking can help, but the enormous variety of building types and siting makes establishment of reference grades very challenging. Once benchmark values are established, allowing (or, even better, requiring) them to be used in property advertisements and listings seems preferable to requiring declarations at the time of settlement. Building owners should also be allowed to display certificates at their option.

- **Attention to the incentives for improvements to existing buildings.** While public policies (especially codes) can affect the energy performance of newly built structures, widespread energy efficiency gains can be achieved only through retrofitting and making operational improvements to existing buildings. Management improvements are easier, cheaper, and faster to make than capital improvements, and benchmarks are an imperfect instrument for encouraging such improvements. Energy usage monitoring and incentives, marketable “white” abatement certificates, inspection, and improvement-recommendation systems will be essential for this effort.
- **Public buildings.** Public buildings should continue to be a test bed for new energy-saving ideas and should promote awareness of building energy performance levels. Nationwide standards for disclosure of energy performance of public buildings can serve both objectives. Given public sector control of most public building operations, disclosure usually should be based on measured energy usage, with an option to provide design ratings, where they exist.
- **Training and certification of experts.** The credibility of any building energy efficiency program depends on the quality and impartiality of the experts who review designs and usage data. No certificate or rating program should be started until an adequate supply of trained and licensed inspectors is on hand. National standards for training and certification could reduce the burden on states.
- **White certificates.** Building energy efficiency programs, with their large potential gains, can play an important part of a carbon (or energy use) cap-and-trade program. The challenge will be to accurately evaluate energy performance improvements and to ensure the credibility of the certificates in a sector with so many actors. It would be more difficult for utilities in the United States to play the role of aggregator and verifier than it would be for those in a country such as Australia, which has state-owned electricity monopolies. Establishment of a system of buildings efficiency ratings and the availability of a cadre of trained and licensed experts to implement it thus would seem to be preconditions for rollout of any broad-based white-certificate program in the United States.
- **Encouragement of voluntary measures.** There are a variety of voluntary initiatives in the buildings energy field, including voluntary rating schemes (such as ENERGY STAR; the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED); and the UK’s Building Research Establishment Environmental Assessment Method (BREEAM)), “green leases” (in the UK and Australia), and tenant energy statements (in the UK). National policy should continue to encourage these schemes, as they can pioneer new approaches and front-load the development energy evaluation expertise in the private sector.
- **Monitoring and evaluation.** Supporting public policy approaches to increasing efficiency in this varied, but important sector will require effective monitoring and evaluation systems. Consideration should be given to increasing the building energy use research budgets of the Environmental Protection Agency and the Department of Energy.