EXECUTIVE SUMMARY

Energy efficiency: an important market that is gaining momentum

Energy efficiency markets deliver goods and services that reduce the energy required to fuel our economies. The International Energy Agency (IEA) estimates that investment in key energy efficiency markets worldwide totalled up to USD 300 billion in 2011. This is a conservative estimate based on an assessment of direct and leveraged investment in identifiable energy efficiency initiatives by the public sector, multilateral finance institutions and major private institutions.

Energy efficiency investment has already delivered significant reductions in energy demand. The IEA estimates that for 11 IEA member countries,[1] investment in energy efficiency since 2005 has resulted in cumulative avoided energy consumption of 570 million tonnes of oil-equivalent (Mtoe) over the five years to 2010. Without these energy efficiency measures, 5% more energy would have been consumed by the 11 countries over that period. This amount of avoided energy is greater than oil used in the United States' transport sector in 2010 (554 Mtoe). In monetary terms, 570 Mtoe of crude oil would be valued at USD 420 billion at a price of USD 100 per barrel. Despite these measures being taken only relatively recently, they have already had a significant impact on total final consumption.

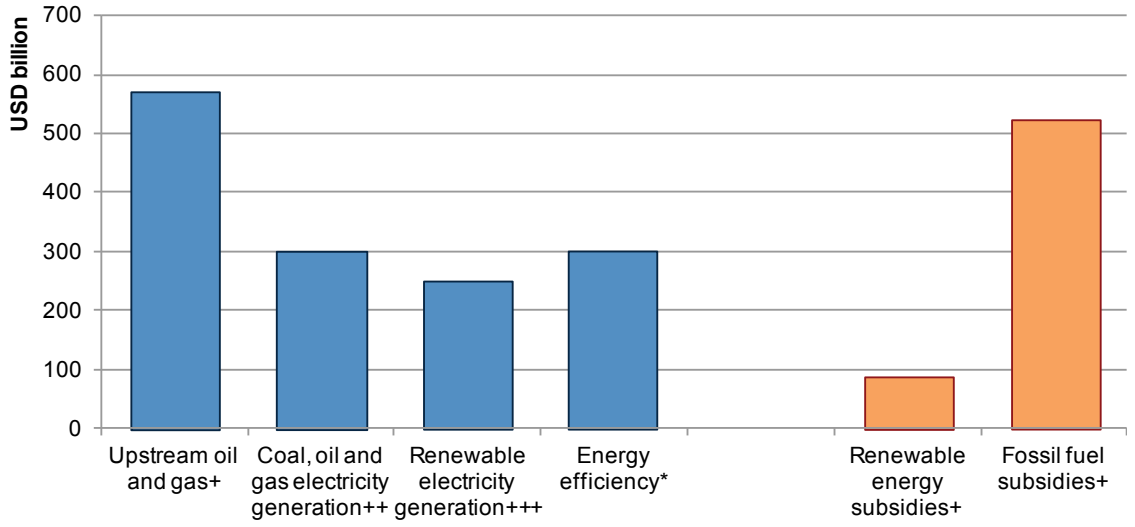
The emerging energy efficiency market

In 2011, total investment in energy efficiency was similar in magnitude to supply-side investment in renewable or fossil fuel electricity generation (Figure ES.1). However, investment in energy efficiency is still less than two-thirds of the level of fossil fuel subsidies. Investment in energy efficiency is distributed unevenly across countries and energy-consuming sectors (buildings, domestic appliances, transport and industry). The estimate provided is considered conservative because, first, limited information on private sector investment means it relies primarily on public-sector investment information, and second, the energy efficiency components of investment are frequently not discernable from business-as-usual infrastructure and consumer investment.

The energy efficiency market is increasingly delivering outcomes that can help address important public policy challenges. Energy efficiency investments can produce multiple benefits by reducing or limiting the demand for energy. This includes reducing both domestic and international pressures on energy supply systems, thereby increasing system resilience and improving security. It can also produce positive economic outcomes, such as allowing spending on energy to be redirected towards other economic sectors, and by reducing public expenditures. Energy efficiency investments can also result in improved health and well-being, and avoided emissions of greenhouse gases and other pollutants. Energy efficiency has a role as an important domestically produced energy resource – it can improve the trading position of countries by reducing the need for fuel imports, or freeing up other domestic energy reserves for export. Governments will need to understand the dynamics that stimulate energy efficiency activity if they are to successfully fulfil the parallel objectives of maintaining a high level of energy services, fuelling economic growth, keeping energy affordable and reducing carbon dioxide emissions.

[1] Those for which sufficient data is available to undertake such analysis: Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States.

Figure ES.1 Global levels of investment and subsidy in selected areas of the energy system, 2011



* Estimated range of USD 147 billion to USD 300 billion.

Note: investment figures include public and private investment and do not exclude subsidies.

Sources: +IEA, 2012a; ++ BNEF, 2013; +++IEA, 2012b.

Box ES.1 Definitions and approach taken

The market for energy efficiency is as diffuse as energy consumption patterns themselves. It is composed of many market actors who demand more efficient provision of energy services, and those that supply the necessary goods and know-how to deliver this greater efficiency. Consumers in this market include individuals, businesses and governments, and market activities cover all energy-consuming sectors of the economy.

Given the methodological and practical challenges associated with defining such a diffuse and diverse market and the "first-time" nature of this analysis, this report draws on three principal metrics to define and measure the energy efficiency market:

- Investments in energy efficiency: in general this encompasses direct public expenditure; investments by private actors, frequently stimulated through government policies and programmes; investment funded by commercial and multilateral development banks; investment by manufacturers; and consumer spending.
- The avoided demand for energy, or energy savings, delivered as a result of these investments: generally measured in the units of energy avoided, such as million tonnes of oil equivalent (Mtoe), megawatt hour (MWh) or tonnes of oil.
- The monetary value of these savings: generally measured in terms of the monetary value of the avoided energy.

Accurate data and information for each metric are not always available or sufficiently comprehensive. Future reports will hopefully benefit from greater data availability, which will require a step-change in reporting.

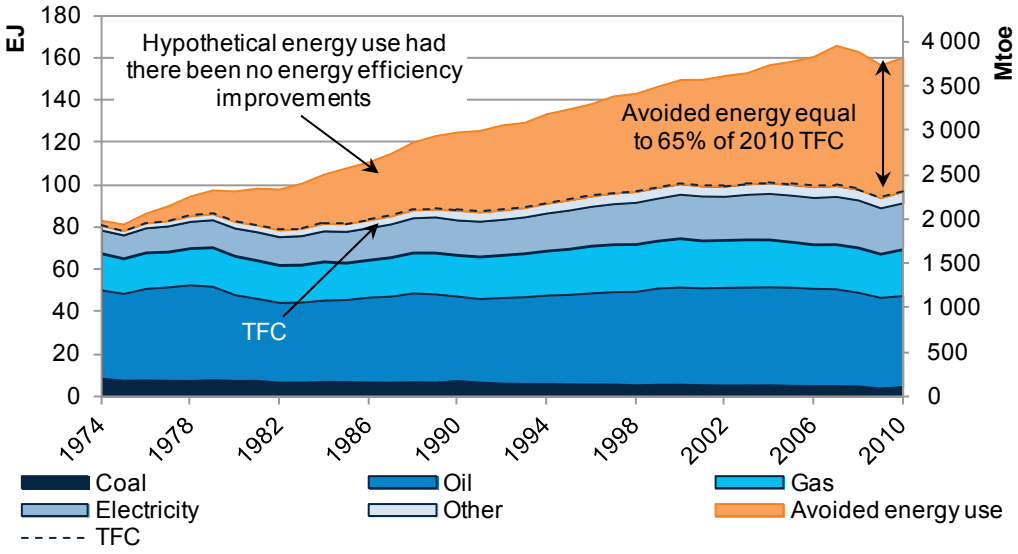
This report does not develop a single recommended methodology, but uses these three metrics to define and measure the energy efficiency market. These metrics, which are used as available rather than comprehensively due to data challenges, provide the basis for describing and framing energy efficiency market activity throughout the report.

This inaugural *Energy Efficiency Market Report* focuses on identifiable demand-side investments and market outcomes from avoided energy consumption. The global market for energy efficiency that this report seeks to analyse is diverse and diffuse, making it challenging to define and measure (see Box ES.1). A chapter on energy efficiency indicators demonstrates changes in energy use that result from energy efficiency. The report also provides an overview of relevant global energy trends and different approaches to quantifying the size of the energy efficiency market. It spotlights the appliance and information and communication technology (ICT) sub-markets. The ICT sector is expected to account for over 14% of global electricity consumption by 2020, and while appliances have become significantly more efficient over the past decade, new challenges and opportunities are emerging in this sector. In addition, 15 country and regional case studies, drawn from all continents and including both IEA member countries and non-IEA countries, demonstrate the variety of ways in which energy efficiency markets operate worldwide. The mix of case studies illustrates the various approaches and policies that drive energy efficiency markets, and their differing impacts.

From "hidden fuel" to "first fuel"?

The energy savings from efficiency measures taken over the longer term exceed the output from any other single fuel source in a subset of 11 IEA member countries. Energy efficiency investments made since 1974 have had a major cumulative impact on annual energy use, resulting in avoided energy consumption of 63 exajoules (EJ) (1.52 billion tonnes of oil-equivalent) in these 11 IEA member countries in 2010 (Figure ES.2). This amount was larger than the consumption of oil (43 EJ), electricity or natural gas (22 EJ each) in these countries in 2010 alone. This reflects an increase in energy efficiency investments over several decades, and the continued delivery of energy savings from these investments, net of any rebound effect. The size and duration of energy savings are affected by various factors, including the lifetime of the investment, and the extent to which disposable income generated from avoided energy consumption is spent on additional energy services (the rebound effect).

Figure ES.2 The "first fuel": avoided energy use from energy efficiency in 11 IEA member countries

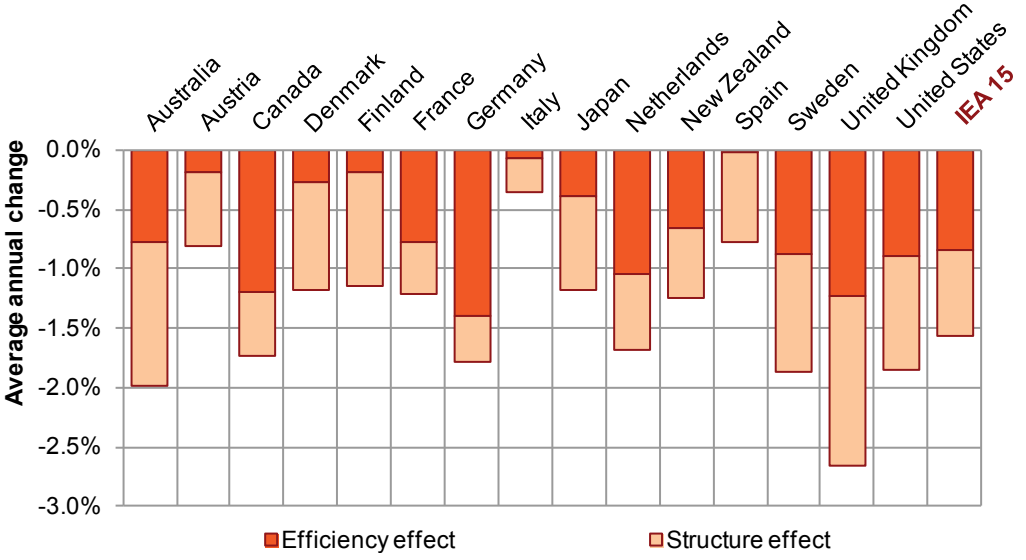


Notes: TFC = total final consumption. The 11 countries are Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States, those for which sufficient data is available to undertake analysis. "Other" includes biofuels plus heat from geothermal, solar, co-generation and district heating. Co-generation refers to the combined production of heat and power.

Source: IEA indicators database.

Energy efficiency investment has also contributed to reducing the amount of energy needed to produce each unit of gross domestic product (GDP). Detailed analysis of 15 IEA member countries[2] reveals the important role that energy efficiency has played in reducing energy intensity over the past two decades (Figure ES.3), alongside structural developments in their economies, and how this has allowed these countries to generate more GDP for each unit of energy consumed. Across the 15 IEA member countries, energy efficiency effects have contributed more, on a cumulative basis, to reducing energy intensity than structural economic changes.

Figure ES.3 Change in aggregate intensity, decomposed into structure and efficiency effects, 1990-2010



Notes: efficiency effect represents the composite economy-wide adjusted energy intensity metric. IEA 15 member countries are those for which sufficient data is available to undertake analysis.

Source: IEA indicators database.

Policies and prices drive the energy efficiency market

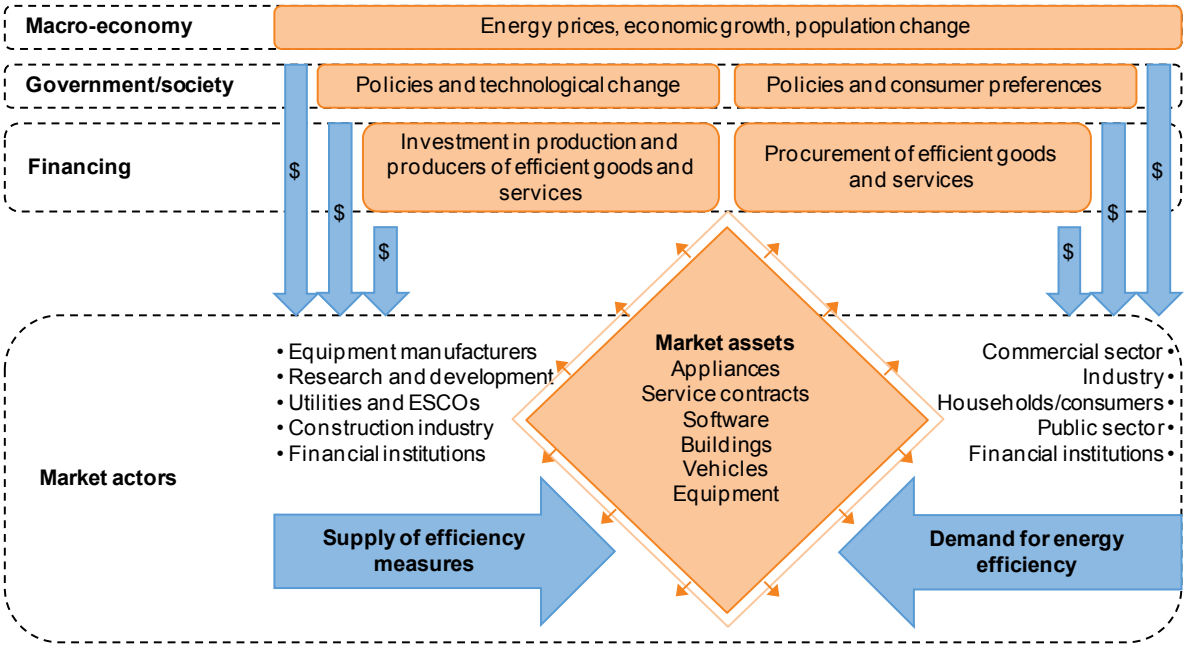
Over the past five years, investment in energy efficiency in most regions has largely been stimulated by policy interventions. In some regions, it has also been driven by higher energy prices. These are two main drivers of energy efficiency investment and therefore of energy savings. They affect a variety of actors (from both the private and public sectors) operating in a variety of economic sectors (*e.g.* transport and buildings). The interplay of these various elements is illustrated in Figure ES.4. Two other factors that influence decisions to invest in energy efficiency include consumer preference and the multiple non-energy benefits from avoided energy demand.

Energy prices are one of the key factors driving expansion of the energy efficiency market. Historically, sustained high energy prices have triggered energy-saving activity. Over the past decade, increases in global oil prices have stimulated technological innovation and enhanced efficiency in various sectors within most IEA member countries, notably light-duty vehicles, which will continue to deliver energy savings in coming years. Increasing oil prices and energy price volatility, as well as high prices for gas in Europe and East Asia, have provided incentives for investment in energy efficiency. They have also created the political space to develop and implement policies that reduce market barriers impeding

[2] Those for which sufficient data is available to undertake analysis.

energy efficiency investments. Energy prices and the presence (or absence) of transparent and dynamic price signals can facilitate or hinder investment in energy efficiency. For example, fossil fuel subsidies distort price signals, lowering the demand for energy efficiency by artificially reducing the price consumers pay for energy. However, other barriers to energy efficiency mean that transparent pricing alone does not directly lead to an optimal level of energy efficiency investment.

Figure ES.4 The market for energy efficiency



Note: ESCO = energy service company.

Policy is the other key stimulus for the energy efficiency market, commonly used by governments to overcome barriers and market failures that undermine the effect of price signals. These barriers and market failures include high transaction costs, information failure, and lack of technical or institutional capacity, all of which dilute the effect of price signals on the demand for energy services and the corresponding demand for energy savings. As a consequence, policy interventions have been essential to stimulating the demand for energy efficiency and by extension for the energy efficiency market. Policy approaches vary, reflecting different drivers within countries and across regions and different economic and energy contexts, such as concerns over energy imports and climate change in the European Union, and the Southeast Asia region's focus on energy security and economic development.

Energy efficiency markets are diverse and growing

Energy efficiency activities in different countries illustrate the development of this market worldwide. The country case studies in this report paint a picture of a market that is diverse and ready to grow in the medium term. The market has distinctive characteristics related to country-specific socio-economic conditions and resource endowments. Despite the various differences between countries, including in their policy approaches, a number of common themes emerge across the 15 countries and regions analysed.

A successful mix of information provision and regulation has played a leading role in stimulating the energy efficiency market. Measures developed include: standards and labelling for a range of

energy-using products (including light-duty vehicles, new buildings, appliances, lighting and other equipment used in the commercial and industrial sectors); providing access to energy assessments and to preferential financing; and energy efficiency obligations placed on energy suppliers. Assessments of these programmes show that most have had a positive impact on the size of national energy efficiency markets.

The great potential for energy performance improvements in buildings has generated significant investment in many countries. In Germany, the government development bank KfW provided USD 12.7 billion in loans for energy efficiency investments in the residential buildings sector in 2012, and it estimates that this stimulated USD 35 billion in home efficiency refurbishments. New Zealand's home insulation programme has invested USD 243 million over the last four years, evaluated as delivering benefits five times the value of this investment. French public spending on energy efficiency in the residential sector stood at USD 473 million in 2011, and total spending associated with its "white certificate" scheme could trigger private spending 20 times this figure based on previous years' performance. In Mexico, the Green Mortgage Programme mobilised nearly USD 1 billion in public subsidies and nearly USD 500 million in additional lending by mortgage providers to over three million householders between 2009 and 2012.

Utility and energy service company (ESCO) schemes have also driven growth in energy efficiency markets, especially among large energy users. In the United States, for example, levels of spending on ratepayer-funded efficiency programmes have grown from USD 1 billion in 2000 to USD 7 billion in 2011, an average annual growth rate of 20%. Annual turnover for Korean ESCOs reached USD 330 million in 2011, an increase of 63% compared to 2010. ESCO activity in Korea avoided the consumption of energy equal to 1.3 Mtoe in 2011. ESCOs are now active in close to 50 countries globally.

Energy efficiency investments are also being actively promoted in the industrial sector, although they can be more difficult to identify; efficiency is often one feature of a broader investment with multiple objectives, and financial flows towards efficiency projects are difficult to single out. Promotion of energy efficiency through information and voluntary programmes, including public-private sector co-operation, has yielded energy savings without the need for significant public capital. In Australia, government assistance with identifying highly cost-effective energy savings opportunities led industry to make net annualised financial savings of USD 283 million in 2010/11, based on investments made from 2006 onwards. The voluntary Canadian Industry Program for Energy Conservation supports process integration studies in industrial facilities, which led to annual energy savings worth USD 54 million in 2012.

In emerging economies, the drivers for energy efficiency investment are more closely related to economic development, energy security and reliability of supply. The emerging economies examined in this report all anticipate increasing energy consumption in the medium term, in many cases coupled with energy supply constraints and/or burgeoning energy import costs. As such, limiting the demand for energy, especially imported sources of energy, is an important tool for meeting growing demand for energy services while limiting public expenditure and meeting environmental objectives. As an example, China's 11th Five-Year Plan raised the importance of energy efficiency as a tool to support the country's social and economic development, leading to a reduction in energy intensity of over 19%. It also stimulated rapid growth in local energy efficiency services markets. For example, the Chinese market for energy performance contracts grew to USD 1.46 billion in the four years to 2008;

the market value of ESCOs increased from USD 694 000 in 2005 to USD 12 billion by 2010; and the International Finance Corporation estimates that technically and economically feasible projects represent a potential ESCO market in excess of USD 100 billion.

A spotlight on appliance technologies and the potential of the ICT sector

The ICT sector presents both important opportunities and challenges for energy efficiency. Networked products provide a good example. The rapid introduction of networked products and services, such as "smart" appliances, will enable a wide range of innovative energy management systems to proliferate and improve efficiency through greater consumer control and price-responsiveness. However, uptake of networked products and services is also driving up aggregate energy demand and the opportunity for these products to power down to energy-saving modes is limited by their constant connection to the network. The amount of excess energy used due to the inability of network equipment to go into a standby mode could reach 550 terawatt hours (TWh) as early as 2020, greater than the annual consumption of electricity in Canada.

There also remains room to improve the energy efficiency of products in the "traditional" appliance market. For example, raising the efficiency of products sold in some of the world's major markets[3] to global best levels, and using other policy levers to sustain improvements, could reduce electricity demand by 1 800 TWh in 2030 (about two-thirds of 2010 electricity consumption in the European Union).

Medium-term prospects

Energy efficiency markets are expected to grow in all the regions examined in this report, principally driven by price and policy. Much of that growth is anticipated to come from private investment enabled by government policy rather than direct public investment. Examples from the cases considered in this report illustrate the extent of growth prospects:

- The new Canadian National Energy Code is expected to save USD 350 million in 2020.
- The French government is considering a nearly threefold increase in the target for the *Certificats d'économie d'énergie* obligation scheme to 600 TWh, stimulating energy efficiency investments in the building and transport sectors.
- Germany's 2010 Energy Concept could avoid USD 42 billion in energy costs in 2020. A 2% renovation rate requirement for buildings will deliver more and deeper energy-efficient retrofits, and provides certainty for market investors.
- The market for fuel-efficient vehicles is accelerating rapidly in South Korea, with a requirement that suppliers shift from 30% to 100% compliance with a fuel efficiency standard of 17 kilometres per litre of fuel by 2015.
- Standards entering into force for a range of appliances in the United States will lead to over 80 TWh of annual electricity savings by 2020. The ESCO industry and low-income weatherisation industry will face challenges as federal recovery funding ends, but ESCO revenues are nonetheless projected to double to USD 13 billion by 2020.
- From 2014, energy suppliers in EU member states will be required to achieve annual energy savings equivalent to 1.5% of their energy sales volume through to 2020. This is expected to lead to expanded energy efficiency investment across the EU.

[3] Super-efficient Equipment and Appliance Deployment (SEAD) Initiative members: Australia, Brazil, Canada, the European Commission, France, Germany, India, Japan, Korea, Mexico, Russia, South Africa, Sweden, the United Arab Emirates, the United Kingdom and the United States.

- China's 12th Five-Year Plan envisages a 17% improvement in energy intensity, continuing the trend towards meeting the world average.
- The UK government has developed polices to stimulate energy efficiency investments by households and businesses, which are expected to save 14.4 Mtoe of final energy consumption annually by 2020. The capital cost of the technical potential for energy efficiency in the residential buildings is estimated at USD 90 billion, of which USD 3.5 billion are low-cost measures.
- The Japanese Top Runner programme, expected to deliver over USD 3 billion in consumer benefits through efficiency targets for lighting, vehicles and appliances, will broaden its scope to cover three-phase induction motors, LEDs, heat pumps and printers in 2015.

The energy efficiency market still holds significant untapped potential to deliver energy savings. The Efficient World Scenario of the IEA *World Energy Outlook 2012* estimates that by implementing cost-effective energy efficiency measures and removing market barriers, total primary energy supply could be reduced by an additional 900 Mtoe in 2020 beyond those reductions generated from current and announced policy interventions. This additional 900 Mtoe in avoided energy is equivalent to 7% of 2010 global consumption, greater than the combined energy supply of Australia, Japan, Korea and New Zealand today, and would produce a corresponding reduction of USD 458 billion in consumer energy expenditure.

Improved metrics and data are essential to catalyse energy efficiency market activity

To ensure that prices and policies create a level playing field for energy efficiency markets, stakeholders must address the urgent need for better data to support stronger systems of measurement. The energy efficiency market is growing in stature and maturity, but it is developing more rapidly than the ability to properly evaluate and understand it. A particular priority is to improve our capability to measure the size, nature and impact of energy efficiency markets and the outcomes from investments made in them.

Further attention is especially warranted in the following areas: how to identify and measure the investments made in energy efficiency; assessing the magnitude of the resultant avoided energy and its monetary value; identifying and evaluating the related social, economic and environmental outcomes; understanding the impacts of energy prices on energy efficiency investments and vice versa; and measuring the impacts of government policies. Improved data and metrics will help policy makers and other decision makers more predictably assess the costs and benefits of energy efficiency investments, and their value relative to other energy sources.

References

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