

McKinsey Global Energy and Materials

Unlocking Energy Efficiency in the U.S. Economy

Executive summary



This report was produced in association with 13 leading institutions with a strong commitment to engaging the public in constructive debate. McKinsey & Company takes sole responsibility for the final content of this report, unless otherwise cited.

No part of this publication may be copied or redistributed in any form without the prior written permission of McKinsey & Company, Inc.

McKinsey & Company is a global management consulting firm dedicated to helping the world's leading organizations address their strategic challenges. With consultants deployed in 50 countries around the globe, McKinsey advises on issues of strategy, operations, organization, and technology.

For more information about this report, please visit www.mckinsey.com/USenergyefficiency or contact McKinsey by email at USenergyefficiency@mckinsey.com



Recycled
Supporting responsible use
of forest resources
www.fsc.org Cert no. SW-COC-001558
© 1996 Forest Stewardship Council



Printed and bound by Villanti & Sons, Printers, Inc., of Milton, Vermont. This report was printed with soy-based inks, used no films or film-processing chemicals, and was manufactured using 100 percent certified renewable energy. The paper, Sundance PC100 White, produced by Neenah Mills from 100 percent postconsumer recycled fiber, was manufactured in a carbon-neutral process, as certified by Green Seal, and by SmartWood in accordance with the rules of the Forest Stewardship Council.

July 2009

Unlocking Energy Efficiency in the U.S. Economy

Executive summary

Hannah Choi Granade
Jon Creyts
Anton Derkach
Philip Farese
Scott Nyquist
Ken Ostrowski

Executive summary

The efficient use of energy has been the goal of many initiatives within the United States over the past several decades. While the success of specific efforts has varied, the trend is clear: the U.S. economy has steadily improved its ability to produce more with less energy. Yet these improvements have emerged unevenly and incompletely within the economy. As a result, net efficiency gains fall short of their full NPV-positive potential. Concerns about energy affordability, energy security, and greenhouse gas (GHG) emissions have heightened interest in the potential for energy efficiency to help address these important issues.

Despite numerous studies on energy efficiency two issues remain unclear: the magnitude of the NPV-positive opportunity, and the practical steps necessary to unlock its full potential. What appears needed is an integrated analysis of energy efficiency opportunities that simultaneously identifies the barriers and reviews possible solution strategies. Such an analysis would ideally link efficiency opportunities and their barriers with practical and comprehensive approaches for capturing the billions of dollars of savings potential that exist across the economy.

Starting in 2008, a research team from McKinsey & Company has worked with leading companies, industry experts, government agencies, and environmental NGOs to address this gap. It reexamined in detail the potential for greater efficiency in non-transportation uses of energy,¹ assessing the barriers to achievement of that potential, and surveying possible solutions. This report is the product of that effort.

The central conclusion of our work: *Energy efficiency offers a vast, low-cost energy resource for the U.S. economy – but only if the nation can craft a comprehensive and innovative approach to unlock it. Significant and persistent barriers will need to be addressed at multiple levels to stimulate demand for energy efficiency and manage its delivery across more than 100 million buildings and literally billions of devices. If executed at scale, a holistic approach would yield gross energy savings worth more than \$1.2 trillion, well above the \$520 billion needed through 2020 for upfront investment in efficiency measures (not including program costs). Such a program is estimated to reduce end-use energy consumption in 2020 by 9.1 quadrillion BTUs, roughly 23 percent of projected demand, potentially abating up to 1.1 gigatons of greenhouse gases annually.*

Five observations are relevant to a national debate about how best to pursue energy efficiency opportunities of the magnitude identified and within the timeframe considered in this report. Specifically, an overarching strategy would need to:

1. Recognize energy efficiency as an important energy resource that can help meet future energy needs while the nation concurrently develops new no- and low-carbon energy sources
2. Formulate and launch at both national and regional levels an integrated portfolio of proven, piloted, and emerging approaches to unlock the full potential of energy efficiency
3. Identify methods to provide the significant upfront funding required by any plan to capture energy efficiency

¹ Non-transportation uses of energy exclude fuel used by passenger vehicles, trucks, trains, airplanes, and ships, as well as transport energy used in agriculture, mining, and construction operations. For simplicity of expression, we sometimes refer to the energy covered by our analyses as “stationary energy.”

4. Forge greater alignment between utilities, regulators, government agencies, manufacturers, and energy consumers
5. Foster innovation in the development and deployment of next-generation energy efficiency technologies to ensure ongoing productivity gains.

In the body of the report, we discuss the compelling benefits of energy efficiency and why this energy resource warrants being a national priority. We then identify and “map” in detail the complex and persistent set of barriers that have impeded capture of energy efficiency at the level of individual opportunities. We also identify solution strategies, including those proven, piloted, or recently emerged, that could play a role in overcoming these barriers. Finally, we elaborate on the five observations noted above to outline important considerations for the development of a holistic implementation strategy to capture energy efficiency at scale.

We hope that our research and this report will help in the understanding and pursuit of approaches to unlock the benefits of energy efficiency, as the United States seeks to improve energy affordability, energy security, and greenhouse gas reduction.

COMPELLING NATIONWIDE OPPORTUNITY

Our research indicates that by 2020, the United States could reduce annual energy consumption by 23 percent from a business-as-usual (BAU)² projection by deploying an array of NPV-positive efficiency measures, saving 9.1 quadrillion BTUs of end-use³ energy (18.4 quadrillion BTUs in primary energy). This potential exists because significant barriers impede the deployment of energy efficient practices and technologies. It will be helpful to begin by clarifying the size and nature of this opportunity; then we will describe the case for taking action to address the barriers and unlock the energy efficiency potential.

The residential sector accounts for 35 percent of the end-use efficiency potential (33 percent of primary energy potential), the industrial sector 40 percent (32 percent in primary energy), and the commercial sector 25 percent (35 percent in primary energy). The differences between primary and end-use potentials are attributable to conversion, transmission, distribution, and transport losses. We present both numbers throughout as each is relevant to specific issues considered. Capturing the full potential over the next decade would decrease the end-use energy consumption analyzed from 36.9 quadrillion end-use BTUs in 2008 to 30.8 quadrillion end-use BTUs in 2020 (Exhibit A), with potentially profound implications for existing energy provider business models.⁴

This change represents an absolute decline of 6.1 quadrillion end-use BTUs from 2008 levels and an even greater reduction of 9.1 quadrillion end-use BTUs from the projected level of what consumption otherwise would have reached in 2020. Construction of new power plants, gas pipelines, and other energy infrastructure will still be required to address regions of growth, retirement of economically or environmentally obsolete

² The Energy Information Administration’s *Annual Energy Outlook, 2008* represents our business-as-usual projection; our analysis focused on the 81 percent of non-transportation energy with end-uses that we were able to attribute.

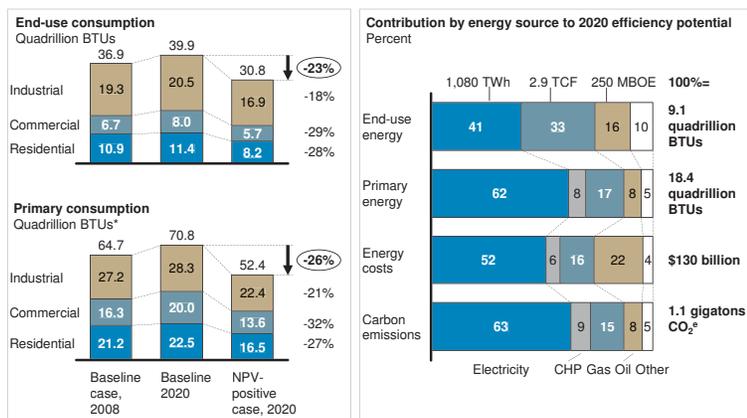
³ End-use, or “site,” energy refers to energy consumed in industrial, business, and residential settings, e.g., providing light, heating and cooling spaces, running motors and electronic devices, and powering industrial processes. By contrast, primary, or “source,” energy represents energy in the form it is first accounted (e.g., BTUs of coal, oil, natural gas) before transformation to secondary or tertiary forms (e.g., electricity). From the end-use viewpoint primary energy is lost during transformation to other forms and in transmission, distribution, and transport to end-users; these losses are an important energy-saving opportunity but one that is outside the scope of this report. Unless explicitly defined as primary energy, energy usage and savings values in this report refer to end-use energy.

⁴ We examine implications for energy provider business models in Chapter 5 of the full report.

energy infrastructure, and introduction of unaccounted-for consumption, such as electric vehicles. However, energy efficiency could measurably reduce the total new infrastructure investment required during this timeframe.

Beyond the economics, efficiency represents an emissions-free energy resource. If captured at full potential, energy efficiency would abate approximately 1.1 gigatons CO₂e of greenhouse gas emissions per year in 2020 relative to BAU projections, and could serve as an important bridge to a future era of advanced low-carbon supply-side energy options.

Exhibit A: Energy efficiency potential in the U.S. economy



* Includes primary savings from CHP of 490 trillion BTUs in commercial and 910 trillion BTUs in industrial.
Source: EIA AEO 2008, McKinsey analysis

The left side of the exhibit shows total energy consumption, measured in quadrillions of BTUs, for the portions of each sector addressed in the report, plus the corresponding consumption if the identified energy efficiency potential were realized. The right side provides different views of the energy efficiency potential in 2020 broken out by fuel type.

In modeling the national potential for greater energy efficiency, we focused our analysis on identifying what we call the “NPV-positive” potential for energy efficiency. We defined “NPV-positive”⁵ to include direct energy, operating, and maintenance cost savings over the equipment’s useful life, net of equipment and installation costs, regardless of who invests in the efficiency measure or receives the benefits. We used industrial retail rates as a proxy for the value of energy savings in our calculations,⁶ applied a 7-percent discount factor as the cost of capital, and assumed no price on carbon. This methodology provides a representation of the potential for net-present-value-positive (NPV-positive) energy efficiency from the perspective of policymakers and business leaders who must make decisions in the broad interests of society. This is in contrast to some studies that report on “technical” potential, which applies the most efficient technology regardless of cost, and differs from reports that project “achievable” potential given historical performance and an implied set of constraints.

We acknowledge, however, that there are different views of future scenarios, societal discount rates, and what constitutes “NPV-positive” from the perspective of individual

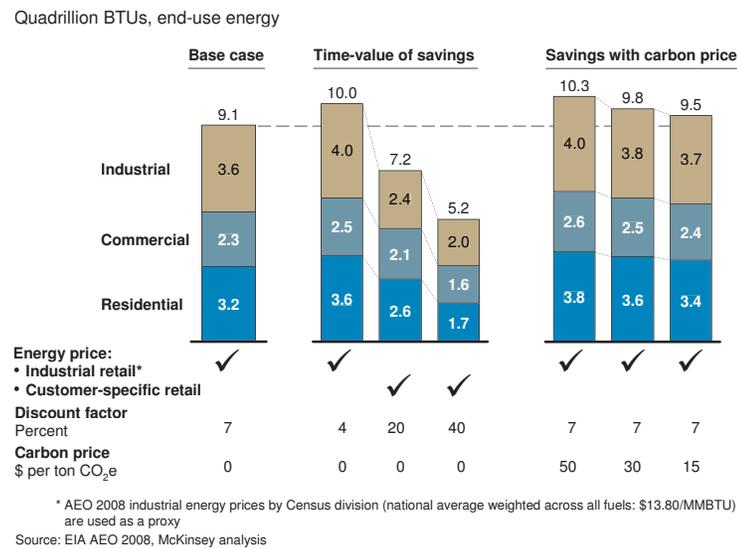
5 See Appendix B of the full report for more details on this calculation methodology.

6 Industrial retail rates represent an approximate value of the energy saved as they include generation, transmission, capacity, and distribution costs in regulated and restructured markets. The bulk of the rate is composed of generation cost, with minor contribution from transmission and capacity, and negligible contribution from distribution costs. Though load factor in these rates underestimates the national average, and thus this rate represents a slightly conservative estimate of the value of the energy savings, the other components are closer to the likely savings if significant energy efficiency were to be realized. We computed the avoided cost of gas also using an industrial retail rate, which likewise is close to the wholesale cost of gas plus a small amount of transport cost. A more detailed discussion of the avoided cost of energy is available in Appendix B of the full report.

actors. Thus we tested the resiliency of the NPV-positive opportunities by adjusting the discount rate (expected payback period), the value of energy savings (customer-specific retail prices), and possible carbon price (\$0, \$15, \$30, and \$50 per ton CO₂e). We found the potential remains quite significant across all of these sensitivity tests (Exhibit B). Introducing a carbon price as high as \$50 per ton CO₂e from the national perspective increases the potential by 13 percent. A more moderate price of \$30 per ton CO₂e increases the potential by 8 percent. Applying a discount rate of 40 percent, using customer-class-specific retail rates, and assuming no future cost of carbon, reduces the NPV-positive potential from 9.1 quadrillion to 5.2 quadrillion BTUs – a reduced but still significant potential that would more than offset projected increases in BAU energy consumption through 2020.

Exhibit B: Sensitivity of NPV-positive energy efficiency potential – 2020

The height of each column represents the energy efficiency potential in 2020 associated with non-transportation uses of energy under the conditions defined at the bottom of the exhibit -- energy price, discount factor, and carbon price. The height of each section corresponds to the efficiency potential in that sector, as labeled at the left, under those conditions.

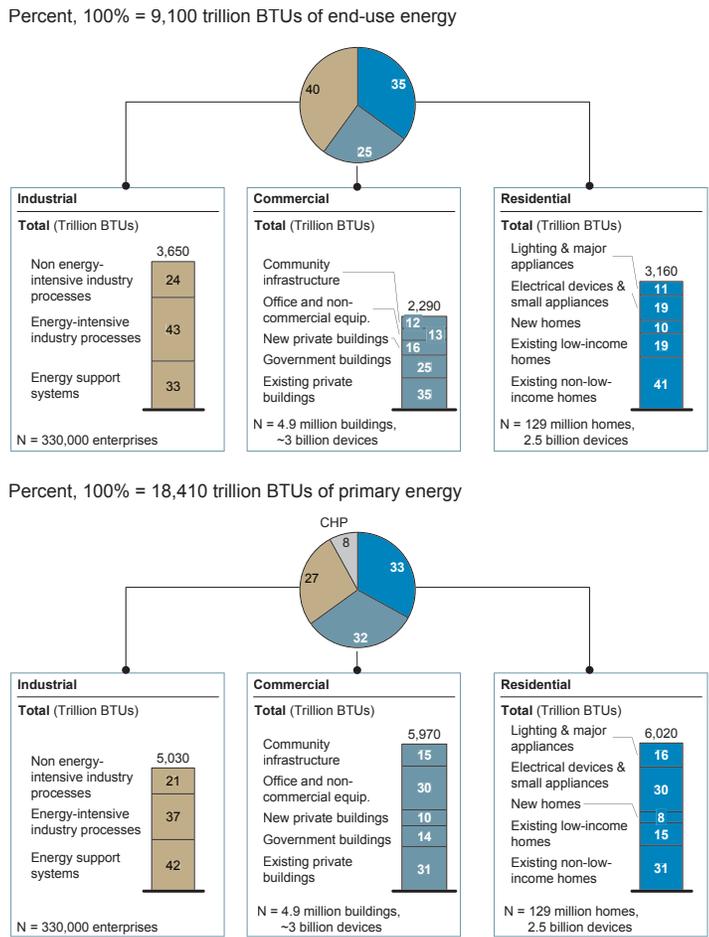


Our methodology is based on detailed examination of the economics of efficiency potential and the barriers to capture of it. Using the Energy Information Administration's National Energy Modeling System (NEMS) and *Annual Energy Outlook 2008* (AEO 2008) as a foundation, for each Census division and building type, we developed a set of "business-as-usual" choices for end-use technology through 2020. Then, to identify meaningful opportunities at this level of detail, we modeled deployment of 675 energy-saving measures to select those with the lowest total cost of ownership, replacing existing equipment and building stock over time whenever doing so was "NPV-positive."⁷ We disaggregated national data on energy consumption using some 60 demographic and usage attributes, creating roughly 20,000 consumption micro-segments across which we could analyze potential.

By linking our models with usage surveys and research on user-related barriers, we were able to re-aggregate the micro-segments as clusters of efficiency potential according to sets of shared barriers and usage characteristics. The resulting clusters as shown in Exhibit C are sufficiently homogeneous to suggest a set of targeted solutions.

⁷ We modeled the energy-savings potential of combined heat and power installations in the commercial and industrial sectors separately from these replacement measures.

Exhibit C: Clusters of efficiency potential in stationary uses of energy – 2020



Source: EIA AEO 2008, McKinsey analysis

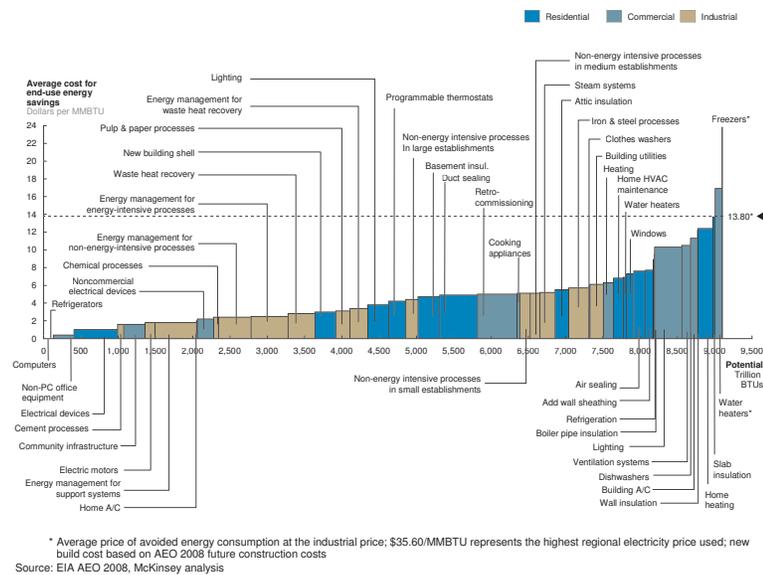
The pie charts show the share (in percent) of energy efficiency potential in 2020 in each economic sector, with end-use energy in the upper chart and primary energy in the lower one. Each column chart shows the clusters of potential that make up each sector, with the total potential in the sector (in trillion BTUs) displayed at the top of the column and the share (in percent) in the corresponding segment. Below each column are numbers for relevant end-use settings.

While not all actions that decrease the consumption of energy represent NPV-positive investments relative to alternatives, by definition in our methodology, all the energy efficiency actions included in this report represent attractive investments. The required investment of these NPV-positive efficiency measures ranges upward from \$0.40 per MMBTU saved, averaging \$4.40 per MMBTU of end-use energy saved (not including program costs). This average is 68 percent below the AEO 2008 business-as-usual forecast price of saved energy in 2020, \$13.80 per MMBTU weighted average across all fuel types (Exhibit D), and 24 percent below the projected lowest delivered natural gas price in the United States in 2020, \$5.76 per MMBTU. Furthermore, the energy and operational savings from greater efficiency total some \$1.2 trillion in present value to the U.S. economy: unlocking this value would require an initial upfront investment of approximately \$520 billion (not including program costs).⁸ Even the most expensive opportunities selected in this study are NPV-positive over the lifetime of the measure and represent the least expensive way to provide for future energy requirements.

8 The net present value of this investment therefore would be \$1.2 trillion minus \$520 billion, or \$680 billion.

Exhibit D: U.S. energy efficiency supply curve – 2020

The width of each column on the chart represents the amount of efficiency potential (in trillion BTUs) found in that group of measures, as modeled in the report. The height of each bar corresponds to the average annualized cost (in dollars per million BTUs of potential) of that group of measures.

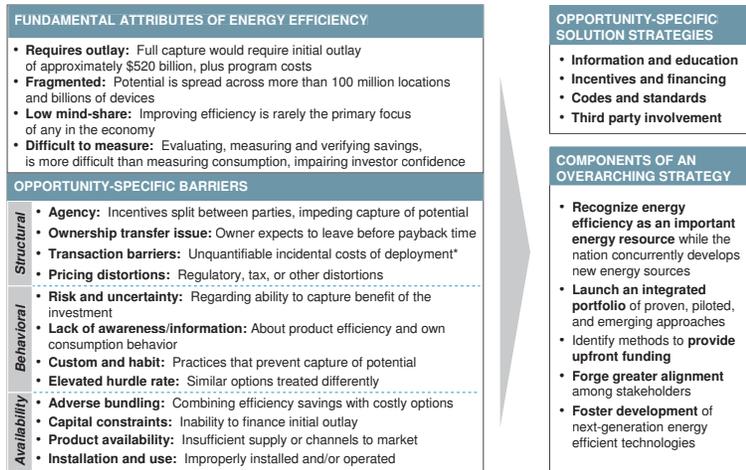


SIGNIFICANT BARRIERS TO OVERCOME

The highly compelling nature of energy efficiency raises the question of why the economy has not already captured this potential, since it is so large and attractive. In fact, much progress has been made over the past few decades throughout the U.S., with even greater results in select regions and applications. Since 1980, energy consumption per unit of floor space has decreased 11 percent in residential and 21 percent in commercial sectors, while industrial energy consumption per real dollar of GDP output has decreased 41 percent. Though these numbers do not adjust for structural changes, many studies indicate efficiency plays a role in these reductions. As an indicator of this success, recent BAU forecasts have incorporated expectations of greater energy efficiency. For example, the EIA's 20-year consumption forecast shows a 5-percent improvement in commercial energy intensity and 10-percent improvement in residential energy intensity compared to their projections of 4 years ago.⁹

As impressive as the gains have been, however, an even greater potential remains due to multiple and persistent barriers present at both the individual opportunity level and overall system level. By their nature, energy efficiency measures typically require a substantial upfront investment in exchange for savings that accrue over the lifetime of the deployed measures. Additionally, efficiency potential is highly fragmented, spread across more than 100 million locations and billions of devices used in residential, commercial, and industrial settings. This dispersion ensures that efficiency is the highest priority for virtually no one. Finally, measuring and verifying energy not consumed is by its nature difficult. Fundamentally, these attributes of energy efficiency give rise to opportunity-specific barriers that require opportunity-specific solution strategies and suggest components of an overarching strategy (Exhibit E).

Exhibit E: Multiple challenges associated with pursuing energy efficiency



* Financial transaction barriers and actual quality trade-offs are factored into the initial NPV-positive potential calculation as real costs.

Source: McKinsey analysis

On the left, this exhibit summarizes the fundamental difficulties of pursuing greater energy efficiency and the opportunity-specific barriers that affect and help define clusters of efficiency potential. On the right, it shows opportunity-level solution strategies to overcome barriers and suggests the essential elements of an overarching strategy for capturing energy efficiency potential.

Our research suggests that unlocking the full potential of any given opportunity requires addressing all barriers in a holistic rather than piecemeal fashion. To simplify the discussion, we have grouped individual opportunity barriers into three broad categories: structural, behavioral, and availability. Structural barriers prevent an end-user from having the choice to capture what would otherwise be an attractive efficiency option; for example, a tenant in an apartment customarily has little choice about the efficiency of the HVAC system, even though the tenant pays the utility bills.¹⁰ This type of agency barrier affects some 9 percent of the end-use energy efficiency potential. Behavioral barriers include situations where lack of awareness or end-user inertia block pursuit of an opportunity; for example, a facility manager might replace a broken pump with a model having the lowest upfront cost rather than a more energy efficient model with lower total ownership cost, given a lack of awareness of the consumption differences. Availability barriers include situations when an end-user interested in and willing to pursue a measure cannot access it in an acceptable form; for example, a lack of access to capital might prevent the upgrade to a new heating system, or the bundling of premium features with energy efficiency measures in a dishwasher might dissuade an end-user from purchasing a more efficient model.

¹⁰ We refer to space conditioning systems generically as HVAC systems (heating, ventilation, and air conditioning), whether a building has a heating system, a cooling system, an air exchanger or all three systems.

SOLUTIONS AVAILABLE TO ADDRESS THE BARRIERS

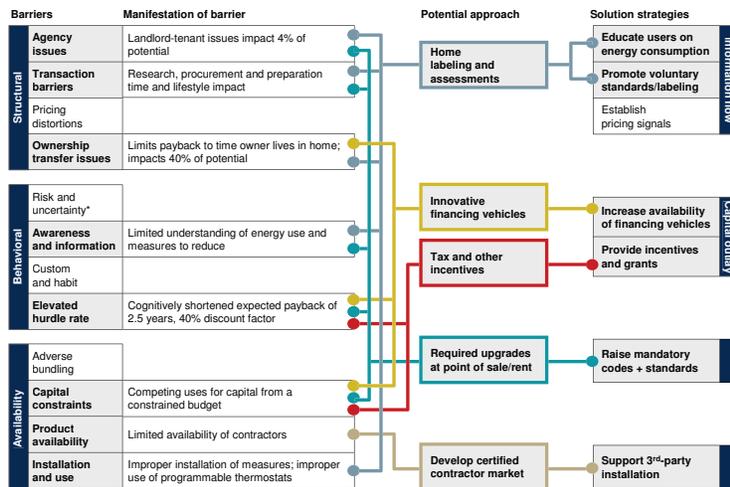
Experience over the past several decades has generated a large array of tools for addressing the barriers that impede capture of attractive efficiency potential, some of which have been proven at a national scale, some have been “piloted” in select geographies or at certain times at a city-scale, and others are emerging and merit trial but are not yet thoroughly tested. The array of proven, piloted, and emerging solutions falls into four broad categories:

- **Information and education.** Increasing awareness of energy use and knowledge about specific energy-saving opportunities would enable end-users to act more swiftly in their own financial interest. Options include providing more information on utility bills or use of in-building displays, voluntary standards, additional device- and building-labeling schemes, audits and assessments, and awareness campaigns.
- **Incentives and financing.** Given the large upfront investment needed to capture efficiency potential, various approaches could reduce financial hurdles that end-users face. Options include traditional and creative financing vehicles (such as on-bill financing), monetary incentives and/or grants, including tax and cash incentives, and price signals, including tiered pricing and externality pricing (e.g., carbon price).
- **Codes and standards.** In some clusters of efficiency potential, some form of mandate may be warranted to expedite the process of capturing the potential, particularly where end-user or manufacturer awareness and attention are low. Options include mandatory audits and/or assessments, equipment standards, and building codes, including improving code enforcement.
- **Third-party involvement.** A private company, utility, government agency, or non-governmental organization could support a “do-it-for-me” approach by purchasing and installing energy efficiency improvements directly for the end-user, thereby essentially addressing most non-capital barriers. When coupled with monetary incentives, this solution strategy could address the majority of barriers, though some number of end-users might decline the opportunity to receive the efficiency upgrade, preventing capture of the full potential.

For most opportunities, a comprehensive approach will require multiple solutions to address the entire set of barriers facing a cluster of efficiency potential. Through an extensive review of the literature on energy efficiency and interviews with experts in this and related fields, we have attempted to define solutions that can address the various barriers under a variety of conditions. Exhibit F illustrates how we mapped alternative solutions against the barriers for a cluster.

We do not believe it is possible to empirically prove that a particular combination of measures will unlock the full potential in any cluster, because the level of impact being considered has never previously been attained. However, we do believe that a holistic combination of solutions that address the full-range of barriers and system-level issues is a prerequisite for attaining energy-productivity gains anywhere near those identified in our analysis.

Exhibit F: Addressing barriers in existing non-low-income homes



* Represents a minor barrier
Source: McKinsey analysis

The left side shows categories of opportunity-specific barriers that can impede capture of energy efficiency potential, with a description of the specific manner in which the barrier is often manifested in the cluster extending toward the right. The far right side of the exhibit lists general solution strategies for pursuing efficiency potential, with the near right column describing how this might be combined into specific approaches to overcome barriers in the cluster. The colored lines map specific solutions to specific barriers; some solutions address one barrier, and others address more.

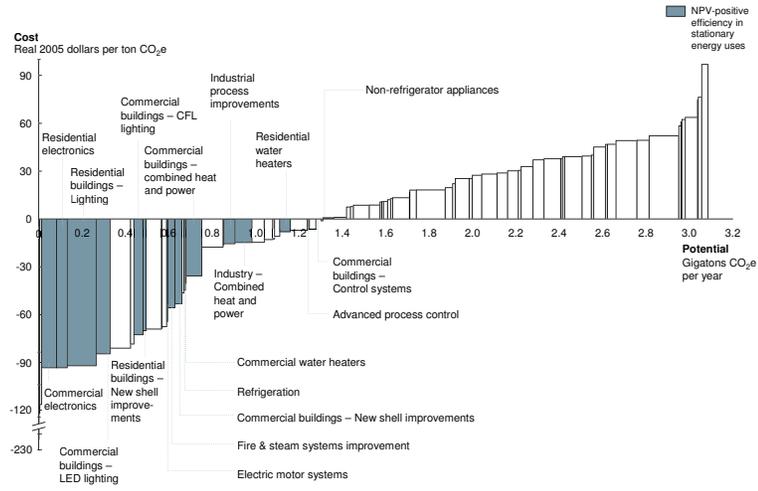
ELEMENTS OF A HOLISTIC IMPLEMENTATION STRATEGY

Capturing the full efficiency potential identified in this report would require an additional investment of \$50 billion per year (in present value terms), four- to five-times 2008 levels of investment, sustained over a decade. Even the fastest-moving technologies of the past century that achieved widespread adoption, such as cellular telephones, microwaves, or radio, took 10 to 15 years to achieve similar rates of scale-up. Without an increase in national commitment, it will remain challenging to unlock the full potential of energy efficiency. As noted previously, there are five important aspects to incorporate into the nation's approach to scale-up and capture the full potential of energy efficiency. An overarching strategy would need to:

1. **Recognize energy efficiency as an important energy resource that can help meet future energy needs, while the nation concurrently develops new no- and low-carbon energy sources.** Energy efficiency is an important resource that is critical in the overall portfolio of energy solutions. Likewise, as indicated in our prior greenhouse gas abatement work, new sources of no- and low-carbon generation are also important components of the portfolio. While it may seem counterintuitive initially given the magnitude of the energy efficiency potential available over the next decade, there are important reasons for continuing to develop new no- and low-carbon options for energy supply. First, as described in our original report on U.S. greenhouse gas abatement (Exhibit G), energy efficiency in stationary uses of energy represents less than half of the potential abatement available to meet any future reduction targets. In addition, some areas of the country will continue to experience growth, and some may need to retire and replace aging existing assets. The uncertain growth of electric vehicles could further complicate these requirements. Finally, pursuing energy efficiency at this scale will present a set of risks related to the timing and magnitude of potential capture. Consequently, there remains a strong rationale to diversify risk across supply and demand resources.

Exhibit G: U.S. mid-range greenhouse gas abatement curve – 2030

This exhibit shows greenhouse gas abatement potential as depicted in the mid-range case in McKinsey's greenhouse gas report (2007), with energy efficiency opportunities associated with stationary uses of energy highlighted. The height of each bar represents the incremental cost in dollars to abate one ton of carbon dioxide (or its equivalent); the width shows the gigatons of such emissions that could be abated per year.



Source: McKinsey analysis

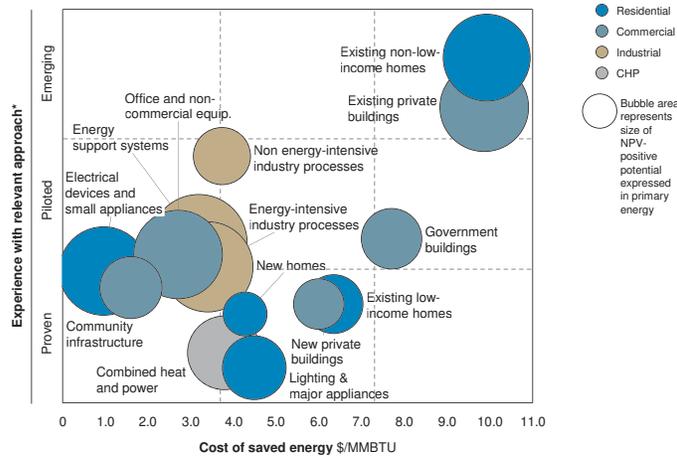
2. **Formulate and launch at both national and regional levels an integrated portfolio of proven, piloted, and emerging approaches to unlock the full potential of energy efficiency.** There are multiple combinations of approaches the nation could take to support the scaled-up capture of energy efficiency. In addition to seeking the impact of national efforts, this portfolio should effectively and fairly reflect regional differences in energy efficiency potential. Any approach would need to make the following three determinations:

- The extent to which government should mandate energy efficiency through the expansion and enforcement of codes and standards
- Beyond codes and standards, the extent to which government (or other publicly funded third parties) should directly deploy energy efficiency measures
- The best methods by which to further stimulate demand and enable capture of the remaining energy efficiency potential.

Exhibit H illustrates one example of a portfolio of solution strategies focusing on the most proven solution strategies deployed to date. Such a tool facilitates evaluation of a portfolio against the relevant parameters of cost, risk (i.e., experience), and return (i.e., size of potential).

3. **Identify methods to provide the significant upfront funding required by any plan to capture energy efficiency.** End-user funding for energy efficiency by consumers has proved difficult. Partial monetary incentives and supportive codes and standards increase direct funding by end-users: the former by reducing initial outlays and raising awareness, the latter by essentially requiring participation. Enhanced performance contracting or loan guarantees are relatively untested but could facilitate end-user funding. Alternatively, the entire national upfront investment of \$520 billion (not including program costs) could be recovered through a system-benefit charge on energy on the order of \$0.0059 cents per kWh of electricity and \$1.12 per MMBTU of other fuels over 10 years. This would represent an increase in average customer energy costs of 8 percent, which would be more than offset by the eventual average bill savings of 24 percent. Different solution strategies and policies would result in different administrative cost structures. For example, codes and standards have been shown to typically incur program costs below 10 percent, whereas low-income weatherization

Exhibit H: Portfolio representing cost, experience, and potential of clusters possible with specified solution strategies



* Drawing an analogy to our work with business transformation; piloted solutions represent those tried on the scale of a state or major city (i.e., over 1 million points of consumption), emerging are untested at that level, and proven have broad success at a national scale

Source: EIA AEO 2008, McKinsey analysis

The bubbles depict the NPV-positive efficiency potential in each cluster, measured in primary energy, with the area of the circle proportional to the potential. The position of the bubble's center on the horizontal axis indicates the cost of capturing this potential with the measures modeled in this report (excluding program costs) in dollars per million BTUs per year. The center's position on the vertical axis represents the weighted average of the national experience with the approaches outlined for the cluster.

programs have averaged between 20 and 30 percent.¹¹ Federal energy legislation under discussion at the time of this report will likely offer flexibility as to the level of energy efficiency each state and energy provider chooses to pursue. It will therefore be incumbent on states and local energy providers to undertake a rigorous analysis to assess the role of efficiency in the context of their overall regional energy strategy.

4. **Forge greater alignment across utilities, regulators, government agencies, manufacturers, and energy consumers.** Designing and executing a scaled-up national energy efficiency program will require collaboration among many stakeholders. Three tasks in particular will need to be addressed to achieve the necessary level of collaboration. First, aligning utility regulation with the goal of greater energy efficiency is a prerequisite for utilities to fully support the pursuit of efficiency opportunities while continuing to meet the demands of their public or private owners. Second, setting customer expectations that energy efficiency will reduce energy bills, but not necessarily rates, will be important to securing their support. Finally, measuring energy efficiency requires effective evaluation, measurement, and verification to provide assurance to stakeholders that programs and projects are achieving the savings claimed for them. Rather than attempting to provide “perfect” information, such programs can provide “sufficient” assurance by focusing on consistency, simplicity of design, and addressing both inputs and impact.
5. **Foster innovation in the development and deployment of next-generation energy efficiency technologies to ensure ongoing productivity gains.** Finally, having launched a significant national campaign to pursue energy efficiency, part of the national strategy must address sustaining the innovation required to ensure future productivity gains can be realized. By design, given the near-term focus of this report, technology development plays a minor role in the potential identified in this report. However, we expect that innovative and cost-effective energy-saving technology will continue to emerge. Ongoing funding and support of energy efficiency research and development can help keep the U.S. on a trajectory toward even greater productivity gains than those presented in this report.

11 Further discussion of program costs is included in Chapter 5 of the full report.



In the nation's pursuit of energy affordability, climate change mitigation, and energy security, energy efficiency stands out as perhaps the single most promising resource. In the course of this work, we have highlighted the significant barriers that exist and must be overcome, and we have provided evidence that none are insurmountable. We hope the information in this report further enriches the national debate and gives policymakers and business executives the added confidence and courage needed to take bold steps to formulate constructive ways to unlock the full potential of energy efficiency.

About this report

In 2007, during research on ways to abate greenhouse gas emissions in the United States,¹² we encountered the puzzle of energy efficiency: How is it that so many energy-saving opportunities worth more than \$130 billion annually to the U.S. economy can go unrealized, despite decades of public awareness campaigns, federal and state programs, and targeted action by individual companies, non-governmental organizations, and private individuals?

Greater energy efficiency will almost certainly be an important component in comprehensive national – and global – strategies for managing energy resources and climate change in the future. For this reason, we launched an effort in 2008 to investigate opportunities for greater efficiency in the stationary (non-transportation) uses of energy in the U.S. economy. This research confirms what many others have found – that the opportunity is significant. The focus of our effort however, has been to identify what has prevented attractive efficiency opportunities from being captured in the past and evaluate potential measures to overcome these barriers. Our goal is to identify ways to unlock the efficiency potential for more productive uses in the future. This report is the product of that work.

We hope this report will provide business leaders, policymakers, and other interested individuals a comprehensive fact base for the discussion to come on how to best pursue additional gains in energy efficiency within the U.S. economy.

Our research has been encouraged and challenged by contributions from many participants with many points of view and sometimes differing opinions. They have generously helped our team access data, test emerging findings and potential solutions, and prepare for the release of this report. We especially acknowledge our governmental, non-governmental, and corporate sponsors for sharing their expertise and co-sponsoring this report:

- Austin Energy
- Department of Energy
 - Office of Electricity Delivery and Energy Reliability
 - Office of Energy Efficiency and Renewable Energy
- DTE Energy
- Energy Foundation
- Environmental Protection Agency
- Exelon Corporation
- Natural Resources Defense Council
- PG&E Corporation
- Sempra Energy
- Sea Change Foundation

¹² *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?*, McKinsey & Company, 2007.

- Southern Company
- U.S. Green Building Council

As part of this work, the team conducted several hundred interviews with representatives of government agencies, public and private companies, academic institutions and research foundations, and a number of independent experts. Though too many to mention by name, these individuals deserve our sincerest thanks for having shared their time and expertise so willingly.

While the work presented in “Unlocking Energy Efficiency in the U.S. Economy” has benefited greatly from these diverse contributions, the views this report expresses are solely the responsibility of McKinsey & Company and do not necessarily reflect the views of our sponsors or any other contributors.