

The Energy-Efficiency Opportunity
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About the 'Breaking the Climate Deadlock' Initiative

'Breaking the Climate Deadlock' is an initiative of former UK Prime Minister Tony Blair and independent not-for-profit organisation, The Climate Group. Its objective is to build decisive political support for a post-2012 international climate change agreement in the lead up to the 2009 UN Climate Change Conference in Copenhagen. Its particular focus is on the political and business leaders from the world's largest economies, particularly the G8 and the major developing countries. The initiative builds on Mr Blair's international leadership and advocacy of climate change action while in office, and The Climate Group's expertise in building climate action programmes amongst business and political communities.

This briefing paper and its companions were commissioned by the Office of Tony Blair and The Climate Group to support the first Breaking the Climate Deadlock Report – 'A Global Deal for Our Low Carbon Future' – launched in Tokyo on June 27th 2008. Written by renowned international experts and widely reviewed, the papers' purpose is to inform the ongoing initiative itself and provide detailed but accessible overviews of the main issues and themes underpinning negotiations towards a comprehensive post-2012 international climate change agreement. They are an important and accessible resource for political and business leaders, climate change professionals, and anyone wanting to understand more fully, the key issues shaping the international climate change debate today.

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Executive Summary

- Without a change in energy policies and consumption behavior, global energy demand and energy-related carbon dioxide (CO₂) emissions will grow by 45 percent to 2020.
- There is potential to cut the projected energy demand growth by two thirds – from 2.2 percent to 0.7 percent per annum – by adopting energy-efficiency improvements that use existing technologies and generate an internal rate of return (IRR) of 10 percent or more.
- Boosting energy efficiency is the most economic way to reduce greenhouse gas (GHG) emissions, representing over two thirds of all available negative cost opportunities.
- Some \$170 billion annually could be invested productively in energy efficiency improvements to 2020, with an average return of 17 percent. This investment would generate energy savings ramping up to \$900 billion annually by 2020.
- Despite the attractive economics, a range of policy barriers, market inefficiencies and patterns of consumer behavior discourage investment in energy-efficient solutions. To overcome these barriers, governments need to create a policy environment that rewards energy-efficient choices and encourages innovation by consumers and businesses.

Recommendations

- Shift the focus of energy policy towards encouraging demand-side efficiency, through explicit overall energy efficiency targets or other mechanisms
- Reform utility-company incentives to reward energy efficiency rather than just volume supplied
- Set efficiency standards for selected appliances and equipment to increase production volumes and reduce costs for high-efficiency products
- Encourage innovative public-private partnerships to collaborate on achieving greater energy efficiency, provide the necessary financing, and share in the benefits

The Energy-Efficiency Opportunity

This paper explores the substantial opportunity that world leaders now have to reduce growth in energy demand – and thus in carbon dioxide (CO₂) emissions – while sustaining economic growth. It sets out:

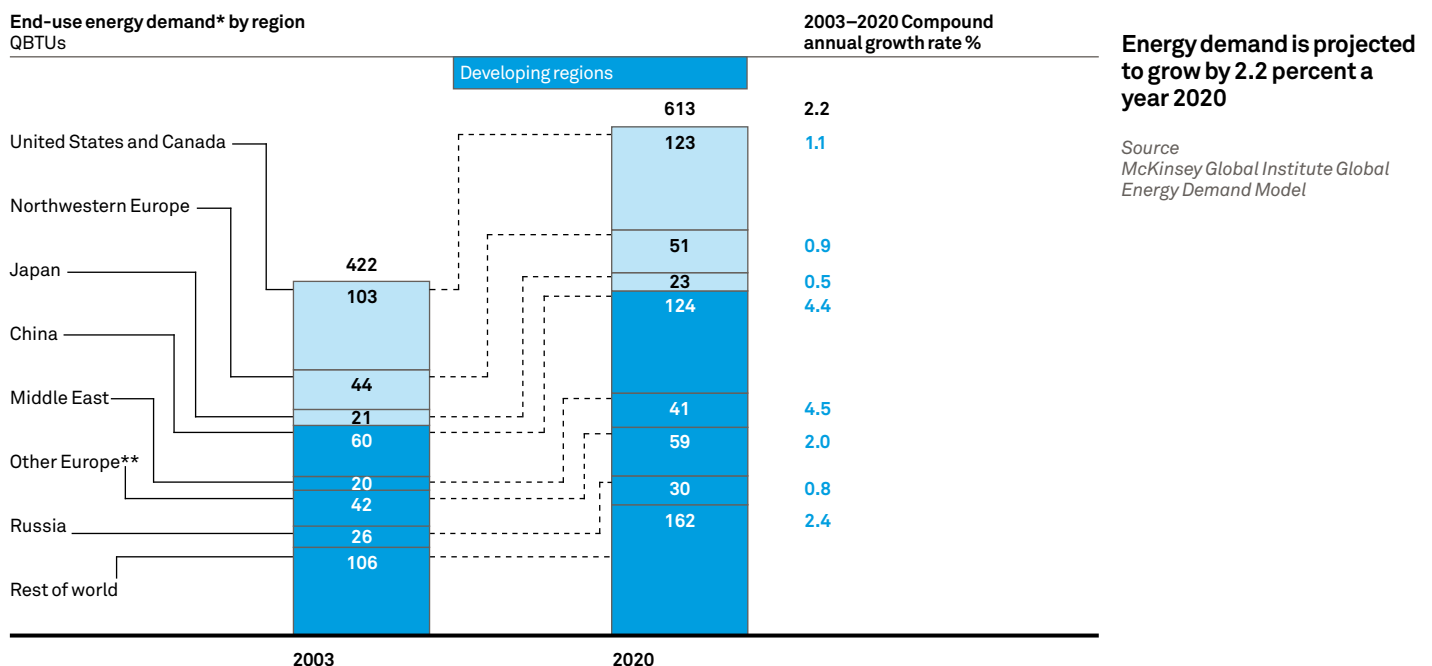
- Expected growth in energy demand and CO₂ emissions under current policies
- The opportunity to reduce this growth dramatically through higher energy productivity across all major sectors of the economy
- The economic case for investing in energy productivity – in both developed and developing countries
- Why market forces alone will not capture the full energy productivity opportunity
- How government policies can create incentives for improved energy productivity

Energy-demand growth and CO₂ emissions set to grow by 45 percent

Without a change in energy policies and consumption behavior, global energy demand is set to grow by 45 percent to 2020 – and energy-related CO₂ emissions will expand by a similar proportion.

Under current policies, energy demand will grow by 2.2 percent annually to 2020, above the 1.7 percent growth rate recorded since 1986 (Exhibit 1). More than 85 percent of this growth in energy demand is expected to come from developing regions, whose rapidly rising incomes will swell their capital stock – buildings, machinery, and equipment – and determine their energy demand for years, and even decades, to come.

Exhibit 1



* Transformation losses (power generation, refining) allocated to end-use segments.
 ** Includes Eastern Europe and the Baltics, and Mediterranean Europe and North Africa.

Higher energy productivity could cut 2020 energy demand growth and CO₂ emissions by two thirds

Organisations from the United Nations to the International Energy Agency (IEA) and the World Bank have argued strongly in favour of increasing energy efficiency as a route to carbon abatement¹. There is widespread agreement that any successful programme of action on climate change must support two objectives: stabilising atmospheric GHGs while maintaining economic growth. The key to meeting these twin goals is energy productivity – the level of benefits we achieve from the energy we consume (see “What is energy productivity?” at the end of this paper).

The McKinsey Global Institute (MGI) has identified an opportunity to boost global energy productivity by 135 quadrillion British thermal units (QBTUs) – 21 percent of projected energy demand in 2020 and the equivalent of almost 150 percent of total US energy consumption today (Exhibit 2). By capturing the potential that is available, the world could reduce global energy-demand growth from 2.2 percent annually to 0.7 percent a year, and simultaneously meet between 30 and 50 percent of today’s target for abating GHG emissions, representing over two thirds of all available negative cost opportunities (Exhibit 3)³.

Exhibit 2

Large opportunities for improving energy productivity are available across sectors

Source
McKinsey Global Institute analysis

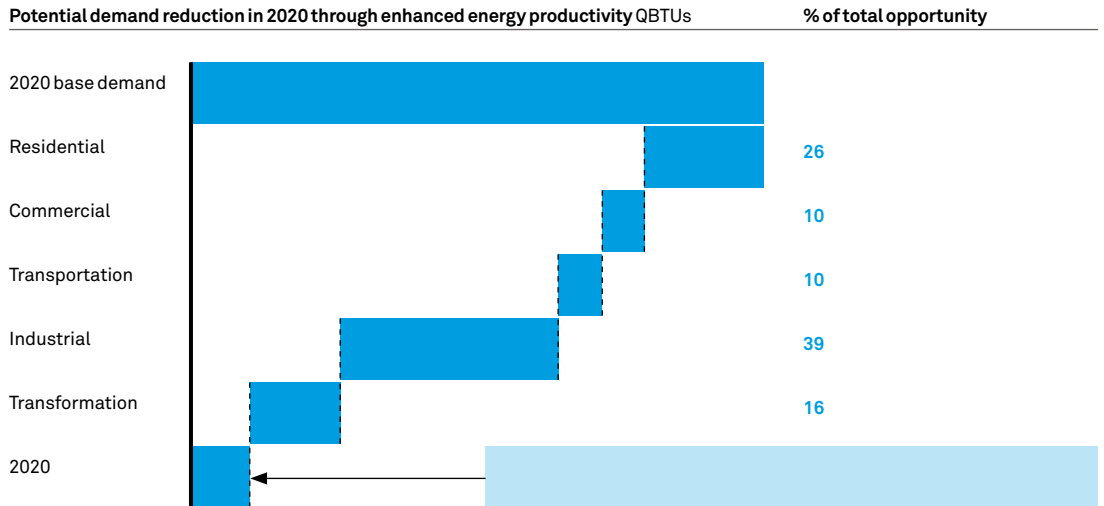
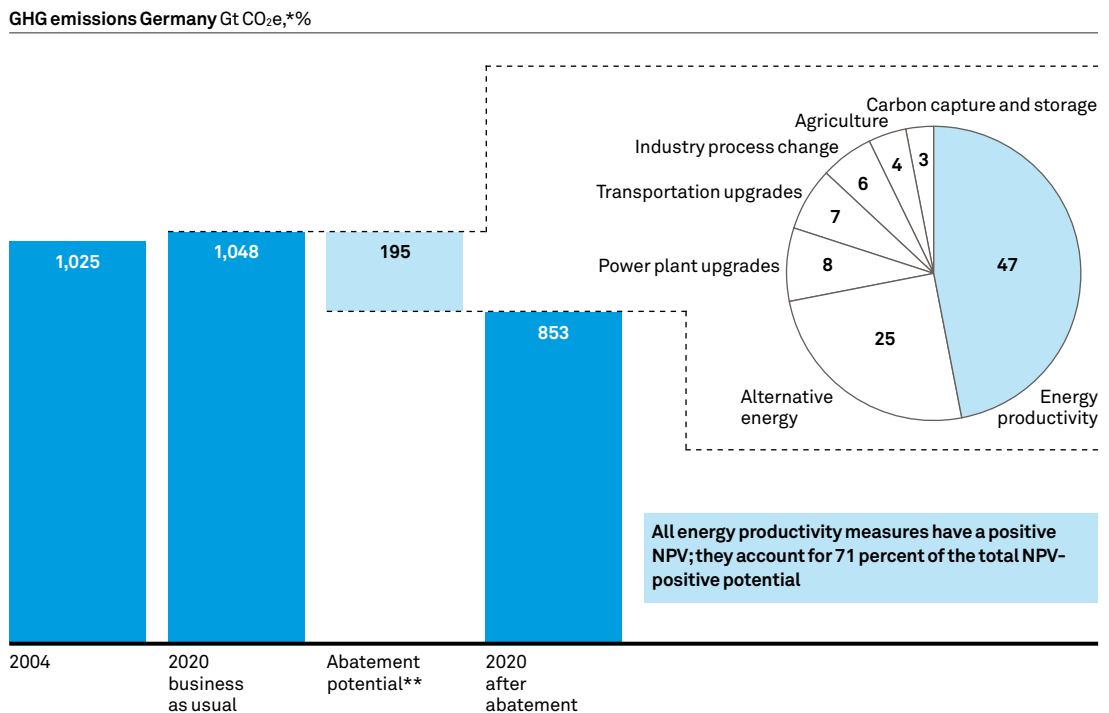


Exhibit 3

Energy productivity is the biggest and most cost-effective lever to attack GHG emissions

Source
“Costs and potentials of greenhouse gas abatement in Germany,” McKinsey & Company on behalf of “BDI Initiativ – Business for Climate”, September 2007



* Carbon dioxide equivalent.

** With abatement cost lower than €20/t CO₂ from a decision-maker perspective and change in energy mix.

There is significant potential to reduce energy demand through existing technologies that pay for themselves in future energy savings across all the major energy end-use sectors⁴. Globally, there is potential for productive investment in energy-efficiency improvements of \$170 billion annually to 2020. Such investment would generate energy savings ramping up to \$900 billion annually by 2020. For each end-use sector, the opportunity is as follows:

- **Residential** (26 percent of the opportunity).
Examples include very high-return opportunities in more efficient appliances and equipment, as well as in compact fluorescent (CFL) and light-emitting diode (LED) lighting; and large, but more capital-intensive, opportunities with longer payback periods in high-efficiency building shells. To capture these opportunities, this sector would need global incremental investment in the range of \$40 billion annually to 2020 – or a cumulative \$15 billion per QBTU abated in 2020.
- **Commercial** (10 percent).
There are significant opportunities in commercial buildings, largely in heating, cooling, and lighting. However, because of the higher initial efficiency level in this sector, the average incremental capital requirement to abate 1 QBTU of commercial-sector energy in 2020 is a cumulative \$21 billion in 2020.
- **Transport** (10 percent).
While automotive manufacturers are likely to adopt engine-related fuel-economy improvements when oil prices are at \$50 a barrel or above, some opportunities remain in reducing vehicle weight and size through material substitution and vehicle redesign. Given the high cost, relative to iron and steel, of lightweight materials such as aluminum and high-performance composites, the incremental capital requirements are larger than in the other sectors – cumulatively close to \$40 billion per QBTU of energy abated in 2020.
- **Industrial** (39 percent).
This is the largest area of potential, with a broad array of fragmented opportunities in steel, chemicals, aluminum, food processing, textiles, electronics, and many other industries. The global incremental investment required to capture this opportunity is \$83 billion per annum – or a cumulative \$20 billion per QBTU abated in 2020. However, this aggregate figure consists of hundreds of smaller opportunities. These include large cross-sector prospects such as combined heat and power (CHP) generation and the optimisation of motor-driven systems, as well as more sector-specific opportunities such as liquid membrane separation in chemicals or thin slab casting in the steel industry.
- **Transformation** (16 percent).
Energy is lost when the power generation and refining sectors transform energy from one form to another. The conversion efficiency of both new and old operations can be improved through investing in efficient technologies with a 10 percent IRR or better. The bulk of these opportunities are in power generation, where the technologies are available to increase the efficiency of new power plants by up to 5 percent. Retrofits of existing plants could also save energy by allowing these plants to operate at higher temperatures and pressures.

[The economic case for investing in energy productivity is strong in both developed and developing countries](#)

All of the opportunities included in MGI's analysis rely on existing technologies and generate an IRR of 10 percent or more. The \$170 billion that can be invested productively annually to 2020 on energy-efficiency improvements is equivalent to only 1.6 percent of global fixed capital investment, or 0.4 percent of global GDP today. It would deliver an average return of 17 percent. At the same time as generating very large annual energy savings, such outlays on energy efficiency would avoid investment in energy infrastructure that would otherwise be needed to keep pace with accelerating demand. The IEA estimates that, on average, an additional \$1 spent on more efficient electrical equipment, appliances and buildings avoids more than \$2 in investment in electricity supply – particularly valuable in economies where lack of capital is a constraint to growth⁵.

Three quarters of the potential increase in energy productivity come from developing regions (Exhibit 4). These countries tend to start from a lower efficiency level than in developed economies. Their faster growth also creates opportunities to adopt the latest energy-efficient technologies in a cost-effective way, “leapfrogging” to higher energy productivity. It is much more economic to incorporate higher energy-efficiency features when installing new capital than to retrofit at a later stage. For instance, the additional

cost of double, versus single, windows for a new building is much lower than replacing existing single windows with new double ones. Given the rapid rate of growth and capital outlays, the choices that developing countries make in the next decade or two will lock in a large part of the future trajectory of energy demand and GHG emissions⁶.

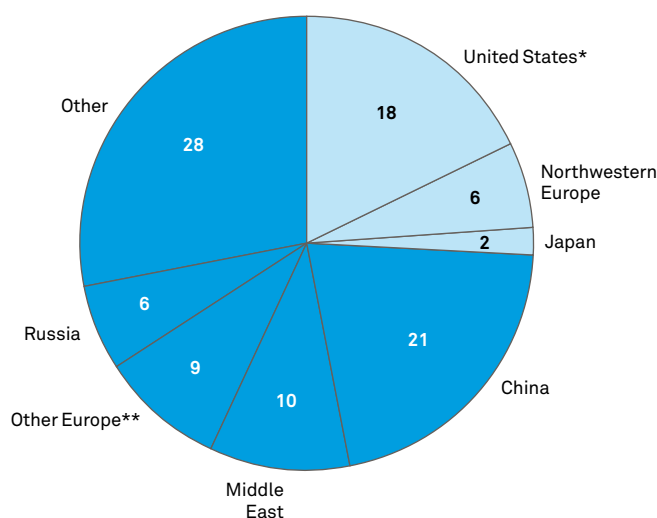
Exhibit 4

The vast majority of energy productivity opportunities are in the United States and developing countries

Source
McKinsey Global Institute analysis

Potential demand reduction in 2020 through enhanced energy productivity 100%=135 QBTU

Developing regions



* Includes Canada (2.4 QBTU opportunity).

** Includes Eastern Europe and the Baltics, and Mediterranean Europe and North Africa.

However, developed economies too have substantial potential to abate energy-demand growth and CO₂ emissions. The US has an opportunity to cap its energy-demand growth and GHG emissions at today's levels through higher energy productivity alone. And Europe could, by 2020, save the equivalent of double the final electricity consumption of all EU-25 countries in 2003 and simultaneously reduce its GHG emissions in 2020 by more than the combined 2003 CO₂ emissions of the United Kingdom and France⁷.

Market forces alone will not capture the full potential for improving energy productivity

A myriad of information barriers, market imperfections and policy distortions today stand in the way of consumers and businesses taking up economically attractive opportunities to invest in energy productivity (Exhibit 5). These hurdles vary in type and seriousness in different geographies. In many regions, energy subsidies directly discourage efficient energy use: fuel subsidies in Middle East, Venezuela and Mexico; residential gas or electricity subsidies in Russia, India and elsewhere; and a range of energy subsidies offered to state-owned enterprises.

Exhibit 5

Distorting policies and market imperfections today act as barriers to energy productivity

Source
McKinsey Global Institute analysis

	Examples
	Fuel subsidies for transportation (e.g., Middle East)
	Energy subsidies or nonmarginal pricing to households (e.g., Russian gas distribution)
	Lack of financial incentives for public industries (e.g., China steel)
	Households unaware of the cost of their energy choices—and often make choices based on nonfinancial factors
	Fragmented energy costs often go unnoticed by companies
	Appliance makers don't adopt efficient materials and technologies if consumers are unwilling to pay for them
	Landlords and tenants opting for lower energy productivity when benefits don't accrue to them
	High hurdle rates in many commercial and industrial companies
	Credit constraints for MUSH* and residential segments

Consumers often lack the information and capital they need to become more energy productive, and tend to make choices based on non-financial factors. Individuals who will not benefit from the energy savings frequently make investment decisions. For example, landlords are not inclined to make investments that benefit their tenants. Among businesses, the high turnover of commercial businesses reduces the required payback periods, and the small and fragmented nature of energy costs in most operations tends to deter businesses from capturing the full potential available⁸.

Higher oil prices alone will not remove many of the barriers to higher energy productivity. There are two reasons why changes in the global oil price do not typically translate into equally large swings in consumer prices. First, petroleum products account for only one-third of global energy consumption, and the prices of other sources of energy – for example, regulated electricity prices or coal – do not necessarily correlate with oil prices. Second, even in sectors that consume oil, a higher global oil price does not often translate into equally large changes in consumer prices. In some regions, fuel subsidies and regulated utility prices have kept petrol and electricity prices from rising, while the large share of distribution margins and taxes dampen residential price fluctuations in all regions.

[Government policies need to create incentives to improve energy productivity](#)

The full potential for abating both energy demand growth and GHG emissions through increasing energy productivity is achievable only through continuing innovation in both public policies and business models. The main challenge continues to be to find ways to overcome today's information and incentive barriers and market failures. While there is a great deal of innovation in progress, there is substantial potential for more, including:

- **Shifting the focus of energy policy toward encouraging demand-side efficiency** possibly through explicit overall energy-efficiency targets and timelines (such as the European Commission's target of cutting energy consumption in 2020 by 20 percent and China's target of reducing energy intensity by 20 percent by 2010). Among other available policy options is the implementation of white-certificate programmes that measure and reward progress toward energy-efficiency targets – these are already established in Italy, France, and the United Kingdom⁹.
- **Reforming utility-company incentives** to reward energy efficiency rather than solely volume supplied. Utilities' revenues are traditionally tied to the volume of electricity they deliver, encouraging growth in electricity consumption rather than energy efficiency. Instead, regulators can reward utilities for promoting energy efficiency and reducing energy consumption among their customers. For instance, the state of California has an incentive program that rewards and penalises the state's privately owned utilities by up to plus or minus \$450 million depending on their energy efficiency performance.
- **Setting efficiency standards** for selected appliances and equipment to increase production volumes and reduce costs for high-efficiency products. Government efficiency standards have been shown to be an effective, low-cost way to coordinate a transition to more efficient products – particularly in white goods and other appliances, and also in consumer electronics products, vehicles, and, arguably, lighting. With the implementation of such standards, economies of scale emerge so that prices for energy-efficient products typically decline to the level of the old, less efficient products. Rather than regulating the use of specific technologies, standards are more effective if they set targets for overall efficiency and leave room for company innovation in ways to meet the target.
- **Encouraging innovative public-private partnerships** that help overcome today's barriers to energy-efficiency investments. For example, improving building efficiency may require new forms of collaboration between energy-service companies (ESCOs) with technical energy-efficiency expertise; mortgage companies with the long-term financing needed for building-shell investments; and utilities with the capacity to tie housing energy efficiency to future energy-cost packages. Under the Clinton Climate Initiative in the US, the federal government has teamed up with partners in building-controls companies and financial institutions in a programme

to increase the energy efficiency of city buildings through retrofitting. A more subtle way to shift behaviour is for governments and companies to change the way they provide information about the choices that consumers and businesses. The options in this regard extend well beyond energy-efficiency labelling. For example, user-friendly smart metering and appliances could translate choices directly into monetary implications – and encourage energy end users to capture the savings available to them.

* * *

The case for prioritising higher energy productivity is stronger than ever, as peak energy prices increase the value of energy savings generated. Time is of the essence, given that every new building or industrial plant built without optimal energy efficiency is an opportunity lost to lock in lower energy consumption and carbon emissions for decades to come. There is every reason for policymakers to act promptly to put in place the incentives that will ensure that we tap into the most cost-effective way to cut CO₂ emissions.

Box 1



Glossary of Terms

CO₂:	Carbon dioxide
IRR:	Internal rate of return
GHG:	Greenhouse gas
IEA:	International Energy Agency
QBTUs:	Quadrillion British Thermal Units
CFL:	Compact fluorescent
LED:	Light-Emitting Diode
CHP:	Combined Heat Power
ESCOs:	Energy-Service Companies
MGI:	McKinsey Global Institute
GDP:	Gross Domestic Product

Endnotes

¹ The IEA argues that energy efficiency presents a unique opportunity to address three energy-related challenges in its member countries: energy security, climate change, and economic development. See *World Energy Outlook 2006*, IEA, 2006; *Mind the gap: Quantifying principal-agent problems in energy efficiency*, IEA, October 2007 (www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1954); and *The Experience of Energy Efficiency Policies and Programmes in IEA countries: Learning from the critics*, IEA, August 2005 (www.iea.org/textbase/papers/2005/efficiency_policies.pdf).

The United Nations Foundation argued recently that each of the G8 countries would reduce energy demand by 20 percent by 2030 by doubling current energy-efficiency improvements and that, if replicated to other major energy-using countries, this could contribute to holding CO₂ levels in the atmosphere to a manageable level for the rest of the century. See *Realizing the Full Potential of Energy Efficiency: Targets, Policies and Measures for G8 Countries*, United Nations Foundation, November 2007 (http://www.unfoundation.org/files/pdf/2007/RPEE_Exec_Sum.pdf).

The World Energy Council (WEC) assesses energy efficiency policies globally and concludes that the introduction and strengthening of energy efficiency policies should be a global priority. See *Energy Efficiency Policies around the World: Review and Evaluation*, WEC, 2008 (http://www.worldenergy.org/publications/energy_efficiency_policies_around_the_world_review_and_evaluation/default.asp).

The Stern Review Final Report highlights higher energy efficiency as a key part of an effort to abate carbon emissions; see *Beyond carbon markets and technology*, Stern Review Final Report, Part IV, chapter 17, May 2008 (www.hm-treasury.gov.uk/independent_reviews/).

³ For MGI's full projections of energy-demand growth and the energy productivity opportunity, see *Curbing global energy demand: The energy productivity opportunity*, McKinsey Global Institute, May 2007. Also see *The carbon productivity challenge: Curbing climate change and sustaining economic growth*, McKinsey Global Institute, June 2008 (all MGI reports are available at www.mckinsey.com/mgi).

⁴ For a full analysis of the energy productivity investment opportunities, see *The case for investing in energy productivity*, McKinsey Global Institute, February 2008.

⁵ *World Energy Outlook 2006*, IEA, 2006.

⁶ China, for example, could slow the pace of its energy-demand growth from 4.4 percent to 2.8 percent per year through 2020, leaving energy demand as much as 20 percent below the level expected under current policies and cutting its CO₂ emissions by at least 19 percent. See *Leapfrogging to higher energy productivity in China*, McKinsey Global Institute, July 2007.

⁷ See *United States: Wasted energy: How the US can reach its energy productivity potential*, McKinsey Global Institute, June 2007; *Capturing the European energy productivity opportunity*, McKinsey Global Institute, June 2008.

⁸ For a synthesis of the research on the barriers to energy efficiency, see *The Experience of Energy Efficiency Policies and Programmes in IEA countries: Learning from the critics*, IEA, August 2005.

⁹ White certificates indicate energy saved as of result of higher efficiency. They can be used to meet regulated efficiency targets and may be traded for financial reward.

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