McKinsey Global Institute

Setting priorities for resource productivity

Fraser Thompson

Explore the resource productivity cost curve with commentary on 5 of the 15 areas that comprise most of the potential benefits.

Meeting the world's growing demand for natural resources in the next 20 years is likely to be a great challenge. Up to three billion new middle class consumers will need energy, water, land and materials such as steel, putting additional strain on these resources.

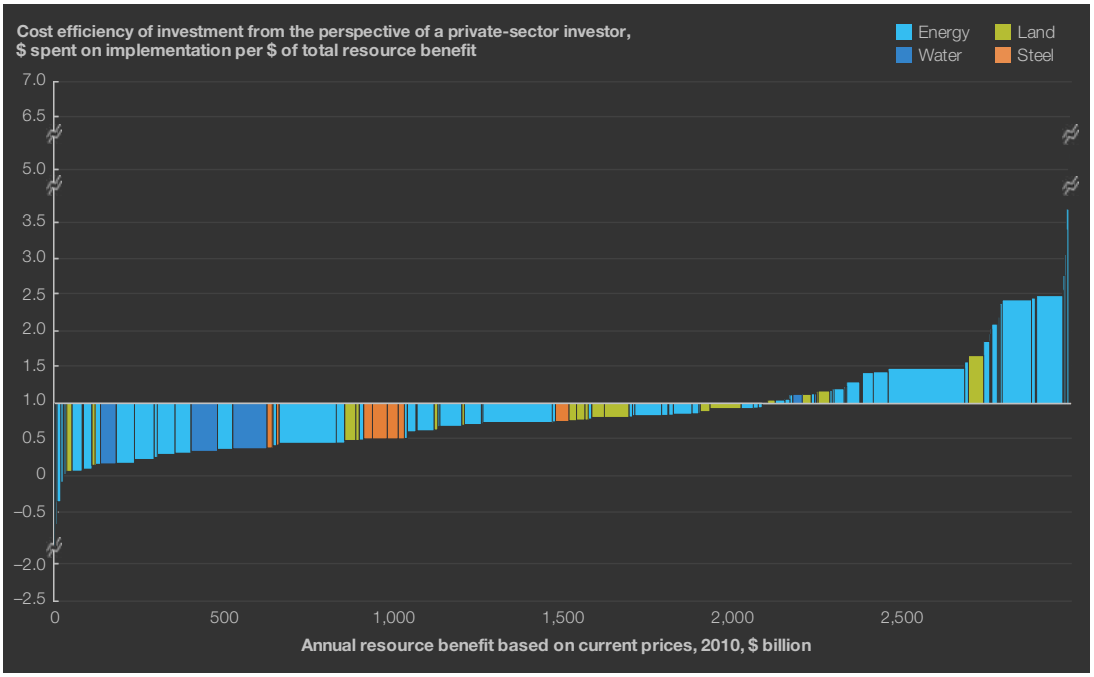
Our new research shows the world's needs can potentially be met by increasing supply and boosting productivity. This interactive looks at both the productivity challenge and the productivity opportunity. We believe that going after the productivity opportunity ahead of us could help meet up to 30 percent of resource demand in 2030.

Over the last few years, McKinsey has analyzed in great detail opportunities for increasing productivity in specific resources, including carbon and water. Our latest work goes a step further by developing an integrated perspective. This is important because of the increasingly strong interplay between different resources.

The data presented here comes as 130 specific opportunities to boost resource productivity across four resources, increasing the amount we produce for every unit of energy, water, land and materials we use (Exhibit 1). Here's how to read the chart. For each opportunity, our estimate of the potential annual benefit is measured along the horizontal axis in billions of US dollars. The vertical axis shows the potential return on investment from each opportunity.

Exhibit 1

The resource productivity cost curve

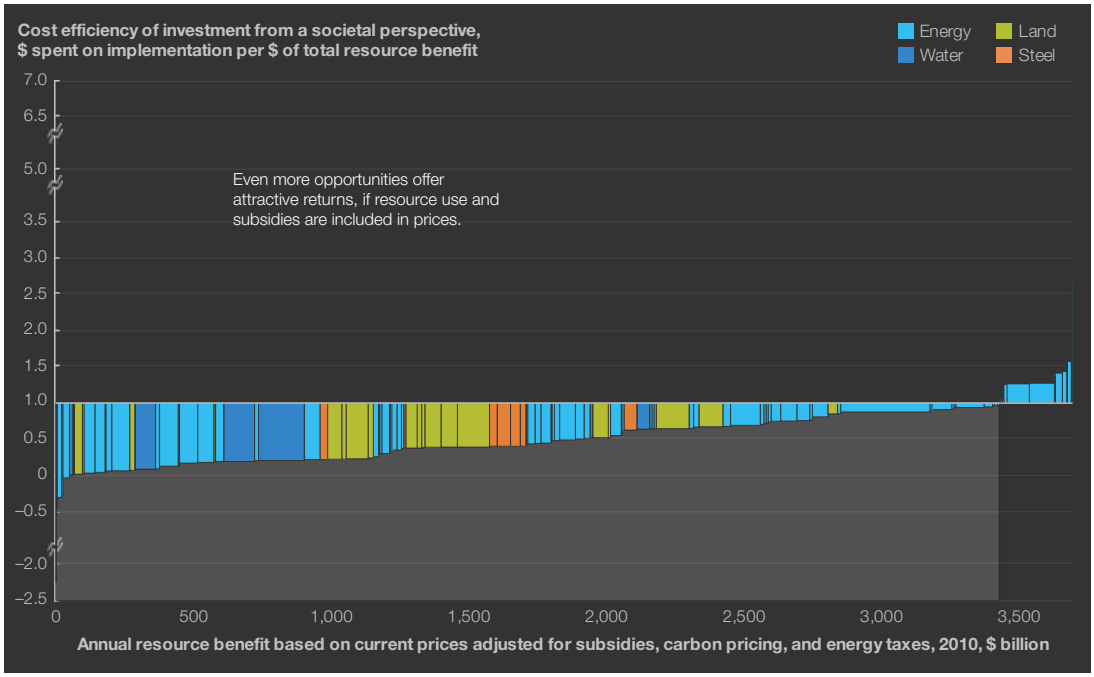


Where a bar falls below the horizontal access, resource productivity could be improved at returns which are likely to exceed the relevant investment hurdle rate. Where the bar rises above the horizontal axis, the productivity opportunities are unlikely to meet the required investment hurdle rate.

Overall we see a global opportunity to create $2.9 trillion of resource-related benefits in 2030 based on current market prices. Under these circumstances, roughly 70 percent of the opportunities we analyze could deliver returns on investment of more than 10 percent. Moreover, this total could be higher, perhaps $3.7 trillion, if subsidies and taxes on energy, water, and agriculture were removed and carbon emissions were priced at $30 per ton (Exhibit 2). To help prioritize, we gathered opportunities into 15 groups. Five of the key areas are explored here.

Exhibit 2

Including resource use and subsidies in prices

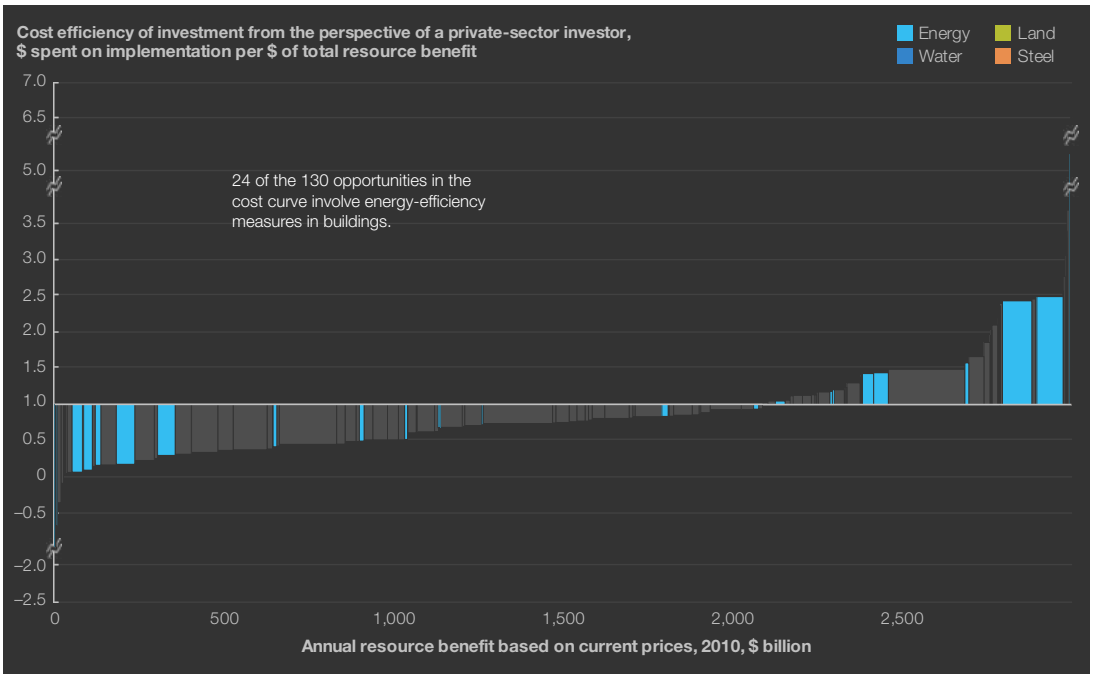


Buildings

Improving the energy efficiency of buildings presents a tremendous opportunity to improve resource productivity. Of the total $3.7 trillion of potential benefits we identified globally, nearly 20 percent arises from better insulation, lighting, and similar energy efficiency measures in our homes, offices, factories, and other commercial buildings (Exhibit 3).

Exhibit 3

Buildings: A range of opportunities

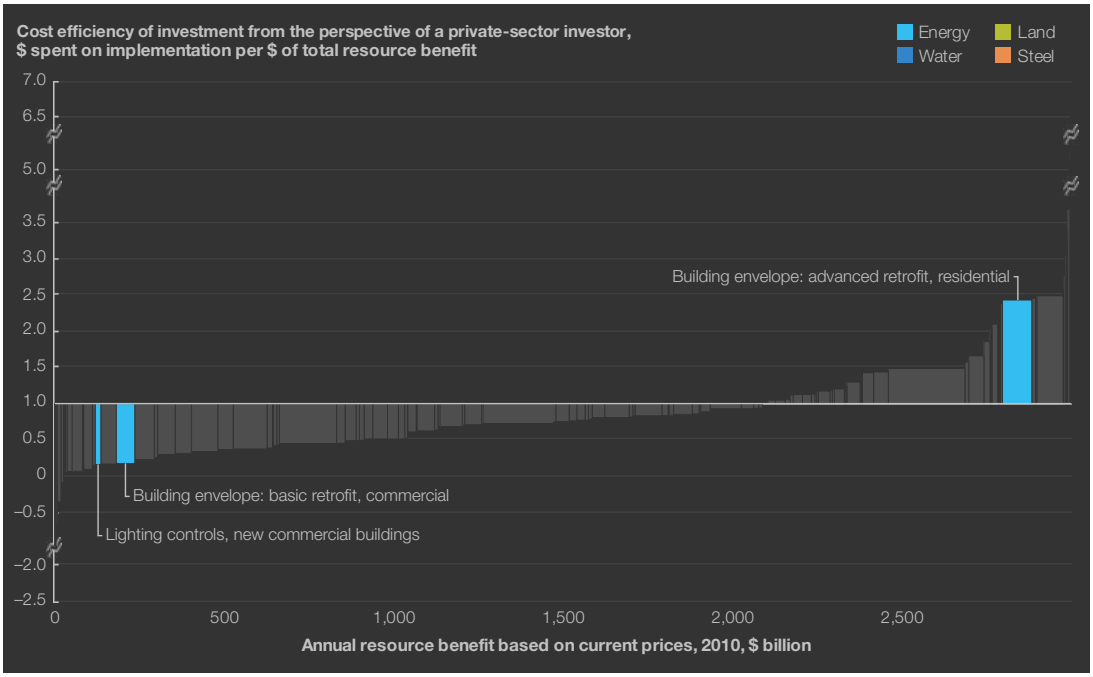


If captured in full, world energy demand could be reduced by 31 QBTUs in 2030. This is more than the combined energy consumption of the world's shipping and air transport industries. Moreover, about one-third of the potential gains in this group are readily achievable. In other words, there are no significant barriers in terms of financing, principal–agent issues or other obstacles.

In the developed world with its aging infrastructure, the biggest opportunity lies in retrofitting existing buildings, especially with better insulation. In developing economies, improving the energy efficiency of new buildings represents a bigger opportunity (Exhibit 4). Every year, China is adding floor space equivalent to two-and-a-half times the size of Chicago to accommodate its new urban citizens. Energy-efficient new buildings could require only 20 to 30 percent of the average consumption of energy of existing buildings in developed countries today.

Exhibit 4

Buildings: Selected opportunities



But while basic retrofits often have rates of return on investment of more than 10 percent, advance retrofits and some new building efficiency measures are often less attractive financially. The large quantities of up-front capital required, as well as agency issues where, for instance, the landlord bears the cost of investing in energy efficient insulation, but it is the tenant who receives the benefit through lower energy bills, are additional barriers to implementation.

Lighting accounts for 19 percent of the world's electricity consumption. In the commercial sector, lighting accounts for more than a third of a building's electricity use. Opportunities include upgrading lighting to light-emitting diodes (LEDs) and retrofitting commercial lighting controls. They all have positive returns on investment.

Food waste

Of the total resource productivity benefit we identified, reducing food waste could contribute about 7 percent. However, there are significant barriers to achieving this. Between 20 and 30 percent of the world's food is wasted somewhere along the value chain, even before allowing for food wastage at the point of consumption.

In developed countries, most waste occurs in processing, packaging, and distribution. In developing countries, a significant share of food goes to waste after harvest due to poor

storage facilities and lack of infrastructure. Because of the energy consumed throughout the length of the supply chain, reducing food waste at the later stages of the supply chain can save three times the energy of cutting waste post-harvest stage (Exhibit 5).

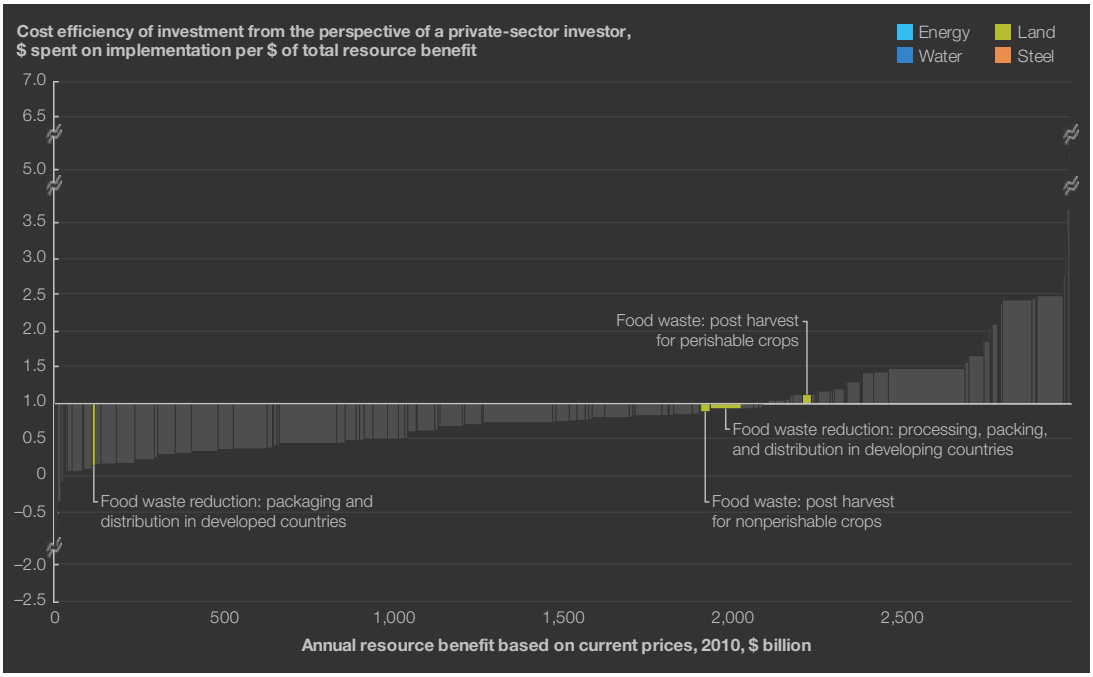
On the other hand, reducing waste post harvest has greater benefits in terms of food security. Reducing food waste would also have significant resource productivity benefits by cutting the amount of water and energy used in agriculture. While many of the opportunities yield potentially attractive returns on investment, there are some significant barriers to implementation.

More than half of the total opportunity in this group comes from reduction of perishable waste throughout the supply chain. But achieving this would require the development of modern cold-storage systems, a significant investment. For example, a cold system in China with a capacity of 30,000 metric tons would cost nearly $100 million annually.

Another barrier to implementation is lack of data, which makes it hard to monitor the amount of food wasted in each value chain. The appropriate metric will differ by food type, the economic development of a country, and even by each part of the food supply chain. However, gathering comparable data within and across countries will be crucial to support concerted efforts to reduce food waste.

Exhibit 5

Opportunities in reducing food waste



Leakage

In many countries, there is enormous potential to reduce the amount of water leaking from old and corroded pipes (Exhibit 6). The rate of leakage varies widely, even among developed economies. While Germany has a leakage rate of just 5 percent, the United Kingdom's rate is 25 percent.

The opportunity to plug leaks is particularly large in developing countries. In India, we estimate that reducing leaks could reduce municipal water demand by 26 percent. Overall, we estimate that the world could save 100 to 120 billion cubic meters of water in 2030 by reducing leaks in the bulk water supply in commercial, residential, and public premises.

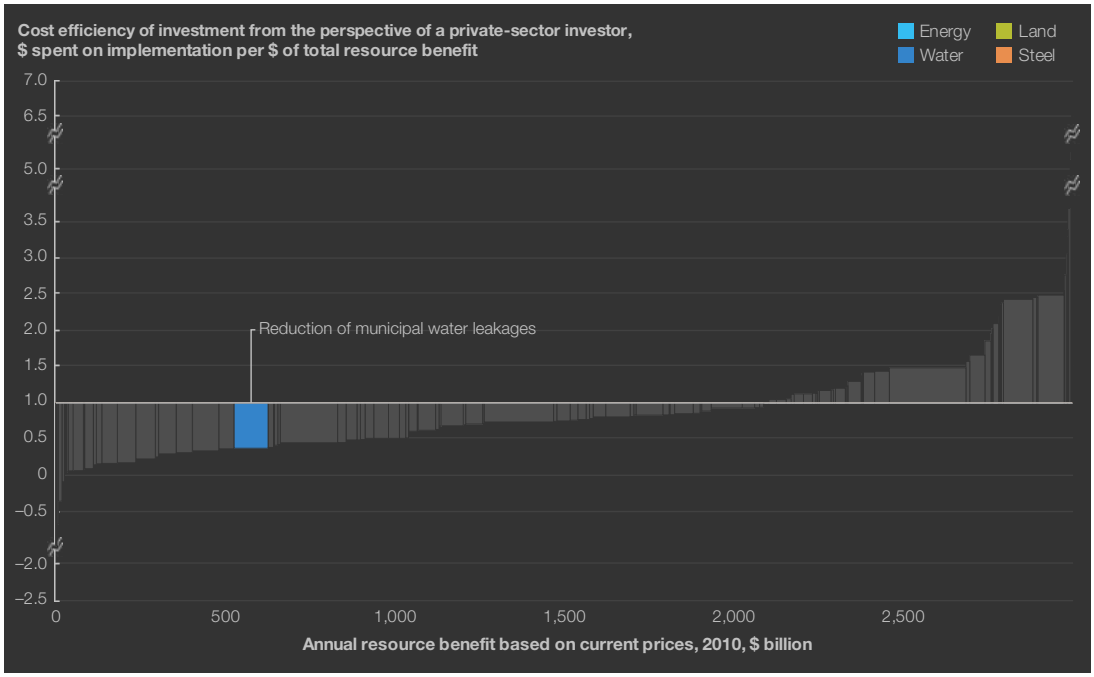
The main causes of leakage are old and corroded pipes and fittings. In addition, unconditional financial support from governments or subsidies within municipal accounts provides a lack of incentives for service providers to improve metering, billing, and collection practices.

Reducing water leakage is capital intensive, but the economics are favorable. We estimate that investment to reduce leakage in China could deliver a 22 percent rate of return, based on the subsidized price of municipal water of 50 cents per cubic meter.

As with food waste, an additional hurdle is that data on water leakage is not easily available, especially in developing countries.

Exhibit 6

Reducing municipal leakages



Electric vehicles

Of the total global opportunity to increase resource productivity, increased penetration of pure electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) accounts for about 4 percent. In our view, however, there are significant barriers to achieving this.

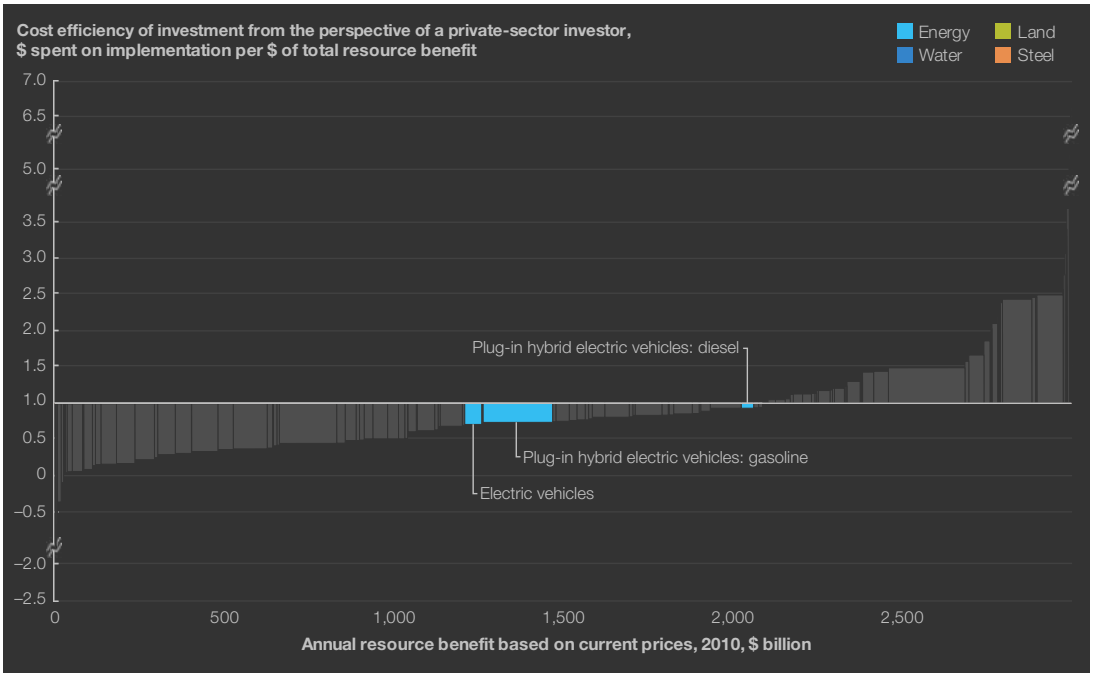
With the right government support, we estimate that electric and hybrid vehicles could account for 62 percent of new light-duty vehicle sales in 2030. A shift on this scale would cut global oil demand by 6.7 million barrels a day, equal to about 8 percent of current demand. Overall energy consumption would fall by slightly less, because demand would shift from oil to the electrical grid.

Yet the widespread adoption of electric and hybrid vehicles (Exhibit 7) faces some serious challenges. Government subsidies are required to make electric and hybrid vehicles financially attractive to consumers today, a difficult prospect at a time when many developed countries are stressed financially.

Other challenges that need to be overcome include restrictive battery range and a lack of recharging infrastructure. However, technological improvements in battery costs could see electric vehicles rapidly become more cost-competitive with internal-combustion engines.

Exhibit 7

Electric and hybrid vehicles: Selected opportunities



Steel

Another 4 percent of the potential resource benefits we identify come from increased efficiency among the main end-users of steel: the construction, machinery, and automotive sectors, which today account for 80 percent of global demand.

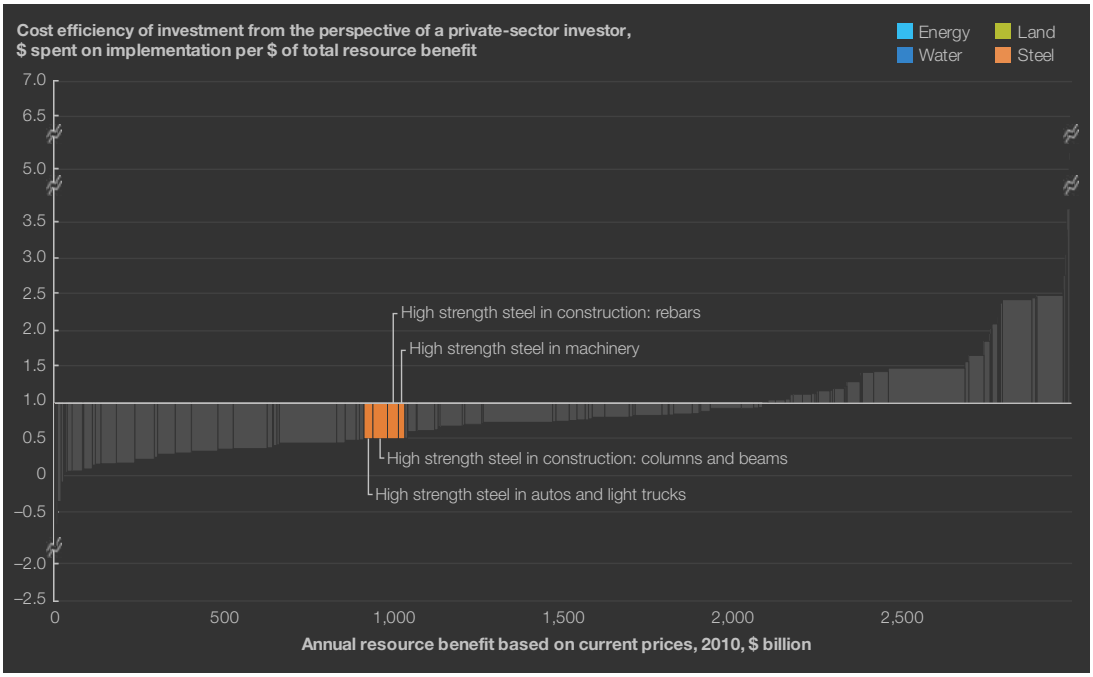
Our research suggests that there's an opportunity to reduce annual steel demand by 165 million metric tons in these sectors by 2030 by optimizing designs and increasing use of high-strength steel. Out of this total, we estimate that about 21 percent is readily achievable.

The construction sector currently accounts for nearly half of global steel consumption. Buildings such as the Shanghai World Financial Center and Emirates Tower in Dubai have already adopted high strength steel. Apart from saving on steel, using this technology reduces the CO_2 emissions during construction by an estimated 30 percent.

In the automotive sector, substantial research has demonstrated a potential to reduce the weight of vehicles by a further 20 to 25 percent through a combination of design optimization and using high-strength steel (Exhibit 8). Even with currently proven technology, realizing the potential weight savings could save 35 million metric tons of regular steel by 2030.

Exhibit 8

Opportunities in end-use efficiency of steel



If we draw on historical trends in weight reduction in the automotive sector, we estimate that the machinery sector could save 25 million metric tons of steel by 2030 by increasing the use of high-strength steel.

Machinery, theoretically, has a similar potential to reduce weight, but thus far lags behind the auto industry because fuel efficiency concerns are relevant for only a few types of mobile machines, such as cranes. Although the economics of adopting high-strength steel are favorable, there is some doubt about whether materials such as manganese will be available in sufficient quantities to use them in alloys.

What's more, there's a lack of awareness about the usefulness of this product among the many fragmented buyers of construction steel in emerging markets. Government standards can play an important role in mandating this use of high-strength steel in different applications to ensure that this profitable opportunity is captured.

Fraser Thompson is a senior fellow of the McKinsey Global Institute and is based in McKinsey's London office.