



Efficiency at the heart of the solution to the Energy ‘Trilemma’

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The triad of energy security, sustainability, and economic development is a familiar one in energy policy circles. Achieving secure and affordable energy supplies across the economy in support of human welfare and economic activity can present the appearance of a false trade-off with environmental sustainability and the achievement of climate change goals. The reality is that those challenges can be met simultaneously with policy, technology, and industry practices working together. Responsible unconventional gas extraction has substantially cut North American carbon emissions while delivering affordable energy to the market, and renewable energy technologies are increasingly competitive in specific applications, such as bringing clean energy access to remote areas. Yet IEA analysis consistently identifies one policy area that stands to contribute the lion's share of cuts to carbon emissions, reductions in local pollution, and cost-effective energy security – energy efficiency. Simply put, the cleanest megawatt will be the one we never need, and the most secure barrel of oil the one we never burn.

Yet the *World Energy Outlook 2012* demonstrates that not enough is being done to improve energy efficiency. Improvements at the global level are difficult to measure, but if we take global energy intensity (a measure of the amount of energy required to produce a unit of GDP), then we see that it actually deteriorated in the two years that followed

the 2008 economic crisis, reversing a historical trend of improvement. Fortunately, some major energy-consuming countries have recently announced new measures to boost energy efficiency. China is targeting a 16 per cent reduction in energy intensity by 2015; the United States has adopted new fuel-economy standards; the European Union has committed to a cut of 20 per cent in its 2020 energy demand; and Japan aims to cut 10 per cent from electricity consumption by 2030.

In June, the IEA released a *World Energy Outlook Special Report, Redrawing the Energy-Climate Map*. The report examined four critical steps that can be taken before 2020, in the absence of implementation of a multilateral agreement on climate change, to keep the world on track to limiting long-term global temperature rises to 2 degrees Celsius. They cannot get us there on their own. Rather, these time-critical measures, which incur zero net economic cost and use proven technologies, can help keep the fast-closing door open to that important international goal. Of the four (which also include limiting the construction of least-efficient coal power plants, minimising methane emissions from upstream oil and gas production, and accelerating the phase-out of fossil fuel subsidies), energy efficiency measures accounted for nearly half of all carbon savings over the outlook period.

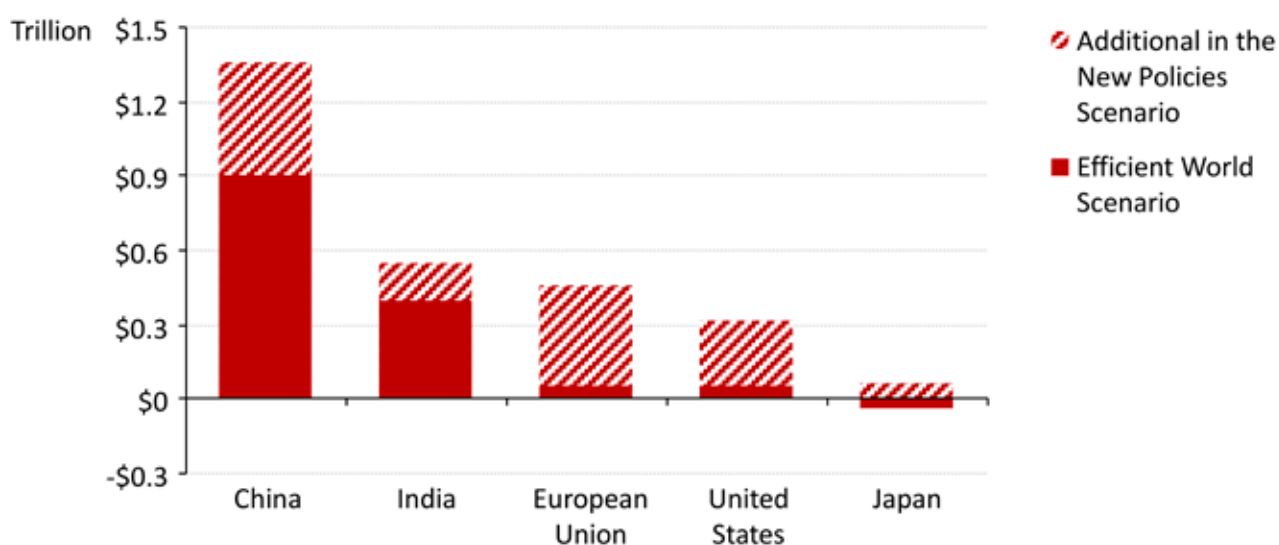
On a longer horizon to 2035, the *World Energy Outlook 2012* showed that energy efficiency accounted for 42 per cent of carbon savings between the greener “450” scenario (consistent with a 2 degree Celsius trajectory) and the baseline “New Policies” scenario. A special “Efficient World” scenario shows what can be achieved to 2035 simply by adopting known best technologies. Global energy demand is cut by half compared to the baseline scenario; oil demand peaks by 2020; savings in natural gas are equivalent to US production in 2010; fuel bills are cut by 20 per

Modern ‘ultra supercritical’ technology raises efficiency in coal-fired power plants



Photo: Siemens

Energy expenditure in 2035 compared with 2010



In addition to cutting energy expenditures by an average of 20 per cent, improved efficiency brings wider economic gains, particularly for India, China, the United States and Europe

cent on average; and the global economy is boosted by a cumulative US\$18 trillion to 2035.

Still, energy efficiency as such covers a wide range of topics and sectors – from transport to industry to buildings. With urbanisation on the rise, particularly in the developing world, urban energy policy design including smart transport and efficient buildings will be particularly key elements. Currently, over 70 per cent of global energy demand is consumed in cities, where roughly half the world's population lives – and that number is set to grow substantially to 2050, when 70 per cent of the population will be urban. Urban energy efficiency policies should strive to create an effective link between national, regional, and local needs. Several of the most important areas to address include city planning, building energy efficiency, transportation, and energy generation, distribution and delivery. Analysing the impact of such policy areas should employ a cross-sectoral approach, since efficiencies typically show up across the system. The link between energy and transport for example is apparent, but less obvious interdependencies can also be important, such as the interplay of energy policies with waste and water management.

Yet sometimes the obvious linkages are indeed the most significant. For example, with such rapid urbanisation comes increasing demand for energy and mobility. Urban travel increased more than 15 per cent between 2000 and 2010, to roughly 13 trillion passenger kilometres. In other words, for every urban inhabitant added to cities between 2000 and 2010, overall urban travel increased by nearly 5,000 passenger kilometres each year. Given that 6.3 billion people are expected to live in cities by 2050, it is likely that urban passenger travel will more than double in coming decades. In some regions, it could increase as much as 10 fold. These issues require immediate action. Already in many cities, especially in developing countries, there is a critical need for efficient, safe and high-capacity transport solutions.

In effect, the world has reached a turning point. The 20th century changed how we move with rapid transit and motorised transport. The 21st century must now address how to move people and goods throughout cities most efficiently. In July the IEA released a Policy Pathway entitled *A Tale of Renewed Cities*, which looks at public transport and demand management solutions around the world

as potential models. Given the importance of transport to tackling the energy policy triad, this pathway provides precisely the kind of best-practice exchange that the IEA promotes.

Certain sectors therefore deserve focus, within an interlinked constellation of energy efficiency opportunities. Understanding that constellation as a market, however, is a relatively new undertaking. At this year's World Energy Congress, the IEA will be launching its first *Energy Efficiency Market Report*. This report joins our series of market reports on coal, oil, gas, and renewable energy – highlighting the importance we place on efficiency as a “hidden fuel”. That is because, in general, energy efficiency represents an important potential alternative to investing in traditional supply-side fuels, and provides important benefits to countries looking to balance energy supply with a demand profile that supports sustainable economic growth. In addition to avoiding the need for new energy supply infrastructure, country case studies featured in this report show that energy efficiency also delivers improved service, economic productivity and consumer benefits, and reduced energy demand growth.

According to IEA estimates, the savings from energy efficiency investments have exceeded the output from any other fuel source in many IEA countries. This reflects an increase in investments in energy efficiency over the last several decades, as well as the “locking-in” of some savings from those investments. At the same time, a variety of factors will affect both the magnitude and sustainability of any savings (of the avoided demand), including increased expenditures on energy supply generated from increased disposable income that result from the savings (a “rebound” effect). Consequently, there remains an important need for better measurement of energy efficiency outputs relative to other traditional fuels to better assess its impact over time. This is particularly true with respect to energy efficiency investments that are far off.

The energy efficiency market is at a

crossroads, and the way forward will vary across countries. Indeed, energy efficiency markets have weathered the financial crisis rather well - stimulus spending has injected US\$56 billion into energy efficiency markets and the leveraging of private investment. However, the winding down of stimulus programmes, combined with continued slow growth, has created a shift in energy efficiency market drivers. The result is that significant cost-effective energy efficiency opportunities are not being exploited. While the energy efficiency market is large and growing (based on recent policies and targets), countries can do much more to analyse the role that energy efficiency can play, and the level of investment needed, to meet economic, security, and environmental goals. Opportunities are different across countries, regions and economic sectors, depending on economic structures, resource endowments, and development levels. However, the potential gains from efficiency are enormous. While the issue may not be so politically exciting as new plants and cutting edge technologies, energy efficiency really is at the heart of any solution to the energy ‘trilemma’.



Global levels of investment and subsidies in selected areas of the energy system

