



American Physical Society Report on Energy Efficiency

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The American Physical Society has just released a report on improving energy efficiency in the transportation and buildings sector:

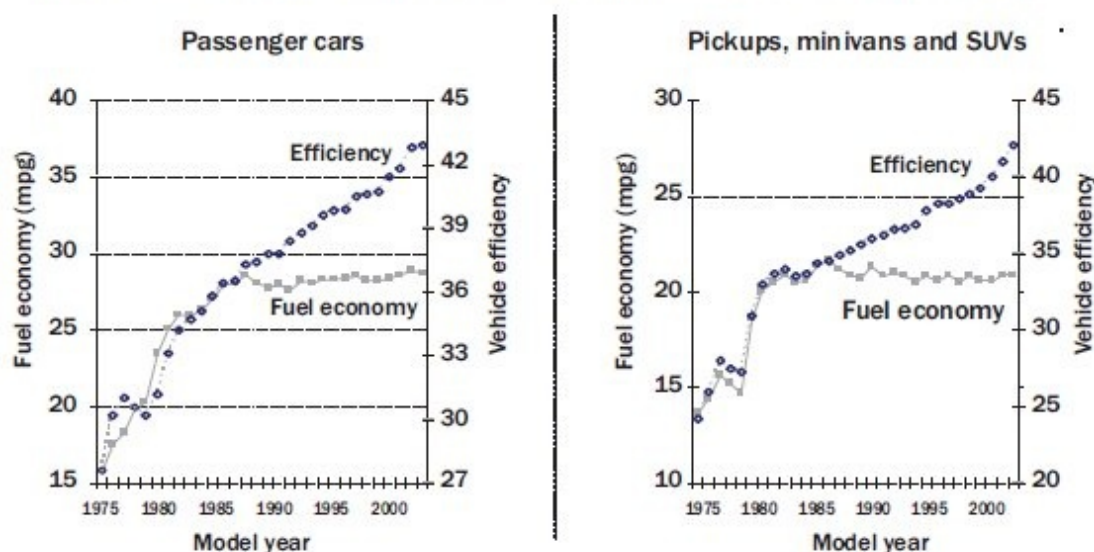
[Energy = Future Think Efficiency](#)

There are links from the above to an Executive Summary and the full report (100 page PDF). This is not just a "change your light bulbs" document, but rather a comprehensive, information-filled challenge to the status quo with regards to government inaction with regards to energy conservation. It is also not a document on energy production and future difficulties in being able to do enough of this to keep the lights on -- even with better efficiency. But it is well worth a read, with lots of data on energy use and great graphics.

Figure 6

U.S. fuel economy vs. fuel efficiency

Fuel economy and fuel efficiency for cars and light trucks in the United States for the period 1975 to 2004. (The unit of efficiency in this figure only is ton-miles per gallon. This is the fuel efficiency mentioned in the text multiplied by the weight of the vehicle.)



This is a political document as well, with salvos aimed at both the Department of Energy and the outgoing administration.

To DOE:

To meet the out-year technology goals this report sets for energy efficiency, DOE must take steps to fold long-term applied research into its scientific programming in a more serious way than it currently does.

On the "Hydrogen Economy":

Hydrogen fuel cell vehicles (FCVs) are not a short-term solution to our oil needs, but rather a long-term option requiring fundamental science and engineering breakthroughs in several areas. Without such breakthroughs, FCVs are unlikely to be more than a niche product. The main challenges are durability and costs of fuel cells, including their catalysts, cost-effective onboard storage of hydrogen, hydrogen production and deployment of a hydrogen-refueling infrastructure.

To Dick Cheney:

As this report shows, we are not remotely near any physical limitations on efficiency improvement. What we need are the innovations, policies and will to achieve the goal.

For Free Market advocates:

Transportation and buildings, which account for two thirds of American energy usage, consume far more than they need to, but even though there are many affordable energy efficient technologies that can save consumers money, market imperfections inhibit their adoption. To overcome the barriers, the federal government must adopt policies that will transform the investments into economic and societal benefit. And the federal government must invest in research and development programs that target energy efficiency. Energy efficiency is one of America's great hidden energy reserves. We should begin tapping it now.

On complacency:

Yet only in times of extreme turbulence — the OPEC (the Organization of Petroleum Exporting Countries) oil embargo in 1973, the overthrow of the Shah of Iran in 1979 and the Persian Gulf War in 1991 — when public frustration became politically intolerable did American officials devote serious attention to energy policy. Although some of the policy initiatives yielded significant benefits, others were left on the drafting board as the nation reverted to a business-as-usual energy routine once the turbulence passed and public dissatisfaction dissipated.

On US energy security:

In contrast to previous market instabilities, however, this one may be more enduring. Thirty-five years ago, when OPEC imposed its oil embargo, the United States was importing 6.3 million barrels a day; today it imports 13.5 million barrels a day, two-thirds of the nation's consumption. Thirty-five years ago, the world's two most populous countries, China and India, were poor agrarian societies that had minimal need for oil; today they are rapidly developing industrial economies with a greatly increasing demand for energy. Thirty-five years ago, unfriendly nation states posed the greatest risk to oil security; today terrorist groups have added substantially to potential interruptions of global supplies.

Here is their full list of recommendations:

Summary of Recommendations

1. The federal government should establish policies to ensure that new light-duty vehicles average 50 miles per gallon or more by 2030.
2. The federal government's current transportation R&D program should have a broader focus. A more balanced portfolio is needed across the full range of potential medium- and long-range advances in automotive technologies. Increased research is needed in batteries for conventional hybrids, plug-in hybrids and battery electric vehicles, and in various types of fuel cells. This more balanced portfolio is likely to bring significant benefits sooner than the current program through the development of a more diverse range of efficient modes of transportation, and will aid federal agencies in setting successive standards for reduced emissions per mile for vehicles.
3. "Time of use" electric-power metering is needed to make nighttime charging of electric vehicle batteries or plug-in hybrid vehicle (PHEV) batteries the preferred mode. Improvements in the electric grid must be made in order to handle charging of electric vehicles if daytime charging is to occur on a large scale or when the market penetration of electric vehicles becomes significant.
4. Federally funded social science research is needed to determine how land-use and transportation infrastructure can reduce vehicle miles traveled. Studies of consumer behavior as it relates to transportation should be conducted, as should policy and market-force studies on how to reduce vehicle miles traveled. Estimation of the long-term effects of transportation infrastructure on transportation demand should become a required component of the transportation planning process.
5. The federal government should set a goal for the U.S. building sector to use no more primary energy in 2030 than it did in 2008. The goal should be revisited at 5-year intervals in light of the available technology and revised to reflect even more aggressive goals if they are justified by technological improvements.
6. To achieve the 2030 zero energy building (ZEB) goal for commercial buildings – replacing fossil fuels with renewables and reducing energy consumption by 70 percent relative to conventional building usage – the federal government should

- create a research, development and demonstration program that makes integrated design and operation of buildings standard practice. The federal government, state governments and electric utilities should carry out the program co-operatively, with funding coming from all three entities.
7. Any green building rating system, such as the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, should give energy efficiency the highest priority and require reporting of energy consumption data.
 8. The federal government should sharply increase its R&D spending for next-generation building technologies, for training building scientists and for supporting the associated national laboratory, university, and private sector research programs. Specifically, funding for building R&D should be restored to its 1980 level — \$250 million in 2008 dollars — during the next 3 to 5 years from the current level of \$100 million. At the end of that period the buildings program should be reviewed carefully to determine (1) how much continued federal funding will be needed for the program to reach its goals; and (2) which parts of the program are ready to be shifted to the private sector.
 9. The existing demonstration program for construction of low-energy residential buildings, along with associated research, should be expanded.
 10. The Department of Energy should develop and promulgate appliance efficiency standards at levels that are cost-effective and technically achievable, as required by the federal legislation enabling the standards. The department should use a streamlined procedure to promulgate the standards for all products for which it has been granted authority to do so.
 11. The federal government should encourage states to initiate demand-side management (DSM) programs through utility companies, where such programs do not exist. Such programs, in which a central agency (often a utility company) assists customers in becoming more energy efficient, have proven cost-effective. The federal government could provide rewards to states that have significant and effective DSM programs and disincentives to those that don't.
 12. Energy standards for buildings, such as the standards promulgated in California, should be implemented nationwide. States should be strongly encouraged to set standards for residential buildings and require localities to enforce them. The federal government should develop a computer software tool much like that used in California to enable states to adopt performance standards for commercial buildings. States should set standards tight enough to spur innovation in their building industries.
 13. Congress should appropriate and the White House should approve for the DOE Office of Science funds that are consistent with the spending profiles specified in the 2005 Energy Policy Act and the 2007 America COMPETES Act. Congress should exercise its oversight responsibility to ensure that basic research related to energy efficiency receives adequate attention in the selection of Energy Frontiers Research Centers.
 14. To meet the out-year technology goals this report sets for energy efficiency, DOE must take steps to fold long-term applied research into its scientific programming in a more serious way than it currently does. The department has several options. It can charge the Office of Science with the responsibility and provide the necessary budget, but if it does so, it must protect the culture and budgets of its current basic research programs. It can designate the Energy Efficiency and Renewable Energy Office (EERE) with the responsibility and augment its budget for that purpose, but in that case, DOE must be careful not to allow short-term activities to continue to diminish long-term opportunities. The department can

also create a new structure to support long-term applied research or adapt Advanced Research Projects Agency – Energy (ARPA-E), which was established by the America COMPETES Act.

15. The Department of Energy should fully comply with the 2005 Energy Policy Act mandate to improve the coordination between its basic and applied research activities. Congressional oversight committees should ensure that DOE fulfills its obligation.
16. ARPA-E, if funded, needs to have its purposes better defined. Its time horizon must be clarified, and the coupling to its ultimate customer, the private sector, needs better focus. This report takes no position on whether ARPA-E should be funded.
17. Long-term basic and applied research in energy efficiency should be pursued aggressively. In the case of transportation, the opportunities often point up the close connections between basic and applied research and underscore the need for close coordination of the two activities. In the case of buildings, the fragmented nature of the industry and EERE's focus on near-term research and demonstration programs have led to a serious lack of long-range applied R&D, a deficiency that needs to be rectified.

Whether you want the United States to achieve greater energy security by weaning itself off foreign oil, to sustain strong economic growth in the face of worldwide competition or to reduce global warming by decreasing carbon emissions, energy efficiency is where you need to start. Thirty-five years ago the United States adopted national strategies, implemented policies and developed technologies that significantly improved energy efficiency. Science and technology have progressed considerably since then, but U.S. energy policy has not. It is time to revisit the issue.

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We conclude by emphasizing, as we did earlier, that technology alone will not lead to the potential gains in energy efficiency we identify in this report. Crafting and implementing wise policies are key to any success.

It is true that making all those gains in energy efficiency won't get us there either (wherever "there" is), but it is a start.



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