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Can IT Help Prevent Climate Change?

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A significant issue today is the need for ways to overcome the threats of global warming while still achieving economic growth. This issue has its roots in the assumption that these two goals, development and environmental preservation, are at odds with one another. Below I examine a topic related deeply to the competitiveness of individual nations: the connection between global environmental problems and the use of information technology to enhance industrial structures.

The IT Energy Debate

The relationship between these two topics has been at the center of a great debate carried out primarily in the United States during the 1990s. America is generally criticized for what is seen as its foot-dragging stance on global environmental issues, but the majority of American scientists have long shared the view that technologies should not be improved solely to increase the convenience their functions provide, but also from the perspective of reducing the environmental impact of their energy consumption.

The case is no different when it comes to IT. The rapid adoption of new computer technologies at first inspired pessimistic predictions about skyrocketing energy consumption. Indeed, installing IT devices throughout our living and work spaces may bring the benefits of more effective information use, but these devices all rely on the power sources we have always used. Greater IT penetration would therefore inescapably mean a corresponding increase in energy use, according to the pessimists.

The optimists countered this line of reasoning with claims that as IT equipment spreads, making possible the distribution of digital content via weightless electrons, we will reduce our use of physical resources like paper and plastics. As society shifts from one that consumes material resources to one built increasingly on exchanges of information, it will see considerable opportunities to reduce its overall energy usage.[1]

The debate has continued since then up to the present day without reaching any significant conclusions. Now that we have entered the first emissions-reduction period set

[1] In “The Internet Economy and Global Warming,” a 1999 report from the Center for Energy and Climate Solutions, Dr. Joseph Romm calculated that Amazon.com expends just one-sixteenth the energy that a major traditional bookseller does per book sold.

forth in the Kyoto Protocol, however, the time is ripe for us to give serious thought to the ways that IT could lead the way to solutions to the environmental challenges that face the globe.

Sluggish Improvements in Japan

As a helpful framework for the debate, let us examine the extent to which various nations have succeeded in "informatizing" their economies—or to put it another way, in moving to service-based economies—and how efficiently they are using energy today. Below I describe the data used for this international comparison.

First is the rate of industrial structure conversion, a measure of how much emphasis a nation has placed on informatizing (or shifting to services in) its economy. Specifically, this means how far the share of manufacturing has fallen in the economy as a whole. And second is the primary energy consumption per unit of GDP, a yardstick for improved energy efficiency in that economy.

The table shows that on the whole, developed nations shifted their industrial structures to services and boosted the efficiency of their energy use following the oil crisis of the early 1970s. The detailed data shows a considerable range in the speed of their conversions, though. Over the roughly three decades covered by the table, Japan and Germany, for instance, saw similar falls of around 10 percentage points in the economic share of manufacturing. In energy efficiency, however, while Japan saw an improvement of only around 25 points, Germany's efficiency nearly doubled.

Table GDP share of manufacturing and primary energy consumption per unit of GDP in developed nations

	1973	1980	1985	1990	1995	2000	2004
Japan	33.2	27.8	28.0	26.8	23.4	22.2	21.0
	100.0	84.2	76.7	74.0	77.4	76.0	74.0
United States	21.0	21.0	19.3	18.1	17.6	15.8	13.3
	100.0	87.6	73.4	67.7	65.0	58.6	53.6
Britain	28.0	24.2	21.6	20.9	19.4	16.0	13.1
	100.0	85.2	77.9	69.0	67.2	59.8	54.6
Germany	29.7	27.3	27.1	25.5	20.5	20.7	20.4
	100.0	91.3	86.3	72.0	62.0	56.4	55.5
France	21.5	22.5	20.3	18.0	16.5	14.3	12.4
	100.0	86.8	83.8	79.6	78.9	73.2	73.2
Italy	25.7	27.1	23.5	21.2	20.0	18.7	17.1
	100.0	80.4	73.2	71.9	73.2	71.9	74.1
Canada	20.1	18.0	16.9	15.7	17.0	17.9	16.7
	100.0	95.6	83.8	79.0	80.2	70.7	68.9

Notes: Upper figures are the share of the economy occupied by manufacturing (%);
lower figures are primary energy consumption (1973 = 100).
Source: Data is taken from the United Nations National Accounts Statistics database and various International Energy Agency statistics.

By 2004 the United States and Britain had both reduced manufacturing's share of their economies to about 13%. Like Germany, they had also nearly doubled their energy efficiency. Why is Japan lagging behind these three nations in the speed at which it has improved its own efficiency over this period?

Conserving Energy Through Industrial Conversion

There are several reasons we might give for this gap. First of all, as a nation with few natural resources of its own, Japan was swift to respond to the oil crisis with measures to conserve energy and improve the resource efficiency of its industrial structures. After a burst of improvement early on, it is only natural that the rate of improvement would slow in later years.

Furthermore, in the case of Japan and Germany, the manufacturing sector occupies a large portion of the economy as a whole as compared to the other nations, keeping the ratio of nonmanufacturing industries similar in those two countries. Moreover, there are considerable differences in the elements that these nations include in their manufacturing and nonmanufacturing (particularly services) sectors, and these differences may produce the disparities in the energy-efficiency figures listed in the table. It is also important to note that the above figures do not reflect the different extents to which the nations have made use of IT in their economies; these figures do not prove that shifts in industrial structures from manufacturing to services lead to immediate efficiency gains in energy usage.

Space prevents me from going into detailed explorations of all these various factors. It can be said, though, that the difficulties Japan now faces in meeting its Kyoto Protocol commitments stem from its lack of the following perspective: Discussion of these matters in Japan to date has focused far too heavily on the major manufacturers that have long been seen as the wellspring of Japanese competitiveness. The result has been the danger that any future moves will seek to keep the existing industrial structures in place. In the short term, it will be important for Japan to pursue further reductions in energy use among its existing industries, putting these improvements to work in ways that contribute to the rest of the world as well. In the medium to long term, the task will be to create entirely new businesses that make full use of advanced IT, thereby accelerating the conversion of Japan's industrial structures.

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