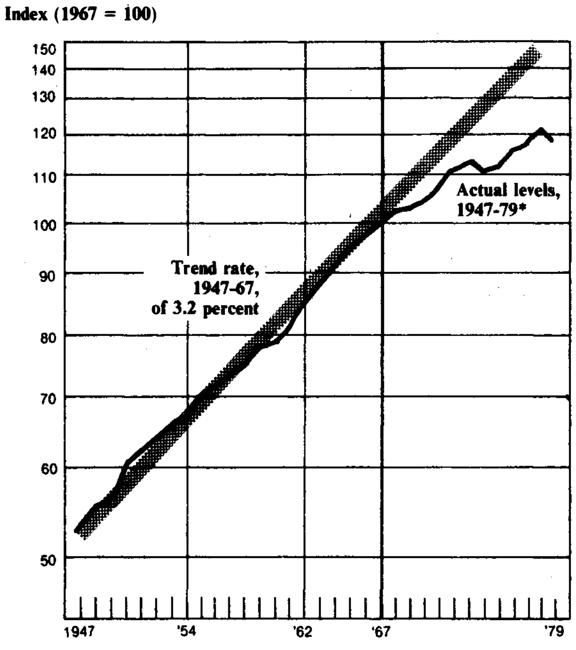
# The relationship between energy, inflation and productivity

by David Goldman and Dr. John Schoonover

What is currently known to the economics profession concerning the behavior of productivity can be summarized in the first three sets of graphs showing 1) the trend of productivity (in terms of output per manhour) in the U.S. economy; 2) the correlation between productivity and the rate of fixed capital formation in various industrial economies; and 3) the inverse correlation between productivity growth rates and inflation rates among a group of U.S. industries. The first three graphs are drawn from a current summary in the Bulletin of the Kansas City Federal Reserve Bank; the last, Graph 3A, was prepared by the *EIR* staff from Commerce Department and Bureau of Labor Statistics data.

A more useful description of the relationship between productivity and inflation is shown in the next, Graph 4, which compares the rate of productivity growth to the

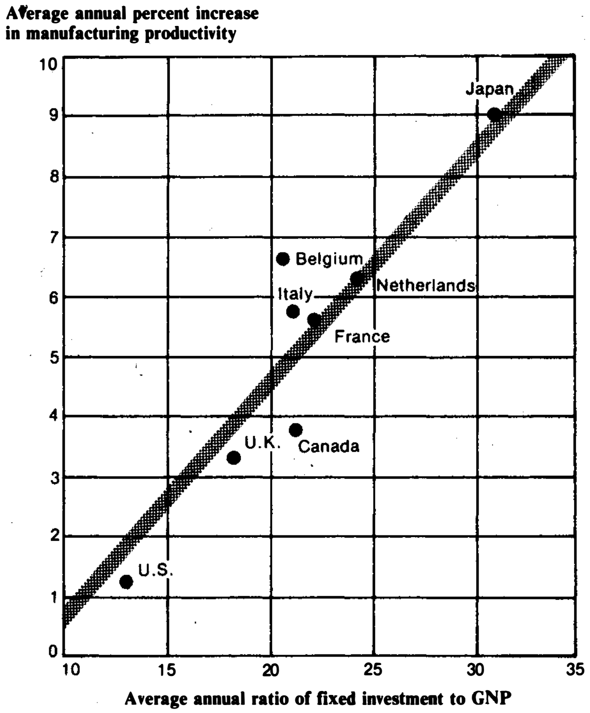
**Graph 1**
**Output per hour in private business economy**




* 1979 value estimated

*Source:* Federal Reserve Bank of Kansas City, *Economic Review*, November 1979.

**Graph 2**
**Investment and productivity, 1960-76**

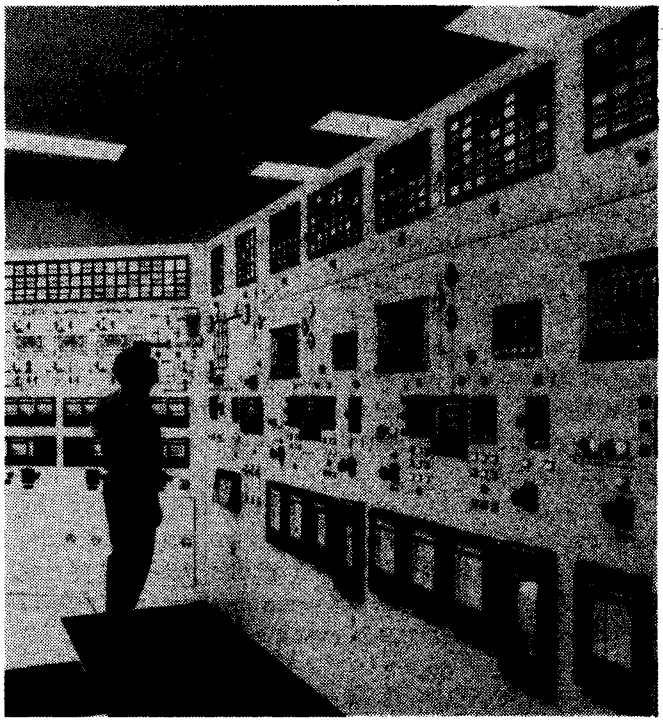



*Source:* Federal Reserve Bank of Kansas City, *Economic Review*, November 1979.

expansion of total indebtedness in the U.S. economy during the past 25 years. After 1967, which we shall demonstrate was a crucial turning point, there is an obvious relationship between the two lines; the rate of indebtedness rises geometrically as the productivity growth rate falls. In the simplest possible terms, this excess in debt expansion at odds with productivity growth rates defines a regime of *structural inflation.*

Graph 5, showing the relatonship between output per manhour, or "productivity" in the conventional definition, and the energy-intensiveness of labor in the U.S. economy, as measured by consumption of British Thermal Units (BTU's) in manufacturing against manhours worked, begins to shed light on how productivity in fact develops. The vertical axis is productivity on the Bureau of Labor Statistics index; the horizontal axis is millions of BTU's per man-hour. Between 1954, the starting point of the time-line of the resulting graph, and 1971, the U.S. economy behaved in such a fashion that every increase in productivity was matched by an increase in energy-intensiveness.

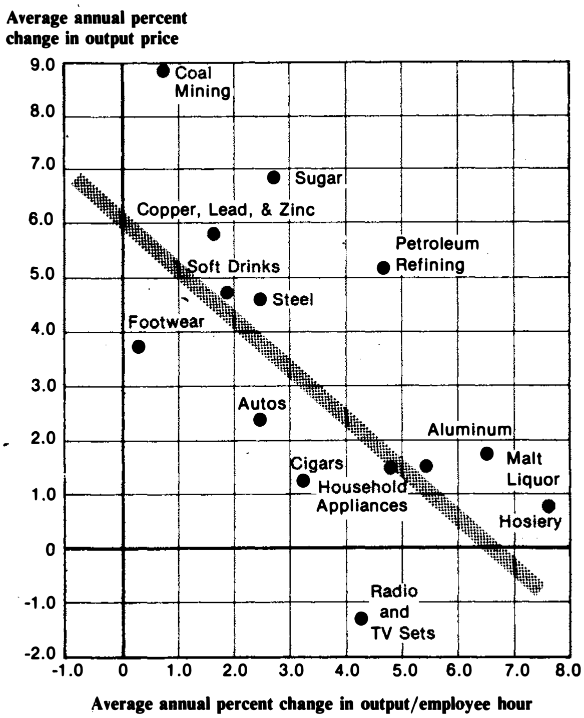
Graph 6, which shows manufacturing output on the vertical axis against consumption of energy measured in quads of BTU's, shows, through 1974, an almost linear function of increase. But it is the previous graph, which



*Part of an 85 foot eontrol panel operating a computerized blast furnace at the Sparrows Point steel plant, Baltimore.*

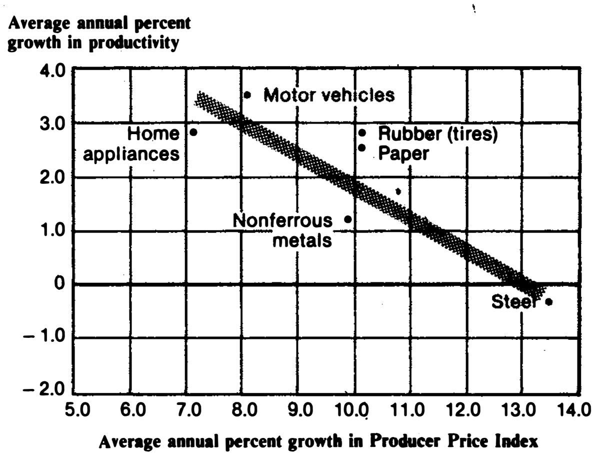
Photo: Bethlehem Steel

**Graph 3**
## Prices and productivity, 1960-75




*Source:* Federal Reserve Bank of Kansas City, *Economic Review,* November 1979.

**Graph 3A**
## Prices and productivity, 1973-78




*Source:* Commerce Department and Bureau of Labor Statistics data.

shows instead the productivity behind that output and the development of energy intensiveness, which tells us much more about the behavior of the economy. Between 1954 and 1959, as the American economy extends in scale, BTU's per manhour rise faster than productivity. During the next eight years, the relationship reverses sharply, and productivity grows much faster than energy-intensiveness. In this eight-year period, the U.S. economy sustained more than half of the productivity growth of the entire 24 year period shown. This spectacular development is attributable not only to high rates of capital formation, but high rates of assimilation of new technologies. These years correspond to the height of NASA spending for research and development related to the space effort.

However, the line breaks sharply at 1967, and the U.S. economy returns to earlier growth rates of energy efficiency. That year was both a secular peak in the rate of capital formation, and the point at which real federal spending for research and development began to fall off sharply.

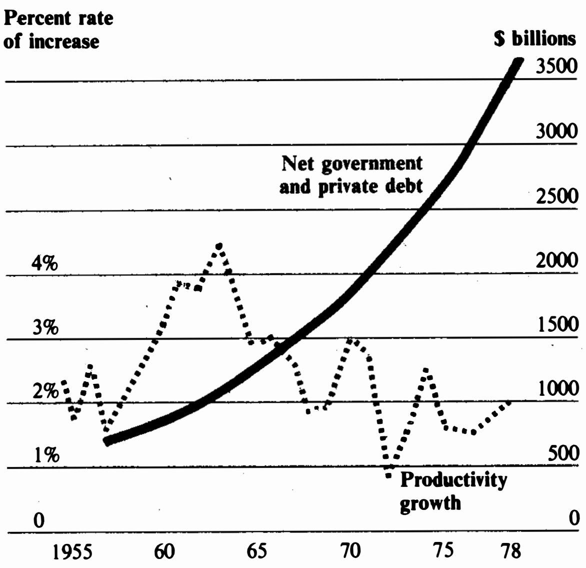
After 1971, productivity growth continues, while the energy-intensiveness of industry falls in absolute terms. As shown also on Graph 6, the raw consumption of energy per unit of output also falls sharply during 1974-1975 and had not, in 1977, reached 1974 levels.

The next set of graphs demonstrates that the post-1971 behavior of the rate of energy efficiency is the result of a fundamental deterioration in the American economy, which we have characterized as a regime of structural inflation. Specifically, the reversal of the trend line occurred as the result of a reduction in scale of the manufacturing sector as a whole, and the distortion of manufacturing away from highly energy-intensive industries toward less energy-intensive industries. This transformation of the mix of industries is specifically biased away from those investment-goods industries which are most important for manufacturing fixed capital formation. This will establish the causal relationship between the lines of declining productivity growth rates and rising indebtedness shown in Graph 4.

Graph 7 shows the absolute decline in total BTU consumption in a number of industries in the years prior to 1977. This decline in absolute BTU consumption, or energy throughoutput, corresponds to the period of growth of both output and productivity despite fewer BTU's per manhour. But during the same period, industrial employment fell sharply, as the most energy-intensive, least-productive sectors of industry, especially in primary metals, were permanently scrapped. Total manufacturing hours worked fell from a peak of 27.4 billion in 1967, not quite equalled by the 27.3 billion of 1974, to 25.3 billion in 1976. Manufacturing hours worked are still below the 1967 peak, as is the absolute level of manufacturing operatives.

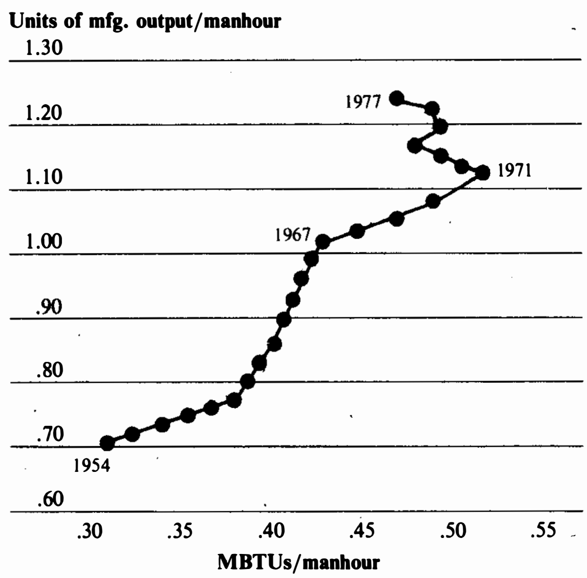
Graph 8, which shows the energy content of Gross

**Graph 4**
**Productivity and total debt**




*Source:* Federal Reserve Board; U.S. Dept. of Labor, Bureau of Labor Statistics

**Graph 5**
**Manufacturing output/manhour vs. energy flux density, 1954-1977**



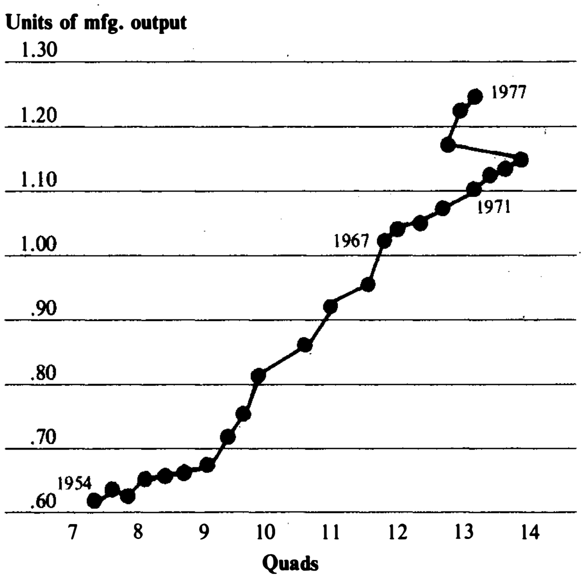
National Product, provides a further illustration of the phase-change of the U.S. economy during the post-1971 period. Nominal GNP in trillions of dollars is the vertical axis; energy consumption of manufacturing is the horizontal axis. The graph shows a much more exaggerated rise in nominal GNP despite the fall in energy consumption than we saw earlier in either the case of productivity per man-hour, or in the case of manufacturing output. This shows the distortion of the economy away from goods-producing activity and towards more non-goods-producing activity, in addition to the shift in composition of manufacturing itself.

That shift is shown in the next three tables. The first two were prepared by Harvard economists Hudson and Jorgenson, the last by the *EIR* staff.

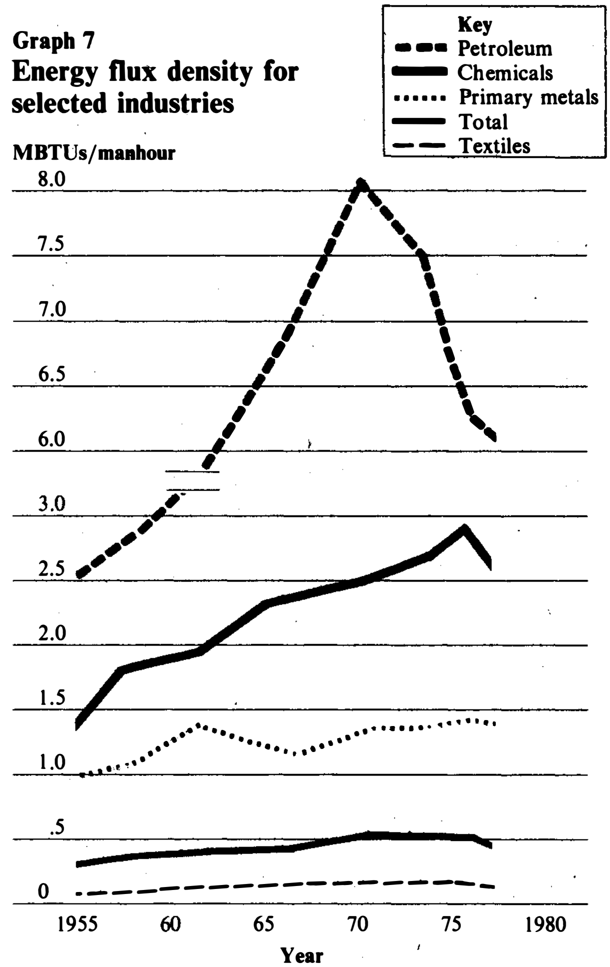
Table 1, "Composition of real final demand in 1976," shows the dropoff in demand for goods and a rise in demand for services as a result of energy price increases. The Hudson-Jorgenson econometric model estimated the composition of spending in 1976 under prevailing energy price conditions, and then simulated what they would have been under 1972 energy price conditions. Their model produced the rather obvious conclusion that demand for goods fell, particularly for energy and energy-intensive products, while demand for services rose, relative to the proportions that would have prevailed had energy prices not quadrupled in 1973.

The next table is the result of Hudson and Jorgen-

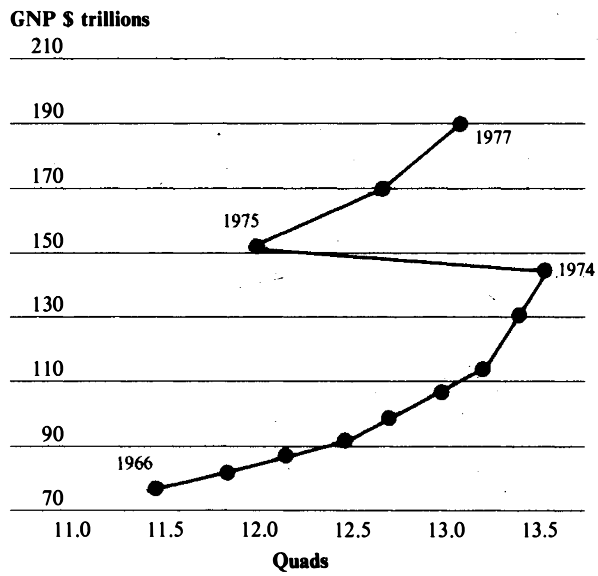
**Graph 6**
**Efficiency of energy use in manufacture**




**Graph 7**
**Energy flux density for selected industries**




**Graph 8**
**Energy content of the GNP**



son's econometric projection into the future of reductions in energy supply. The "Base Case," "Policy 1," and "Policy 2" represent differing degrees of stringency in reduction of energy supplies. Again, the Harvard economists come to the straightforward conclusion that the more other factors, especially labor, are substituted for energy, the lower real growth will be and the worse off the economy will be.

The final table in the series, Table 3, documents the shift in composition of manufacturing industries away from energy-intensive toward less energy-intensive industries between 1973 and 1978. By sector, the table states the shipments of each industry as a percentage of total manufacturing shipments, and compares the change in the proportion among the industries to energy-intensiveness. The results are quite dramatic. The least energy-intensive industries show a significant rise in proportion of total shipments; the most energy-intensive show a drop. Most dramatic is the drop for the most energy-intensive industry listed, primary metals, which falls from 8.1 percent to 7.2 percent of total output. The biggest increases—in transportation equipment, electrical equipment, and food—are in the least energy-intensive industries.

This last table actually understates the change in state of the economy, because it shows only the proportions within the manufacturing sector, not the decline of the manufacturing sector in both absolute terms (as measured by total manhours worked) and in relative terms, with respect to the rest of the economy.

To summarize the data displayed above: it is in fact the case that the American economy managed to increase productivity in terms of output per manhour and to increase overall output while reducing energy consumption. However, this was the result of 1) a decline in the tangible economy with respect to the paper economy in absolute terms, 2) a decline in the proportion of economic activity devoted to tangible-goods production, and 3) a perversion of the internal composition of the goods-producing sector itself. Overall, the process was the cause of declining rates of productivity growth with respect to historical levels, and declining productivity especially with respect to the rate of growth of indebtedness in the economy. That defines an accelerating structural inflation in the U.S. economy.

## A period of structural inflation

The above description provides a unique, and accurate, measurement of what structural inflation is, an explanation entirely lacking in most accounts of the development of inflation. The following section, on capital formation in a regime of structural inflation, demonstrates that the American economy has entered a period of self-feeding structural inflation, and potential hyperinflation.

Lydia Schulman's analysis demonstrates that as of 1980, the adverse structural shift away from energy-intensivity in the U.S. economy will absorb virtually all fixed capital formation in manufacturing—i.e. new plant and equipment investment will add neither to the supply of goods nor the productivity of labor, but merely change the energy composition of the economy. Under such conditions industrial capital formation becomes an overhead burden on the economy, worsening precisely those tendencies in the real economy that capital investment should solve, and leading to self-feeding inflation.

**Table 2**
**Capital, labor and energy inputs in 2000**

| Quantities of input | Base case | Policy 1 | % change from base case | Policy 2 | % change from base case |
|---|---|---|---|---|---|
| Capital services* | 831.5 | 821.9 | −1.2 | 806.3 | −3.0 |
| Labor services* | 1281.3 | 1281.2 | −0.0 | 1281.1 | −0.0 |
| Energy** | 138.5 | 126.6 | −8.7 | 116.3 | −16.0 |
| Real GNP | 2721.7 | 2679.8 | −1.5 | 2634.9 | −3.2 |

* Measured in billions of 1972 dollars
** Quadrillion Btu of primary energy input

**Table 1**
## Composition of real final demand in 1976
(percent of total real final spending)

| | Simulated with 1972 energy prices | Simulated with actual energy prices |
|---|---|---|
| Agriculture, construction | 12.3 | 12.0 |
| Manufacturing | 32.4 | 32.2 |
| Transportation | 2.6 | 2.5 |
| Services, trade communications | 48.8 | 49.9 |
| Energy | 3.9 | 3.4 |
| Total | 100.0 | 100.0 |

**Table 3**
## Shift in composition of U.S. manufacturing industries, 1973-78

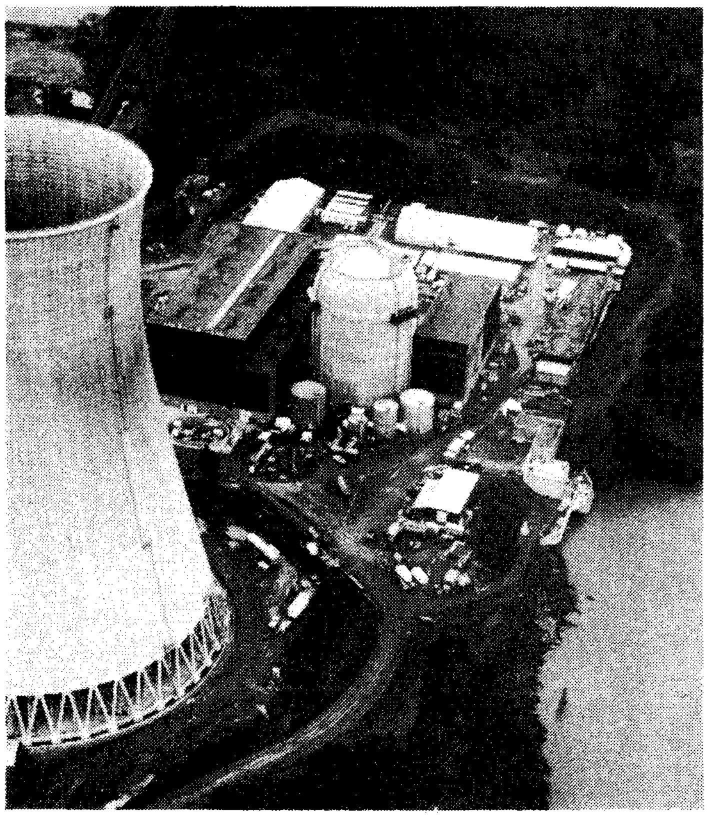
| | Shipments as % of total* | | Energy intensity indicator † |
|---|---|---|---|
| Sector | 1973 | 1978 | % |
| Food | 13.5 | 14.3 | 4.1 |
| Textiles | 3.7 | 3.8 | 6.8 |
| Paper | 4.0 | 4.0 | 12.2 |
| Chemicals | 8.7 | 8.7 | 10.5 |
| Petroleum and coal products | 4.0 | 4.4 | 15.9 |
| Rubber and plastics | 3.2 | 3.1 | 4.6 |
| Stone, clay, and glass | 2.7 | 2.7 | 12.9 |
| Primary metals | 8.1 | 7.2 | 15.8 |
| Machinery, not electrical | 9.7 | 9.5 | 1.9 |
| Electrical eqpt. | 8.0 | 8.2 | 1.9 |
| Transportation eqpt. | 14.2 | 14.9 | 2.1 |
| Other** | 20.2 | 19.2 | -- |

* Inflation-adjusted data

** Includes tobacco, apparel, lumber, furniture, printing leather, fabricated metal products, instruments and miscellaneous

† Fuel and electricity costs as % total value added. Does not include feedstocks; thus, primary metals, chemicals and petroleum are relatively more energy-intensive than would appear from these figures.

*Energy inefficiency: A solar panel in the Pyrenees.*



*Energy efficiency: The Trojan nuclear plant in Portland*
Photo: Portland General Electric