

\$25. Economic Development and Energy Use

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It is well-known that economic development is correlated with energy consumption. A chart of this correlation appears in many textbooks of energy science and gives a useful idea of the energy consumption likely to result from improving economic development and of the consequent need for new energy sources. However most textbook charts employ old data and do not include the effects of currency inflation during 1970-1980, improved energy conservation after the 1972 Oil Shock, effects of information technology and corporate restructuring, and effects of the dramatic pace of economic development in certain countries. We studied recent statistics(1,2) on income and energy and report the results because they are relevant to the purpose of the NIFS Data and Planning Center.

Figure 1 shows annual energy consumption per capita in equivalent kilograms of petroleum for several countries versus net industrial production per capita in US dollars. The various countries are not exactly comparable because of differences in accounting and reporting. There are questions about how to count income from multinational companies and about the value added by, for example, military or other government spending. Therefore we emphasize that the data are approximate. However it is obvious there is a strong correlation of energy consumption and economic development.

It is natural to expect that cold countries would consume large amounts of energy. Russia, Canada and Finland have high per capita energy consumption, but climate is probably not the main reason. Household energy consumption is only 15-25 % of the total energy use and so the most important differences between countries are in the industrial use of energy.

The deviations from the straight-line correlation show how energy is used. For example, several states from the former Soviet Union have high energy consumption relative to their current national incomes, probably because of difficulties with the efficiency of heavy industry. Saudi Arabia is also above the diagonal trend because its oil exports are treated as consumption in this data (as for Russia).

Hong Kong is a center of banking and trade and has an unusual combination of high income and low energy consumption. China is special because of its large population and because of the rapid growth of the Chinese economy.

The per capita figures for Japan are similar to France, Denmark, Germany and Switzerland. However Japan relies heavily on imported fuels. Japan imported oil and coal costing about $3.7 \cdot 10^{12}$ ¥ (1996), an energy equivalent of about $3.7 \cdot 10^{12}$ kWatt-hr. (The electrical energy produced was about $9 \cdot 10^{11}$ kWatt-hr.) Energy imports were about 10 % of all imports by cost. Total expenditures for scientific research on energy are not known to this author, but the budget of the National Institute for Fusion Science represents about one half of one percent of the cost of the imported coal and oil.

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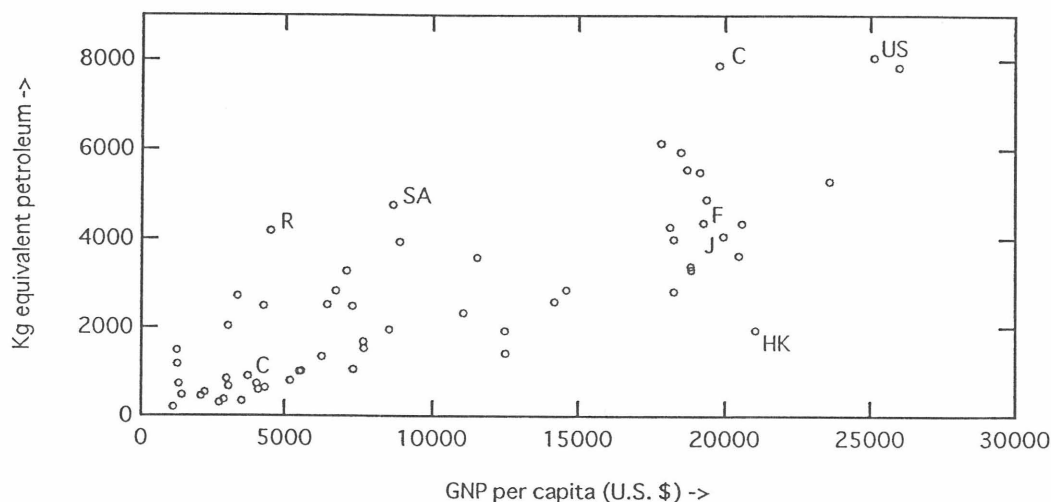


Figure 1. Energy consumption (kilograms of petroleum equivalent per capita per year) and industrial production (US dollars per capita per year) for several countries.

Key: C = China (lower left), R = Russia, SA = Saudi Arabia, F = France, J = Japan, HK = Hong Kong, C = Canada (upper right), US = United States