CO_2 and transportation

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The insidious problem

One of the most vital parts of our economy and our lives is transportation. No one doubts that transportation returns enormous benefits to our economies, both private benefits to each of us using the system for personal (or goods) mobility and collective benefits as well. But transportation is not without important side effects, or externalities that impose costs not only on system users but on others and on the natural environment as well. The carbon dioxide (CO_2) generated thereby is not the worse thing we face, but it is unfortunately linked with the potential for some serious long-term environment problems. What makes this particularly insidious is that we really don't have a mechanism for dealing with it socially. We don't have a social consensus. We don't have a political consensus. And after we have dealt with many of the other problems in connection with transport and energy use, we'll find we may still have CO_2 to deal with.

The inventory of transportation concerns includes: accidents, noise, dirt (particulates, residues, and junk), congestion, space use (pavement and suburban sprawl), habitat disruption, emissions (pollution and CO_2), and energy use (oil), the deadly sins of transportation. Some of these problems are getting better. Fewer people are killed per kilometer of travel every year in most Western countries. Air pollution, at least in the United States, tends to be getting better. Noise and material recycle are improving.

The other problems are worsening. Most of these have local impact, which means both that they do not threaten the global system and that local controls can and eventually will be applied by those directly concerned.

Oil depletion and CO_2 are different. This is the plight of the global commons; local motivation is absent and the entire system can prove to be uncontrollable and ultimately self destructive. It is not currently a big problem; it is not now a costly problem. But if you look at it from a long-term, societal point of view, it may indeed be very serious, even a threat to human survival.

"Transport for a Sustainable Environment," a recent National Academy of Sciences study in which I was a member, focused on CO_2 and habitat disruption as factors that threaten future generations the most, i.e., threaten sustainability. The CO_2 generated by transportation may not be the worst problem we face, but it is unfortunately linked with the potential for some serious long-term environment problems. What makes this particularly insidious is that we really don't have a mechanism for dealing with it socially. We don't have a social consensus. We don't have a political consensus. And after we have dealt with many of the other problems in connection with transport and energy use, we'll find we may still have CO_2 to deal with.

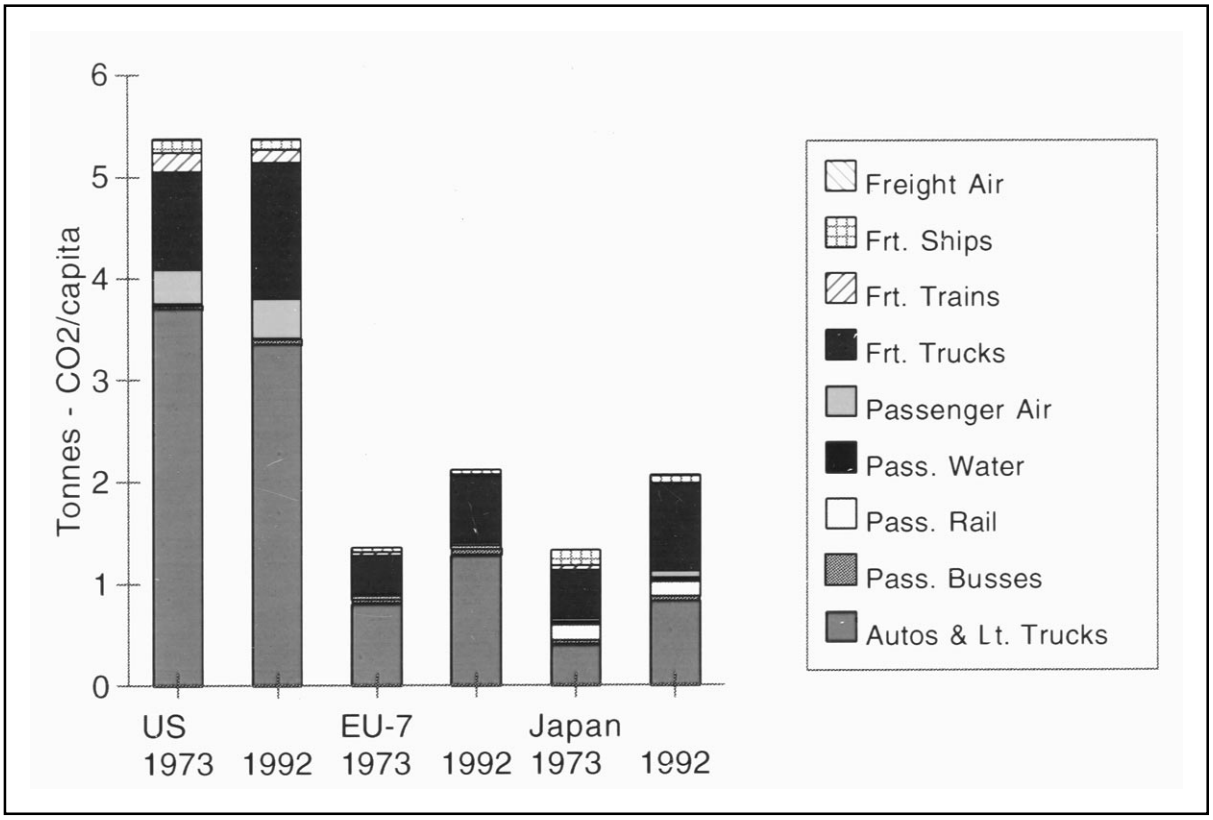

Figure 19-1. CO_2 emissions from transportation by the advanced countries of the world for 1973 and 1992.

CO_2 from transportation

CO_2 emissions from travel are shown in Figure 19-1, which portrays the specific sources: cars, buses, railroad, or air travel. It is interesting that, on a per capita basis, the U.S. emissions were level over the period shown; in fact they even fell a bit, while they rose in the seven European countries depicted and Japan. The reason that emissions rose in those countries is increased mobility: people are moving around more. Whereas, in the United States, while we are much more mobile than we were 20 years ago, we went through a period in which we basically shrunk the size of our cars. Fuel use per kilometer in the United States is now rising again after falling for more than 20 years.

Worldwide mobility is increasing due to several factors— growth in the number of cars, the spread of suburbs, the addition of more women to the workforce, and an expansion in the amount of leisure time. Fuel prices have stayed relatively low, particularly in the United States. We haven't had any real long-term constraints in either transport or oil. We have cheap energy, particularly in the United States. Relative to the high price era of the early 1980s, even Europe is basically better off than it was ten years ago.

People want mobility, particularly if it is cheap

People want their mobility and it is very difficult for politicians, whether in Los Angeles or Washington or Paris, to step in the way. Voters, however, are not interested

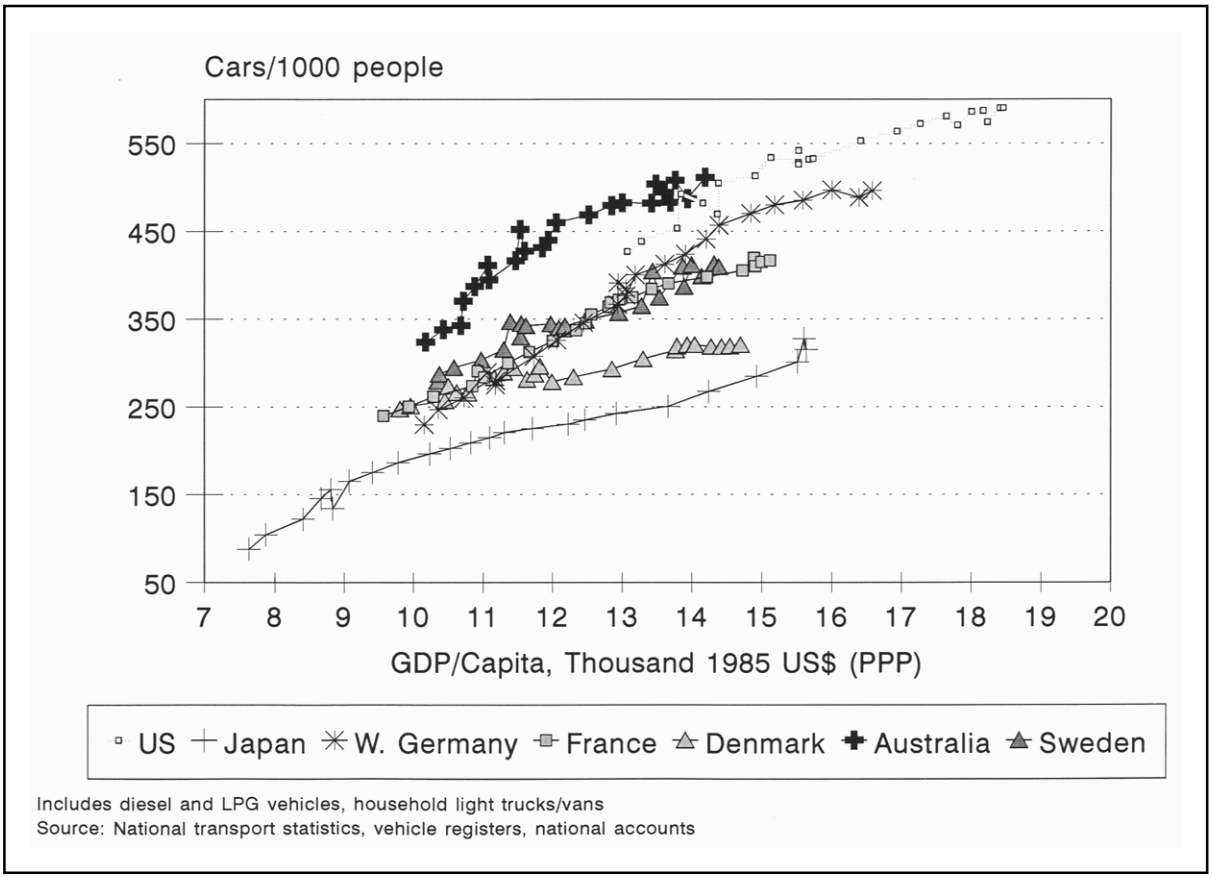

Figure 19-2. Automobile ownership versus Gross Domestic Product (GDP).

yet in paying for decreased CO_2 emissions. Certainly for a while, the United States and Canada broke the trend, with higher prices and the comprehensive automotive fleet emission (cafe) standards. But the trend-break is over. Where once we had a period of climbing fuel efficiency, we now see emissions increasing per unit of travel as people purchase larger cars. Unless we understand the people problem—how people, and for that matter how goods, move around—we can't deal with CO_2, and that is why we are paralyzed today.

The coupling between our income and our mobility is strong (Figures 19-2 and 19-3). Basically, as we get richer, we move around more. In the long run it has been getting cheaper to move around. And as a result it is very difficult to say, don't move. In the Third World and Eastern Europe the number of cars went as the inverse square of the Gross Domestic Product (GDP). Even during the years when the economies were collapsing, the number of cars was rising steadily.

But it is not just people that move around. As wealth increases freight transportation increases (see Figure 19-4) and becomes a greater source of transportation problems (noise, road damage, accidents, air pollution) and also a greater source of CO_2. While the United States has relatively efficient trucks and trucks represent only about 35% of the freight hauled, trucks are gaining their fuel-use share of freight hauled. This is because there is a trend toward smaller shipments, because trucks are faster in many markets, and because diesel fuel itself is cheap. Everybody wants things quickly and

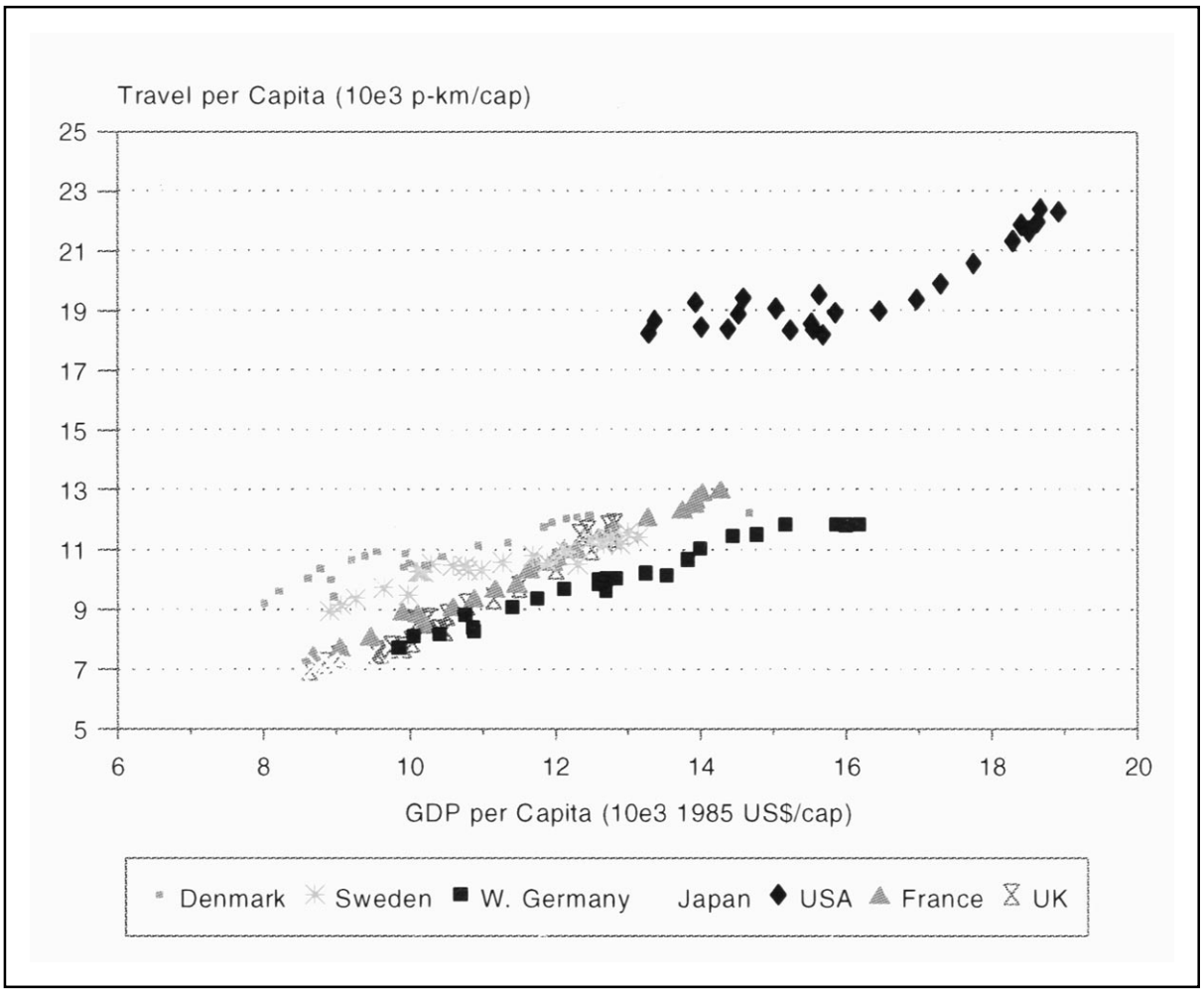

Figure 19-3. Domestic travel versus Gross Domestic Product (GDP).

just in time so load sizes are decreasing and distances are increasing. The laptop that I use in California came to me by overnight express. The computer company in New York sent it by air and by truck at no cost to me, since the transportation cost was small compared with the price of the computer. Two-thirds of that shipment was the packaging for the computer. You can begin to understand why we are using more energy and releasing more carbon per unit of freight.

Technology?

Technology promises solutions, but the question is whether technology is enough. Technology feeds back on people. What we do more efficiently, we enjoy more and actually do more, eating up some of the efficiency savings. This is illustrated in Figure 19-5, which shows fuel inefficiency as gallons per mile or liters per 100 kilometers. What you see is that the United States, which was much more inefficient than countries in Europe, showed an enormous improvement. This came to an end in 1991 as our efficiency improvements flattened and began to reverse. At the same time the changes in Europe have really been very small, because while we were shrinking our

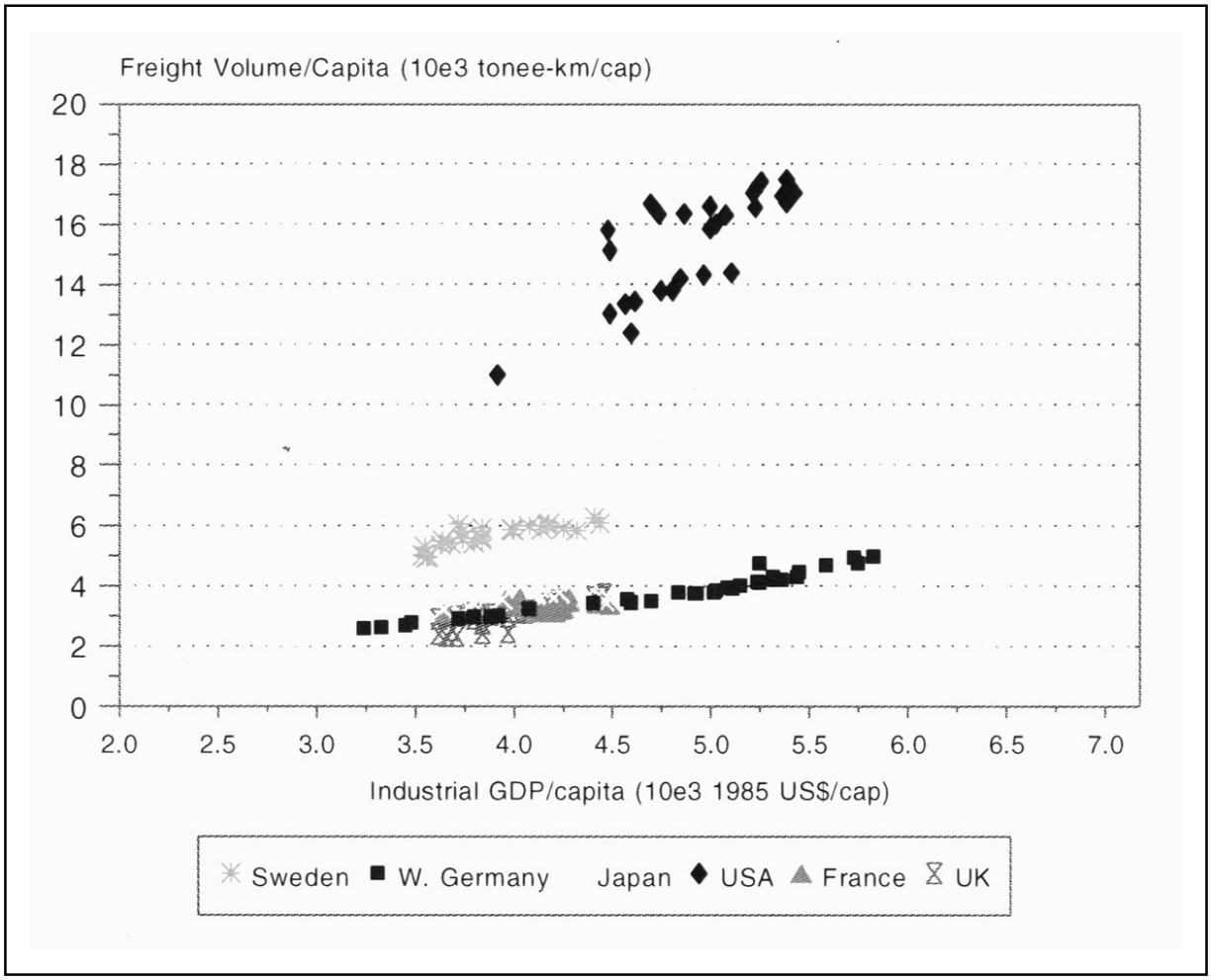

Figure 19-4. Freight volumes versus industrial Gross Domestic Product (GDP).

cars, the Europeans were getting bigger cars.

If you look very carefully, you find that it takes far less energy to move a kilogram of car a kilometer than it did 20 years ago (Figure 19-6). We are much more efficient. But what is happening is that we are using our technology to give us bigger cars (Figure 19-7) and more performance, with little saving in energy use, and energy in this case is almost the same as CO_2. In France, for example, half of the new cars sold are diesel. Never mind the air pollution problems the diesels give, diesel fuel is priced so low that you get about the same cost per mile of driving as we do in the United States. It is not surprising that the French are so enthusiastic over diesel cars and are driving them 50% more than those who have gasoline cars, when gasoline is priced much higher.

There will, of course, be more fuel-efficiency improvements. There is an enormous potential, but right now these improvements are mostly being countered by more power and bigger vehicles in the United States and in Europe. So again, technology is enormously promising, but it is not being used to decrease energy use or CO_2 emissions. We build 24-valve cars to save fuel; instead all of that technology is being used to boost power.

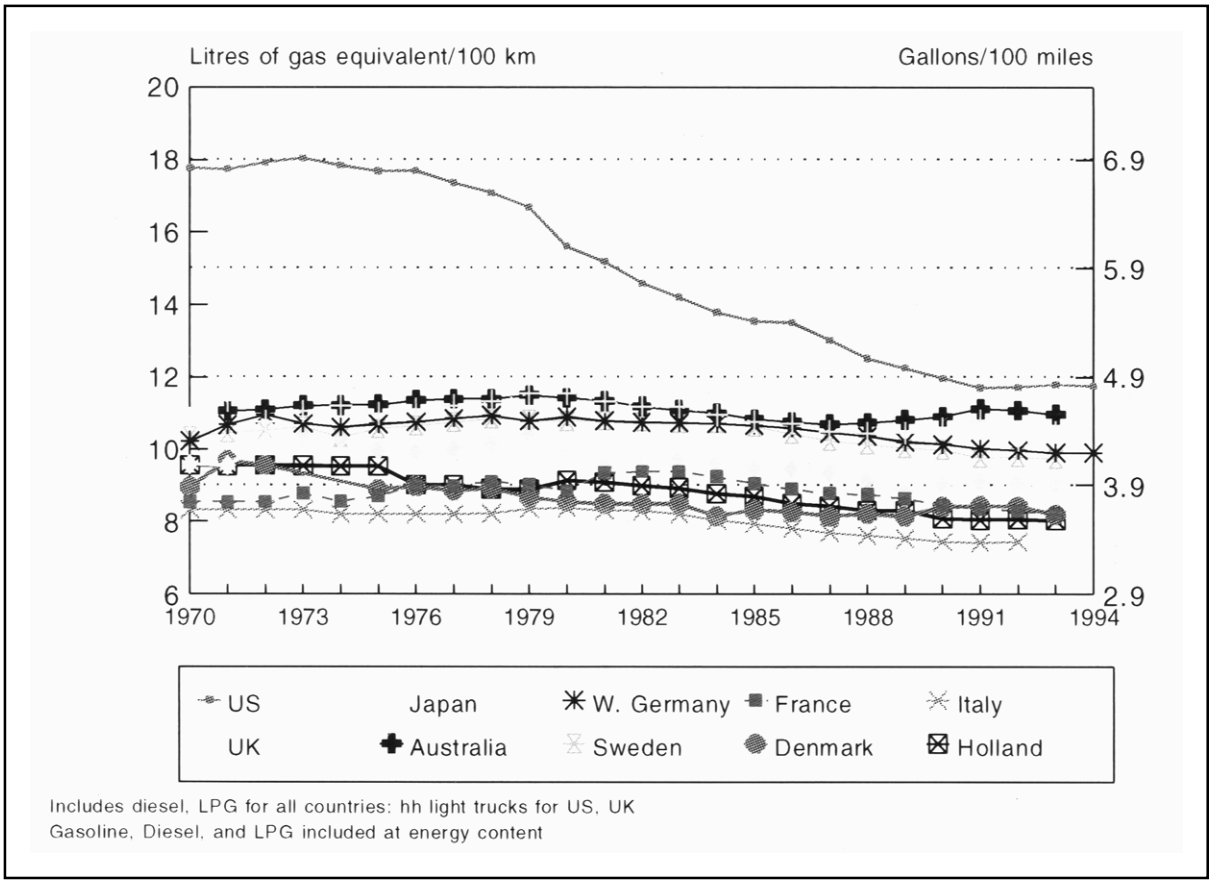

Figure 19-5. On-road fuel use per 100 kilometers by country.

Alternative fuels intended to decrease CO_2 release have also produced mixed results. We subsidize ethanol production from corn in the United States at the equivalent of 60–80¢ a gallon gasoline equivalent, about the wholesale price of gasoline itself. This ethanol is sold as a renewable fuel, but there is evidence that suggests that the gasoline and diesel burned on farms and in factories to produce the ethanol may lead to a greater CO_2 release—what I call "closet CO_2"—than if we simply used these fuels directly. Because of this subsidy in the name of renewable fuels and clean air, users see no incentive to change how or how much they use their cars nor to seek less fuel- intensive cars, all of which contribute directly to solving the problems that farm-based ethanol allegedly will mitigate.

This situation is unfortunately one of the grounds for my pessimism. The United States loves to promote "solutions" whose basis is entirely hidden subsidies. While I have some faith in alternative fuels (natural gas, ethanol from true biomass grown in forests) and in the potential for electric drive (such as Chrysler's recently announced gasoline-to-hydrogen fuel cell), I cannot see these alternatives succeeding as long as gasoline and diesel remain cheap—relative to the unpaid social costs of using them.

Another is that we are unwilling to price gasoline such that reasonable alternatives are cost competitive. As a result we get nowhere with establishing a viable alternative fuel market, and that is the experience worldwide. Strong market signals are

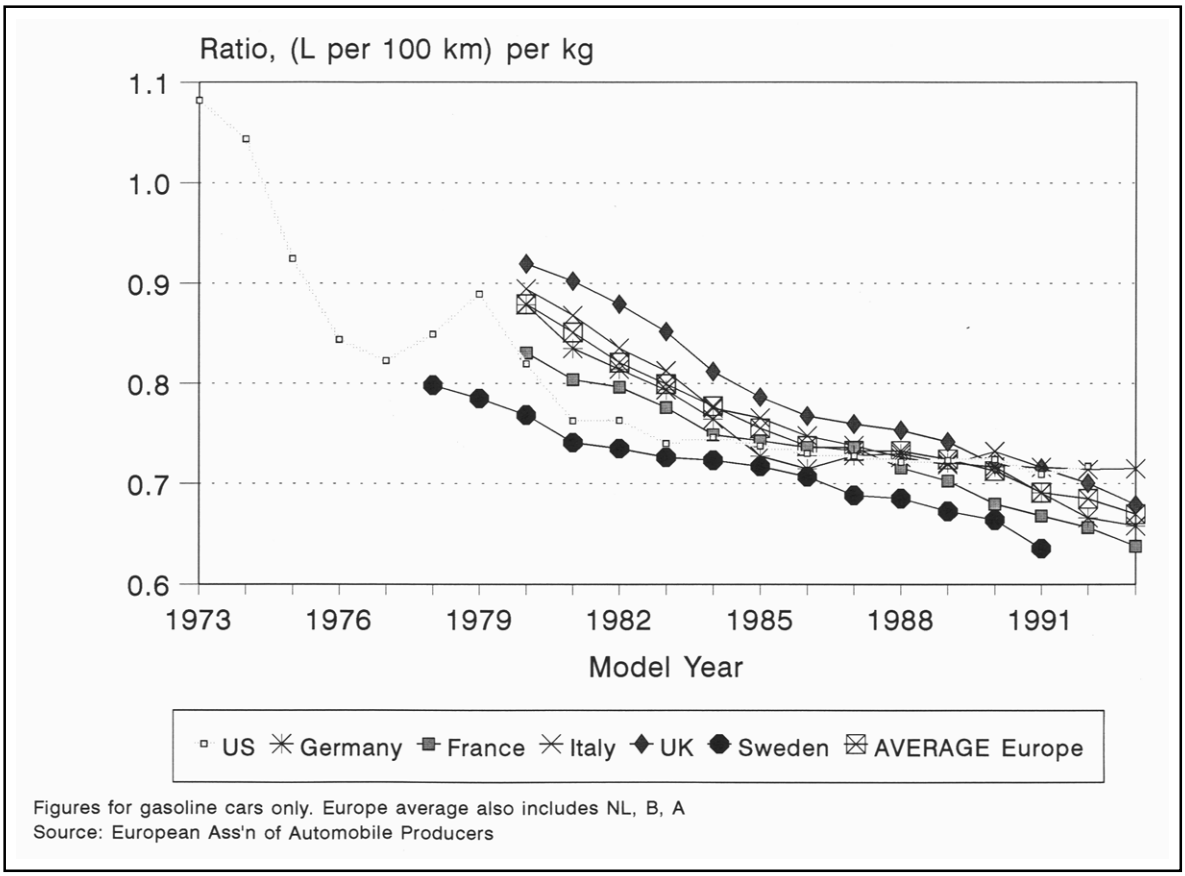

Figure 19-6. Test average fuel use per 100 kilometers per unit mass.

needed to provoke significant changes in which fuels we used, and how well we use them.

Fuel use for freight could also be restrained significantly. The biggest improvements in freight transport would occur if trucks were more fully loaded and traveled shorter distances. If the fuel costs rise, the cost of trucking will rise, and people will begin to choose closer suppliers because distant suppliers will think twice about offering free air and truck delivery overnight with the purchase of a $2,000 computer. However, it is important to note that in the last five years the United States has been reducing the energy and the CO_2 per unit of freight shipped.

With information technology reducing our need to travel, mobility could be reduced with no loss of freedom. On the other hand, information is probably the most important reason why we are getting richer, and so while we don't need to travel as much in order to make the money, we find that we are traveling a lot more when we want to spend the money.

In other words, without a major breakthrough in a no-CO_2 fuel like hydrogen produced from non-fossil or truly renewable sources, or a major breakthrough in the area of very, very low energy vehicles, we will not solve this CO_2 problem technologically. This is not to say that the Partnership for New Generation of Vehicles in the United States or the equivalent programs in Europe and in many European auto compa-

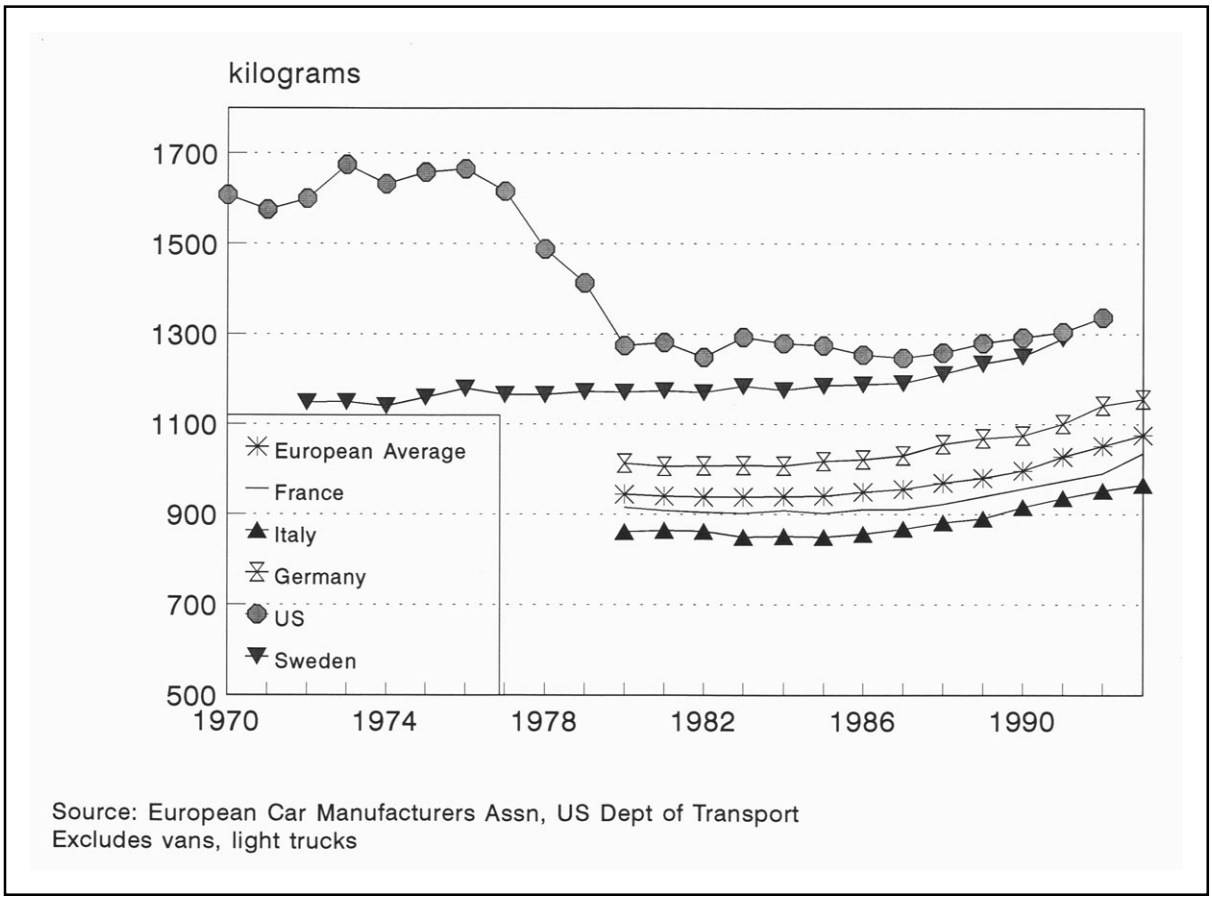

Figure 19-7. Average new car mass in Europe and the U.S.A.

nies might not succeed. But this is a gamble because in the past we have banked only part of our technology improvements as bottom-line lower energy or lower CO_2 .

Full-cost pricing

The U.S. approach to constraining emissions focuses on technology and not on behavior. Pricing as an important strategy is left out much to the consternation of the rest of the industrialized world. Indeed, on the other hand, all the European governments are now talking about full-cost pricing. What that means is the following: Consider the real health damage today from people breathing the air in Los Angeles. Based on disease rates, the resulting medical bills, and the fuel used, the health cost equivalent per gallon of fuel consumed is about 60¢ a gallon, very close to the wholesale price of gasoline in Los Angeles. Of course as cars get cleaner these costs will fall; in some regions the costs are minimal, too. Nevertheless the principle often repeated by the Organization for Economic Cooperation and Development, which houses the International Energy Agency where I work and from where this broadcast emanates, is "The Polluter Pay Principle": The most efficient way to deal with the pollution problem is to tax the pollution itself.

In other words, what economists have been telling us for decades is that we

should all be paying that 60¢ a gallon. Instead Angelenos pay a lot less. After all, Los Angeles, as a city, built what is called the "No Regrets Light Rail Line." It is called the "No Regrets" because I have no regrets if you take it to work! My benefit if you take the street car to work should compensate my share of the cost to build and operate it. It was paid for by a small gasoline tax. Nevertheless, if you calculate the costs to move a passenger on the "No Regrets Line", including all the capital costs, you get something like $8–18 per trip. So Los Angeles has said it is worth a substantial amount from collective general tax funds—$8–18 per trip—to get someone to take a streetcar, presumably to lessen congestion and to improve health and safety conditions, but no one is willing to burden automobiles directly with these costs.

Is that the value to Los Angeles of reducing car trips? How many of the new users would otherwise have taken their cars? Imagine if each person using a private car had to pay this extra "declared value" of, say, only $8 to use the car (roughly what a day's parking costs). Certainly some would be deterred from driving, and would walk or take public transportation; over the longer run, others might relocate. The point is not that everyone or even a majority would change radically, but that significant changes would occur. After all, even a 10% shift out of cars to busses or the "No Regrets" line would essentially double the share of non-car trips to work in Los Angeles. Done on existing lines, this would improve transit incomes enormously!

Full-cost pricing is not easy. Although Europeans do not really know exactly the equivalent costs of externalities, they know that these are considerable and that users of cars, trucks, and other transport modes should pay for these common-subsidy benefits. Indeed, it may be that gasoline is too heavily taxed in Europe, while kilometers driven are under-taxed. And your car insurance? I would argue that at least half of that is proportional to how much you drive, yet most pay a fixed sum for collision and liability. If my own collision and liability premiums were expressed on a per kilometer basis (about 3¢/km) and then converted at 30 miles per gallon to an equivalent per gallon basis, they would come out to a "tax" of nearly $1.50 a gallon! So distorted is our way of paying for transportation today.

With these kinds of distortions, I believe we need a more price-responsive transport system. The potential changes are large. So to me, full-cost pricing (or even partial external-cost pricing) is one of the first steps in constraining CO_2 emissions, but we all know that this is almost impossible to bring about. For example, several years ago local authorities proposed an experiment for the Oakland–San Francisco Bay Bridge in California, to charge a higher toll at peak traffic hours to encourage car pooling and better distribute the bridge usage. Makes sense, doesn't it? It took two years to find a state legislator who was willing to sponsor the legislation.

And look at how the airlines protested when the government wanted to raise landing fees and other collective costs of using airports, indignant that the traveler should have to pay for the costs he or she incurs. In America, in particular, there is a strong aversion to using pricing to influence transportation patterns.

We prefer administrative measures, but these are very easy to thwart. In France just before the election, everybody is exonerated for their unpaid parking tickets. In the United States we force large companies to institute carpool programs in clean-air nonattainment areas. To meet their 20% reduction targets, some companies suggest employees go to a four-day work week; but then employees drive as much or more on

the fifth day, not the responsibility of the company.

Consider HOV (high occupancy vehicle) lanes. If you calculate their cost, make a liberal estimate for the number of new carpools they attract, presume all of these represent formerly single-drivers, and take into account the slower traffic the remaining drivers face, you get the "No Regrets" system providing some pollution and CO_2 relief at very high costs per gallon saved. But local communities pay very little for these HOV lanes; federal funding, aka pork barrel, provides the bulk. This is hardly a way to engineer a slow but deliberate path to a low-CO_2 transportation system.

The good news is, if we mature enough to do transport policy right, then we can deal with CO_2 rather easily, because the kinds of things that make sense to defeat congestion and pollution will change transportation modes, change vehicles, change fuels, and even change lifestyles. Why? Because if we had to pay what it really costs to get into the city at rush hour, or to spew out all that dark smoke, we would make other choices about how you travel. Every time this sort of experiment is run, whether it is in a rich country or a poor country, we always see big changes. Most see the hidden costs of CO_2 as small compared with other externalities. In the United States, that means if we shed our fears of using pricing as a primary (but not exclusive) instrument in dealing with transportation problems, we are likely to see substantial long-run reductions in total traffic and fuel use over what we'd otherwise expect for reasons related solely to direct transportation costs and problems. This could give us as much as a 20% reduction in emissions from cars and trucks even before we consider making vehicles themselves more efficient and looking for fuels with lower CO_2.

United States needs to lead

The United States generates the most CO_2 per capita from transportation of any nation, although other countries are rising and transport's share of CO_2 generation is rising everywhere (Refer back to Figure 19-1). The United States also leads the world's energy and automotive industries. Therefore we must lead in attacking transportation and CO_2 problems. There are responses to this situation. The World Energy Council has analyzed incentive scenarios that might actually reduce automotive CO_2 by a factor of 50 or 60% from our 50-year projections. The problem is not that we don't know of mechanisms and technologies to stabilize or reduce CO_2, it is that we have no feedback in our economic systems to do so. We have no social feedback; nobody cares enough to want to do so. Only in the Nordic and some European countries are they beginning to tax CO_2 and tax driving more. Car makers are looking at low energy cars and low carbon fuels, but there is no market for these yet, partly because 12 years ago we were paying 2.5 times more in real terms for fuel than we are today. In 1981, the Ford Motor Company thought that by 1985, they would selling 35 mpg cars. But the price of fuel crashed. German auto makers and (unilaterally) Volvo have made pledges to reduce by 25% fuel use per kilometer in the cars they sell. The Danes have proposed a graduated yearly car registration fee that rises with car fuel consumption per kilometer.

The trouble is, of course, that everybody is waiting for the United States to act. Fuel costs four times in Paris what it costs in the United States. Europeans were incredulous that we thought to use the strategic petroleum reserve to compensate a 20¢-per-gallon price increase and strongly rejected gas taxes of a few cents per gallon. Our

squabbles over the Clinton gasoline tax of a few cents per gallon, or the Bush proposal of 9¢ per gallon in 1990 were viewed by Europeans as ludicrous. I remember one day in 1993 when the Ministry of Transport in Estonia asked me whether they thought that a tax of 20¢ (U.S.) per liter on gasoline (at the time there were no taxes) was reasonable, given that such taxes at the time ranged from 25¢ per liter in Poland to 75¢ per liter in most of Western Europe. Given the purchasing power of the Estonians at the time and the differences in the real value of currencies, this tax was more like 40¢ per liter or $1.60 a gallon to Americans. That very day in the United States, our Senate rejected a tax proposal of slightly under 8¢ per gallon. I was ashamed.

That is really the challenge for the United States and the reason that I am so worried. The solutions, be they technological or social or economic, are all there, but if I look back over 20 years at the way we have reacted to the energy problems, I am worried that we really don't have the internal consistency to be able to take those solutions. I hope things change, but I am pessimistic that our sociopolitical systems are capable of solving this problem. Carbon dioxide need not be an environmental threat, but the inability of the United States to take it on suggests that only after CO_2 has become a major problem, i.e., when it is almost too late, will the United States act.