Environmental Protection in a Knowledge-Based Economy

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Economic theory solved most environmental problems forty years ago. The simple solution was to either establish tradable property rights for environmental goods and services or to price these goods and services. For instance, urban pollution would be reduced to socially desirable levels by charging polluters different amounts based on time of day, location and nature of the emission. Similarly, power plants would pay time of day emission fees, automobiles would pay emission fees based on where and when they are operating.

As is often the case, what works in theory does not necessarily work in practice. There are two fundamental problems in translating into practice the theoretical prescriptions for solving environmental problems. One is distributional. Often, the burden of environmental control – what economists call the incidence – falls disproportionally on segments of the populations, often the poor. The most polluting vehicles are often the oldest and least maintained – and often owned by the poor. Or certain industries (employees and owners) may bear much of the cost of cleanup. For instance, coal-reliant countries ultimately must take more stringent measures to reduce greenhouse gases than natural gas-reliant countries, all other things being equal.

A second issue concerns monitoring. In order to levy emission fees or to enforce property rights for pollution, it is necessary to monitor emissions. The easiest sources to monitor are the large sources of pollution discharging through a few outlets, such as a power plant with a single stack. But even for these sources, monitoring requires measuring pollution levels and auditing the monitoring. Monitoring emission levels from smaller, more diffuse sources, is very difficult. Automobiles are a case in point, as are emissions from small industries in an urban area and agricultural runoff in rural areas. It is not that monitoring is impossible – rather it is that the cost of monitoring small sources is just not justified: exclusion is just too costly. This is one reason for the preponderance of technology-based standards for polluters. It is easier to observe whether an automobile has emission control equipment installed than it is to observe the emission level on a continuous basis.

The rise of the knowledge economy has had little effect on the distributional consequences of regulations to control emissions. But on the second issue – monitoring – the rise of information-based technologies has had important effects and the promise is of dramatic impacts. The cost of exclusion is dropping dramatically. A list of examples is instructive.

Road congestion is a major problem around the world, although not strictly an environmental problem. The economic dimension of road congestion is that roads are open-access congestible public goods and we expect many open access resources to be over-used. Controlling access to roads, particularly urban roads, has been very difficult. Tolls can be levied on limited access thoroughfares but collecting tolls is very costly, both in terms of the manpower

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involved in collecting fees and in terms of congestion at toll facilities. However, information
technology is beginning to solve this problem. Automatic toll collection is in place on many
roads around the world – transponders are located in cars and charges are levied as cars pass
certain points. On some roads (such as a motorway in Southern California) the charge varies by
time of day, based on the level of congestion. The recently instituted charge for cars entering
Central London has received a lot of press, primarily for the way in which the fee will be
collected – using automatic number plate recognition technology. Cameras will record the
license plates of cars entering the central zone, computers will “read” those license plates and
identify the owners. Owners will independently pay for their day use of the city. Those who do
not pay will be identified through the license-plate reading and sent fine notices. Thus the whole
process is automated.

Another automobile-related example has to do with emissions from cars. Two
technologies have emerged to help solve the problem of monitoring these emissions. One is the
ability to remotely measure the discharge from an automobile tailpipe as the car is in motion,
using laser-based remote sensing. Although this is not currently used for routine monitoring of
emissions (as far as I know), the potential is great. Another development is the widespread
adoption of emission testing in many parts of the world. In my home state of California in the
US, all automobiles must be tested every two years and the emission rate for several pollutants
entered into a master database. The only data missing which would permit computing annual
emissions for each vehicle is data on the distance a vehicle travels. Tamper-proof odometers
should not be that difficult to require for vehicles. The implication is that charging vehicles for
the pollution they emit is technological at hand.

For stationary sources, one of the innovations of the 1990 amendments to the air
pollution statutes in the US is the market in emission rights for sulfur dioxide. One of the fears
of opponents to markets for emission rights was that cheating would be too easy. Although that
is debatable, the legislation put the fear to rest by mandating the installation of continuous
emission monitors on the smokestacks of sources participating in the market. Although not
cheap, such monitors are another product of modern technology.

In sum, a great obstacle to using economic solutions to use of the environment has been
the difficulty of monitoring emissions. The knowledge based information economy has great
promise for solving this problem. The progress that has been made is impressive and the
prospects are very bright.

Let me end with a personal example of the knowledge economy at work, an example
germane to my being here at this conference. The carbon dioxide emissions associated with the
Lufthansa flights that I took to Delhi are outside the Kyoto Protocol or other regulations on
greenhouse gas emissions. However, the internet allowed me to easily purchase an offset for the
emissions from my flights. By visiting 500ppm.com, a web interface informed me that my share
of the emissions from my 14,264 mile return trip from Boston would be 2.9 tonnes of CO2
equivalent. The website also offered me an offset to these emissions at a price of $13 per tonne,
including a $5 administration fee to assure that the offset was legitimate. I paid $40 for the
offset, which is an electricity generating facility somewhere in India using chicken waste as fuel.