

# **Environmentally and Economically Damaging Subsidies: Concepts and Illustrations**

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# **Environmentally and Economically Damaging Subsidies: Concepts and Illustrations**

**Carolyn Fischer and Michael Toman\***

## **Introduction**

A common adage in environmental policy discussions is that there are substantial opportunities for improving the environment and the economy through elimination of various subsidies that distort the decisions made by producers and consumers. Several publications in the past few years have addressed this claim, and it figured prominently in the recommendations of the President's Council on Sustainable Development in 1996. That body called for a systematic review of both expenditure and tax policies by a national commission to ferret out such dually unproductive elements.

Energy subsidy reduction has become an important component of the debate over the economic burden of greenhouse gas (GHG) emissions and the policies that should be pursued to reduce these emissions. If there are substantial subsidies that excessively encourage the use of fossil energy, then reduction of these subsidies would generate GHG savings at a negative cost – society as a whole would benefit in terms of improved allocation of scarce resources and in terms of reduced local environmental burdens.

If there is one thing on which economists agree, it is on the elimination of subsidies that reduce economic efficiency. However, economists view both subsidies and economic efficiency from a perspective that is a little different from the common usage of these terms. For example, the failure to address environmental spillovers in energy pricing is a source of inefficiency from an economic perspective; yet it does not necessarily follow that elimination of this implicit subsidy would increase economic performance as conventionally defined. In other words, elimination of economically inefficient subsidies may still involve tradeoffs between environmental values (including climate change mitigation) and conventional goods in many

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cases. Identifying subsidies that harm both the environment and the economy also gives rise to several tricky methodological questions.

We address these issues further in the balance of this paper. We first discuss the definition of subsidy in somewhat more detail. Then we discuss some challenges that arise in measuring environmentally and economically damaging subsidies. We provide several illustrations of energy-related subsidies that seem clearly to be economically inefficient, but we note that in several cases the environmental benefits and GHG implications of their removal are unclear at best. We also discuss subsidies intended to promote environmentally desirable outcomes.

### A Working Definition

A good working definition of environmentally damaging subsidy for our purposes must start with the general concept of economically inefficient subsidy, then progressively narrow the scope to identify more concrete meanings. Broadly speaking, an **inefficient subsidy** of a good or service occurs whenever its price does not correspond to the overall cost to society of producing and consuming a little more or less of the good or service. In such a case, society as a whole necessarily can be made better off in broad terms by correcting the subsidy.

There are several features of this general definition that warrant emphasis. A key focus in this definition is on subsidies that *change behavior* by altering relative prices of goods and services, as opposed to pure income transfers. As we discuss below, thinking about subsidies in terms of the effects of price changes on behavior can lead to conclusions that are very different from an accounting definition that simply divides a total payment or tax benefit by the amount of observed activity to determine an average. The relevant calculation from an economic perspective is a *marginal* one—how a change in price alters behavior.

In terms of scope, the general definition of subsidy is broad enough to encompass subsidies to producers that inflate prices as well as subsidies to consumers that lower prices. It also is broad enough to encompass the provision of public goods that the market cannot offer well (like urban infrastructure), as well as distortions in the pricing of private market goods and services (but see below for important caveats on this).

At this most general level, the concept of subsidy includes the failure to internalize environmental spillovers that result from unregulated market decisions, as well as more direct

### **Box I: How Subsidies Work**

Subsidies, in this context, are transfers to a particular group, based on certain characteristics or actions (for example, small oil producers or resource depletion). Unless bestowed in an unconditional lump-sum form, subsidies change the effective cost of a good. Some subsidies have a direct effect in the short run by changing the marginal cost of a good (for example, tax credits for ethanol). The result is that producers are willing to accept a price lower than the actual cost of production, because the subsidy makes up the difference (or, alternatively, consumers are willing to pay more because the difference will be rebated). After markets adjust, some of the subsidy will be passed on in the form of lower prices to purchasers and an expansion of output. (Or some of the rebate will be passed back to producers as a higher price; in either case, producers are receiving more and consumers paying less on the margin.)

The incidence of a subsidy depends on the relative elasticities of supply and demand: Even if the producer is the transfer recipient, if demand is relatively inelastic (unresponsive to price changes), the subsidy will operate mostly to benefit consumers through lowered prices. On the other hand, consumers may receive a tax credit for purchasing, say, energy-saving durables, but if supply is inelastic, most of that subsidy would be passed on to suppliers as consumers bid up prices.

Other subsidies lower the fixed costs to firms of producing a good: examples include subsidies to start-up costs like oil exploration, R&D, or building a nuclear power plant. Once paid, these types of subsidies are "sunk" and generally do not affect short-run decisions involving the current marginal cost of production. However, if they continue to be offered in the long run they can affect decisions to enter or exit the industry and affect long-run average costs. In the long run, supply tends to be elastic, and the subsidy primarily purchasers.

Although certain groups benefit from subsidies, society as a whole loses from those policies, unless they serve to correct a pre-existing market failure. Efficient resource allocation requires prices to equal marginal costs, and minimum average cost in the long run. Subsidies distort relative prices and shift the allocation of resources away from more productive sectors in the economy. Subsidies can also exacerbate pre-existing efficiency losses, such as when they are funded by government revenues raised through distorting labor income taxation.

subsidies with environmental side effects. De facto subsidies from noninternalization of environmental externalities may be quite substantial, though uncertainty and controversy continue to surround estimates of such subsidies. As already noted, however, such subsidies do not present the same set of "win-win" opportunities as more direct subsidies. The latter subsidies may make it possible both to reduce environmental damages and also to increase market efficiency in the narrower, more conventional sense.

In what follows we first distinguish subsidies according to the deliberateness of the underlying policy. An *active subsidy* is created by the presence of government policy and causes financial resources to flow directly or indirectly from government to private actors or among private actors. A *passive subsidy* stems from the absence of a policy to correct "externalities." We can define an **inefficient active subsidy** as an active subsidy that reduces economic inefficiency.

Active subsidies can flow through any of five possible channels. **Direct payments, provision of in-kind services, and tax preferences** all involve the government budget directly. Although the latter form may seem less direct, the foregone revenues from tax preferences represent real costs that must be made up with higher tax levies elsewhere in the economy. All three methods reduce the cost of the targeted good or services, benefiting both producers and consumers, but harming overall taxpayers. The last two channels do not involve directly traceable government expenditures or tax benefits but nonetheless convey benefits of substantial value to a favored few.

**Trade preferences** (like the sugar import quotas) and **regulatory mandates** (requirements that certain products or technologies be used) raise revenues for suppliers by limiting market alternatives. Unlike the previous examples, consumers of the protected products do not share in the benefits of the subsidy: rather, they shoulder the burden through higher prices instead of the taxpayers paying higher taxes.

In this paper we consider **environmentally damaging active subsidies**, those economically inefficient active subsidies which also have negative environmental side effects. To illustrate first in a non-energy context, one example would be government outlays in support of timber harvesting that are not justified on economic or environmental grounds, even when multiple use benefits (e.g., greater recreational access) are taken into account. The sugar import control program is another important example; this program roughly doubles the US cost of sugar relative to the world price, putting an unwarranted floor under other sweetener sources as well (e.g., sugar beets), and protecting ongoing sugar plantation output that damages the

environmentally sensitive Everglades. Where such subsidies have significant effects on economic behavior and the environment, neglecting them overstates the cost of environmental protection. However, the importance of subsidies in practice often is a complicated empirical question, as discussed below.

While our main emphasis here is on active subsidies with negative environmental consequences, it is useful to subject to similar scrutiny active subsidies that attempt to provide environmental or other social benefits. A subsidy is not inherently inefficient; it may serve to correct some existing market failure. In practice, however, the existence of unrealized environmental or other social benefits does not in and of itself offer a compelling argument for subsidization. Subsidies usually are inefficient policy tools since they stimulate efforts to expand eligibility ("rent-seeking" behavior) and they are usually not well targeted to address the problem (e.g., tax breaks for open space preservation may not discriminate well in terms of importance of land area or economic circumstances of the landowners). They can also be quite costly compared to the behavior induced: while some recipients will change their behavior to receive more of the subsidy, all qualifying actions that would have occurred anyway will also be rewarded.

### Challenges in Identifying and Measuring Subsidies

Several questions come up in practice in evaluating environmentally damaging active subsidies and their consequences. Before one can determine the magnitude of subsidy effects, one must first identify which portions of which subsidies may be inducing environmentally damaging behavior. A prime example of a common error is seen in evaluations of how government support for the development of different technologies may adversely affect the environment. Average historical subsidies are easy to calculate—one merely aggregates cumulative budget outlays or tax expenditures for a new technology and divides that sum by the cumulative output from the technology in question (say, a power generation technology)—but the resulting ratio in no way reveals a current, policy-relevant subsidy of the unwanted output or technology.

In fact, all past expenditures are *irrelevant* for current subsidy assessments, except insofar as they determine the baseline against which changes in current and future activity are measured. What's done is done; the relevant question instead is what public expenditures are occurring today, and how these expenditures might increase unwanted activities today and in the future. In the case of government technology expenditures, the question is how today's support for R&D might be affecting the development and penetration of technology with unwanted environmental

side effects by lowering its cost. Note that this calculation inherently involves not just incrementalist reasoning (versus calculation of averages) but also the need for difficult counterfactual estimation.

This baseline problem is complicated by the introduction of other externalities that may be improved by the subsidy. Suppose, for example, the inability to patent the results of basic R&D means that the government supports research that also leads to the development of profitable but environmentally damaging technology. This support of R&D is a response to a nonenvironmental market failure and does not represent an environmentally damaging subsidy. But ongoing government support for the development and commercialization of the damaging technology arguably is an environmentally harmful subsidy (especially since private markets seem reasonably capable of undertaking profitable technology development and diffusion without government help).

Just as subsidies for other externalities can indirectly induce environmental damage, so can the subsidization of goods that are used in concert with environmentally damaging goods. With respect to the fees charged to road users, for example, there is debate about whether light-duty motor vehicles pay appropriate rates relative to those paid by heavy trucks, as well as debate about whether road fees generally are too low. In either case, the environment would be harmed not just by the subsidization of travel per se (which might, for example, increase noise and accidents), but also by policies that can encourage environmentally damaging energy use. Policies that affect energy use by affecting land use (for example, deductibility of home mortgage interest that encourages larger dwellings, and policies that encourage exurban development) may also stimulate energy use and put pressure on inadequate water infrastructure.

Important practical problems arise in detecting subsidies when looking at the pricing of public goods like roads, or the regulated pricing of "lumpy" services (including some utility services like electricity transmission, for example) where fixed costs are high relative to variable costs. In practice, the most economically efficient approach to pricing such services involves a variety of departures from pure short-run marginal-cost pricing. Subsidies in the provision of lumpy services need to be calculated against this baseline—no mean feat in practice, given the difficulty in identifying so-called cross-subsidies (the portion of the price premium attributable to the costs of providing production capacity).

Additional problems in evaluating subsidies in the provision of public goods occur where there are many different types of beneficiaries. For example, the benefits of an urban road network generally fall to property owners, not just to drivers. If road building and upkeep are

paid through property taxes, road use may not necessarily be subsidized. The question is whether users in each group are paying the right amount. Of course, efficiency would require drivers to pay for their marginal impact on road maintenance costs, as well as congestion and other externalities; however, the amount of this complicated array of costs has little to do with general road construction costs and the accompanying benefits.

Thus, the magnitude of the relevant subsidy is sometimes as difficult to estimate as the magnitude of the environmental impact. For many of the same reasons just cited, the total expenditure on a subsidy is a poor indicator of the amount inducing a behavioral reaction and thereby the amount of harm. In other words, by determining the direction of the behavioral response, one can identify a "win-win" situation; however, the size of the "win" in terms of greater economic efficiency and less environmental degradation is harder to pin down. The bottom line is that the easiest environmentally harmful active subsidies to identify are those that involve more or less conventional market goods and services, without too large a fixed infrastructure component, and which benefit a well-defined subset of consumers or producers.

While we have been addressing subsidies with environmental harms, we again need to consider ostensibly "good" subsidies as well.

In addition to the general problem of long-run inefficiencies induced by subsidies, in cases where good behavior cannot be directly targeted, costly and even perverse results can occur in the short run. Consider, for example, the ubiquitous use of subsidies to promote better land management or agricultural practices with less damaging offsite effects, in lieu of trying to punish bad management. In some cases it might be argued that inducements are useful, or at least necessary, because of difficulties in directly monitoring bad behavior (for example, agricultural pollution from smaller "nonpoint" sources) or because part of the problem lies in polluters lacking adequate information, which the government can help supply. However, it may be equally hard to monitor good behavior and thereby decide whether the effects of subsidies intended to improve the environment are working, or working cost-effectively. Well-intentioned but poorly targeted and supervised subsidies could even encourage environmental damage. For example, a land preservation or greenhouse gas policy could create an incentive to deforest land prematurely or excessively in order to gain eligibility for a reforestation credit.

## Some Illustrations from Inefficient Energy Subsidies

### *Environmentally Damaging Energy Subsidies*

All fossil fuels give rise to emissions of carbon dioxide, a greenhouse gas. Local environmental damage from energy use comes from two main sources: end-use combustion, primarily in the form of gaseous emissions, and production byproducts, such as effluents, leakages, accidents, spills, and reclamation costs. Any subsidies encouraging production increase the latter type of damage; however, only subsidies that lower the cost of energy use affect GHG emissions and local damages from energy end-use. For example, subsidies to domestic oil production will increase oil-related wastes, but since the price of oil is largely determined on the world market, such policies are unlikely to lower domestic prices and increase end use. On the other hand, if coal prices are largely determined domestically, coal subsidies could lead to lower prices and more domestic coal combustion. By the same token, policies that protect domestic high-cost energy supplies from foreign competition (as has occurred in Germany) will discourage the use of that type of energy. Nor are production subsidies the only culprits: subsidies to goods consumed in concert with energy can increase both combustion and, to the extent that producers respond to higher energy prices with increased supply, industrial byproducts.

As described in more detail in Box 2, one can identify in the US several environmentally harmful active subsidies in the sense defined in the previous section: no economic justification for the subsidy is apparent, so eliminating it should enhance overall economic performance, and its removal is likely to provide at least some environmental benefit. Several examples involve tax preferences for US fossil fuel producers, such as extra tax write-offs for oil and gas depletion, preferential tax treatment of royalty income, and exemptions from passive loss write-offs, as well as tax-preferenced financing for various governmental or quasi-governmental entities supplying electricity. Others involve in-kind transfers like below-market mineral rights leasing. Still others involve potential subsidization of goods and services used in concert with energy, like roads, whose magnitudes and consequences are more controversial. Again, only some of these subsidies encourage increased energy end-use and GHG emissions. Finally, while some analysts include past expenditures or tax benefits for R&D in current subsidy calculations, we argued above that only current outlays that affect current and future energy decisions are relevant.

**Box 2: More Detail on US Energy Subsidies***Subsidies to Primary Energy Supply*

Tax preferences are a common form of subsidy, though less transparent than direct forms. Such preferences distort the allocation of capital and raise the cost of public budget finance by requiring higher tax levies elsewhere in the economy. When a whole sector benefits from some tax credit not available to the rest of the economy, it makes sense to check for any justification in terms of offsetting other tax distortions and, if not, label the preference a subsidy. Several examples are present in the energy sector.

The easiest tax expenditure subsidy to target is the **Percentage depletion provision** (\$840m in 1999 for fuels): rather than deducting cost depletion, producers can elect to deduct a certain percentage of gross income from resource production, 10% for coal and 15% for oil and gas. (However, the oil and gas provision is limited to smaller independent producers). This option has no discernable economic justification, not even compliance simplicity, since taxpayers still have to calculate their cost depletion to figure which one is greater. (Cost depletion, while not quite true economic depreciation, is at least comparable to the treatment of other capitalized assets in the tax code).

Individual owners of resource properties have additional special tax breaks. Individual owners of coal leases have **preferential tax rates** (\$50m in 1999): their royalty income is taxed as capital gain. As these rates are being lowered, this subsidy will increase. (Owners who elect this option cannot take the percentage depletion provision. Both preferential treatments should be eliminated simultaneously to avoid shifting between subsidies.) Working interests in oil and gas properties are granted an **exemption from the passive loss limitation** (\$50m in 1999), meaning excess losses can be used to offset ordinary income rather than being carried over to offset future passive losses.

Some analyses argue that **applied technology development expenditures or tax breaks** constitute subsidies, in that with a patent system these technologies (unlike basic research) will be adequately rewarded in the market place. Conceptually this argument seems correct. The problem is in estimating the subsidy. Total expenditures or some calculation of average expenditure per output are not accurate indicators of the level of behavioral impact. The appropriate question is: how much less is the cost of energy supply today because of an unwarranted technology development expenditure in the past? And, looking ahead, to what extent are today's technology development expenditures subsidizing future energy production? These questions are inherently hard to answer. Nevertheless, we can say that government support for technology development the market could have handled is economically unwarranted and may also put pressure on the environment.

Some other, less obvious production subsidies also exist. **Below-market leasing of mineral rights** on federal lands has no economic justification. The environmental harm resulting from these leases is not easy to estimate, however. Firms will still have an incentive to plan the timing and intensity of resource development and extraction to maximize the market

value of output. Of course, favorable terms could cause sites that have greater value in an undeveloped state to be developed. The economic harms are more recognizable: by depriving the government of revenue, the leases require greater revenue generation elsewhere in the economy, with the resulting economic distortions. **Infrastructure investments**, such as port and railway building and maintenance, may have other public-good aspects, but nonetheless lower transportation costs for fossil fuel producers. Unless beneficiaries of these investments shoulder the burden of financing them, the resulting lower transportation costs will stimulate fossil fuel production.

#### *Subsidies to Primary Energy Demand*

An important category of subsidies to primary energy demand, but one that is declining in importance, involves electricity generation. **Tax exemptions for interest on state and local bonds** help finance large capital investments for public utilities. Cooperatives are exempt from income tax as non-profits and are eligible for low-interest loans from the **Rural Electrification Administration**. Power Marketing Administrations are able finance their debt at rates through the Treasury on favorable terms. All these policies lower the cost of electricity production, thereby stimulating electricity demand, which in turn leads to more purchases of primary energy sources to produce electricity. However, as wholesale electricity markets become more competitive, the effect of these subsidies on electricity prices will diminish in importance; they will simply reflect local windfalls. Moreover, direct subsidies for capital financing have been reduced over time.

Other potential demand-side subsidies involving transportation and land use are even more controversial. Automobile use (and thereby fossil fuel use) is encouraged by grants to states to develop and maintain roads and highways. Notwithstanding the public goods and safety aspects of highways, many see this form of financing as a subsidy. However, the magnitude of the subsidy is very difficult to estimate in practice, especially when one takes into account that the costs of road congestion and overbuilding are to a considerable extent borne by drivers (though environmental side effects are more broadly borne). A more straightforward subsidy is the tax preference employees can enjoy from use of employer-provided parking, when benefits for offsetting the cost of mass transit use are more limited. Another controversial item is the tax preference for home mortgage interest deductions, which some have argued causes people to purchase larger, more energy-consuming dwellings that may also be further from urban centers.

Another example is various tax expenditures for alcohol-based motor fuels, including an exemption from gasoline excise taxes and a tax credit for small ethanol producers. These tax breaks provide very limited local environmental benefits at best, since they chiefly displace cheaper substitutes in the market for fuel blenders. Corn-based ethanol also is a questionable means of reducing GHGs, once one accounts for the fossil fuels used in cultivating and processing the feedstock. Meanwhile, they reduce tax revenues by several hundred million dollars per year (revenue losses in 1998 and 1999 are estimated to be \$720 million and \$750 million, respectively; projected future losses exceed \$800 million per year beginning in 2001).

Moreover, it should be emphasized that the magnitudes of environmental benefits that might result are uncertain, and may be relatively small in a number of cases. Part of the reason is that subsidies to oil producers have relatively little effect on world oil prices, so eliminating them will do little to discourage energy use. The greater opportunity for environmental improvements may lie outside the scope of our definition in this paper, in which one seeks to restrict harmful environmental byproducts of energy production and use to achieve environmental benefits even though there are likely to be real economic costs of doing so as well.

### ***Energy Subsidies for Environmental Goals***

A number of tax expenditure items in the US are related to various renewable energy sources. The largest is the tax credit for ethanol fuels and exemption of these fuels from excise taxes. This item is a prime example of our earlier caution concerning the use of subsidy policy for environmental improvement. A number of analyses have shown that this policy generates few if any environmental benefits: when one takes into account the fossil fuels used in cultivation and processing, the net greenhouse gas savings from corn-based ethanol are small at best, and the environmental advantages of ethanol in reformulated gasoline are at best controversial. The primary beneficiaries of this policy are ethanol producers who benefit from a subsidized demand for their output, and to some extent Midwestern farmers who experience marginally firmer markets for their crops with the program.

Another example of a tax subsidy related to promotion of environmental goals lies in the 1997 Taxpayer Relief Act, which extended (though not to full parity) current tax preferences for employer-provided parking to other transit benefits. Doubtless this policy will serve to encourage some shift toward more environmentally friendly travel. In this way the subsidy differs from the corn ethanol example. But the larger question is why there are tax-preferenced forms of employee compensation that give rise to the need for such adjustments.

Beyond these more or less easily quantified tax preferences, numerous regulatory programs or proposals can or could affect energy use. The Energy Policy Act requires improved appliance efficiency and greater use by the government of certain kinds of products (like alternative transportation fuels). Such regulatory mandates raise demand for the favored goods (energy-saving parts or alternative fuels) with the effect of creating an implicit subsidy to producers. A number of proposals are circulating that would require electricity producers in a more competitive, restructured marketplace to supply at least a minimum fraction of their power using some kinds of renewable technologies. (More flexible versions of this "generation

portfolio standard" would allow some companies to fall below the threshold if they paid other companies with a comparative advantage in renewables use to go above the threshold.) This mandate would provide an implicit subsidy to renewables and also an implicit tax on nonrenewables, since additional generation from a nonrenewable source must be accompanied by a certain additional amount from a renewable source.

The question is, what if any justification might there be for such policies—and are there better alternatives? The fact that renewables might be environmentally friendlier in some cases does not in itself justify a mandate. (Of course, in other cases renewables may not be so friendly overall: for example, biomass burning generates particulate matter, and hydro projects create controversies over land inundation.) Mandates are poorly suited to distinguish differences within the targeted groups: all renewables are not equal in their actual environmental consequences, nor do all nonrenewable energy sources have identical emissions characteristics. The more efficient approach to pollution control would be to levy policy sanctions directly against pollution or greenhouse gases, thus making cleaner technology choices more attractive. Some analysts have argued that other market failures call for more intervention in energy markets. One argument is that renewable energy technologies need government protection for "market creation," in order to overcome market inertia or achieve scale economies. Another assertion is that the market's choices regarding energy efficiency are flawed (for example, tenants may not have adequate incentives to invest in energy efficiency or may not even pay for energy separately from the lease payment). Sorting out what are legitimate market failures in these cases is complicated, and it remains the subject of ongoing research and debate. Generally speaking, however, policies that most directly target the problem are most efficient. Mandating or protecting certain technologies is almost always less efficient than penalizing pollution or greenhouse gases, as the latter will also create incentives for developing and using cleaner technologies and induce changes in institutional and contractual arrangements that impeded energy efficiency. Any specific instances of market failure related to the development and diffusion of renewable or energy efficiency technologies are also best tackled directly (for example, through information and demonstration programs).

### **Environmentally Damaging Subsidies in Developing and Transitional Countries**

Whereas the scale of environmentally damaging subsidies in the US and other advanced industrialized countries is somewhat unclear, it has been almost an article of faith that massive subsidies exist in developing countries. The International Energy Agency estimates that in the eight largest countries outside the OECD (China, India, Indonesia, Iran, Kazakhstan, Russia,

South Africa and Venezuela), end-use energy prices are approximately 20% below their economic opportunity cost. This underpricing both spurs overconsumption and also leaves energy firms with inadequate financial resources for investing in productivity, capacity, or environmental improvements. The production inefficiencies associated with state control of the energy sector thus add to environmental woes as well as economic ones: from excess emissions due to overuse of fossil fuels to soil and water contamination from poorly maintained pipelines. In addition to this direct form, energy subsidies in developing countries also take indirect forms, such as trade barriers that limit the availability of more energy-efficient technologies. Estimates by the World Bank and other experts in the early 1990s put the magnitude of environmentally damaging subsidies (energy and otherwise) in the hundreds of billions of dollars. While some of this amount reflected necessarily crude efforts to impute values of noninternalized environmental damages, the estimated magnitude of active subsidies still was substantial.

While these subsidies still exist, they have been declining in recent years. According to recent World Bank figures (see the paper by Reid and Goldemberg in Further Readings), during the 1990s total fossil fuel subsidies in 14 developing countries declined by 45%, compared to OECD subsidy reductions of 21% during the same period. According to other figures cited by Reid and Goldemberg, China in particular has engaged in a significant effort to reform its energy pricing. It cut coal subsidies from 37% in 1984 to 29% in 1995, and petroleum subsidies from 55% in 1990 to 2% in 1995. India, Mexico, South Africa, Saudi Arabia and Brazil have also cut fuel subsidies significantly in recent years.

One important change lying behind this trend is the transition of most (though not all) centrally planned or highly statist economies toward more market-oriented economic systems. A major part of this transition has been substantial increases in energy prices toward efficient levels. While energy subsidies do persist, especially for households, they are much smaller than in the past. This trend in turn means fewer opportunities remain for "win-win" subsidy removal in this sector. A second force that has worked toward reduced subsidies is progress toward more open trade, which has lowered protections for inefficient and environmentally damaging domestic manufacturing sectors in some countries. (Outside the energy arena, subsidies can also include failure to effectively manage "commons" resources like forests, making the effective cost of resource extraction well below the true opportunity cost. Inadequate regimes for management and protection of commons resources then often result in excessive exploitation and deforestation.)

## Conclusions

Our discussion has attempted to illustrate both the potential importance and the controversies surrounding the assessment of environmentally damaging subsidies in the US, particularly those related to energy. More research is needed to better understand the magnitudes of existing subsidies in terms of their effects on behavior. At the same time, a clearer public consensus on the effects of subsidies and what to do about them (including what to do with beneficiaries) is needed. This suggests a two-pronged approach. At the national policy level, an institution like the military base closures commission could be empanelled to examine existing subsidies and recommend corrective actions for up-or-down Congressional vote. To support the commission's work and increase public understanding generally, the relevant government agencies and concerned private foundations should maintain and increase analysis (in-house and with extramural funding) of environmentally damaging subsidies.

## Further Readings

Many of the figures presented in this document were taken from the Fiscal Year 1999 Budget of the United States (obtained via the Internet). Other useful sources of information or analysis include:

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