Chapter 7 THE EXTERNALITIES OF DOI ACTIVITIES: MOVING TOWARD FULL COST ACCOUNTING

INTRODUCTION

Other chapters of this report discuss economic contributions of DOI activities and highlight the contributions the Department's activities make in supporting important sectors of the economy. In particular, Interior resources provide energy, minerals, forage, water, habitat, and timber that are subsequently used throughout the economy to generate electricity, provide fuel for transportation, and provide raw materials used as inputs in a number of industries. Yet, in many cases the benefits provided by the raw materials and products that flow from DOI managed lands, as well as the production, distribution and use of these products, also may cause adverse effects on the environment, economy, or society. Economists typically characterize these adverse effects as *negative externalities*. Conversely, some of Interior's activities (e.g., restoration of habitat, historic buildings) have external benefits called *positive externalities*.

In a nutshell

- Market prices often do not fully reflect the impacts of land management decisions on environmental goods and services because these goods and services are not directly bought and sold in markets.
- Activities or actions by one party that are not reflected in market prices and that affect the well-being of another party are termed *externalities*.
- The ability to evaluate negative externalities is an important component to strengthening the set of information available to decision makers. The use of a common metric allows comparisons across alternatives to be made on a consistent basis.
- Full cost accounting would help promote more cost-effective investments on public lands.

This chapter provides an introduction to the concept of externalities, discusses the application of these concepts in the context of several Interior related examples, and highlights the importance of moving toward full cost accounting of DOI land management activities. Full cost accounting refers to the collection and presentation of information about the economic, environmental, and social costs and benefits related to a particular policy decision.

What is a Negative Externality?

A negative externality is an activity that imposes uncompensated costs on other people. For example, externalities from energy exploration, development, production, and use can include the air pollution emitted by cars and power plants, oil spills, radioactive emissions from nuclear power plants, acid mine drainage, and congestion from overloaded streets and highways. More recently, scientists have identified greenhouse gas emissions, such as the carbon dioxide that comes from burning fossil fuels, as a particularly important externality.

DEFINITION OF AN EXTERNALITY

Market prices typically account for both the positive and negative effects associated with the use of a good or service. However, it is common for market prices to not fully reflect the impacts of land management decisions on environmental goods and services because these goods and services are not directly bought and sold in markets. Activities or actions by one party that are not reflected in market prices and that affect the well-being of another party are termed *externalities*. Externalities can be positive or negative. The explanation for why market prices may not fully reflect the opportunity costs (the value of the next-highest-valued alternative use of the resource) associated with environmental goods and services (e.g., clean air and water) is complex, but is closely related to the fact that goods such as clean air and clean water are not typically bought and sold in markets (thus they do not have a market price that consumers and producers can readily observe and account for in the market value of the product). The reason these environmental goods and services are not typically bought and sold in market is often associated with the lack of clear property rights for these goods and services.

Externalities can be distinguished from secondary or indirect effects. For example, increased food prices caused by the conversion of agricultural land from food to biofuel production, are not considered to represent an external cost, as they result from (presumably properly functioning) markets. Higher food prices may of course raise important social concerns and may thus be an issue for policy makers, but they would not be considered an externality.

THE IMPORTANCE OF ACCOUNTING FOR EXTERNALITIES

The presence of externalities has implications for decision making because if market prices leave out important benefits or costs, buyers and sellers cannot make informed decisions. Thus, failure to account for externalities can distort decision making and reduce society's total welfare. When the prices of goods and services does not adequately reflect the monetary value of benefits or adverse effects, decision makers (including individual consumers, public land managers, and entities in the private sector that lease, develop, or purchase energy, minerals and other resources) may not recognize the full effects of their actions. In general, when external benefits are ignored, the result is an underproduction and overpricing of the goods that generate the positive externalities. In contrast, when external costs are ignored, the result is an over-production and under pricing of the goods that generate these negative externalities.

Why environmental goods and services are not typically bought and sold in markets? *Some goods and services are easy to put a price on and integrate into the economy, for example a movie ticket or a loaf of bread. Others such as a clean air and water, biodiversity, resilient ecosystems, and clear vistas are not typically bought and sold in markets, and thus very difficult to value or put a price on. This lack of markets is due to the fact that the property rights for these resources are often not well specified. When ownership of resources is unclear, markets to allocate them are slow to arise.*

Negative externalities matter because, when they are not accounted for, they can lead to a lower quality of life for at least some members of society. For example, suppose that a proposed energy development on public land has the ability to reduce the amount of air pollution emitted during exploration and development by 10 tons, at a cost of $40 per ton. Suppose further that the full cost of the air pollution (for example, health and visibility impacts) is $50 per ton. If the developer were to reduce its air pollution emissions, total social welfare would

increase—the additional cost to the developer would be $400 (10 tons × $40 per ton), but the "savings" to society (that is, the reduction in adverse effects) would be $500 (10 tons × $50 per ton). Society's wellbeing would be increased by this change. However, if the externality had not been accounted for in the developer's decisions, aggregate well-being of all members of society would be lowered.

The Role of Government in Correcting Externalities

> *"Government investments as well as regulatory policies can improve well-being by correcting market failures and protecting safety, health, and environmental quality. In fashioning long-term policies, the Nation should not overlook those factors that contribute to well-being even if they are not fully captured in economic statistics." —Economic Report of the President, 2012*

When market prices do not fully reflect the opportunity costs associated with a particular activity, there may be a case for government intervention. The goal of policies that correct for externalities is to essentially have private companies or individuals "internalize" the externality in their decision making or production decisions so that more socially optimal levels of output are produced. Possible policy approaches to correct externalities range from "command and control" policies to "market-based" policies (or perhaps a combination of the two approaches). Command and control policies are generally regulatory approaches; market-based policies rely on establishing markets for pollution or markets for activities to offset the impacts of environmentally damaging activities (examples include transferrable permits, pollution taxes, and habitat conservation banks). Each approach may have advantages in particular situations. For example, pollution issues involving highly toxic materials (e.g., nuclear waste) or high-cost events (e.g., large oil spills), a regulatory approach might be appropriate. Thus, regulation by the new Bureau of Safety and Environmental Enforcement (BSEE) is intended to reduce the likelihood of significant oil spills. Market-based approaches offer advantages in situations where the concern is with large numbers of polluting entities that have varying pollution control costs. Market-based policies that may have relevance for addressing externalities associated with DOI activities include habitat conservation banks, policies to facilitate the development of ecosystem service markets, and policies that promote the sale or lease of DOI-managed resources at their opportunity cost.

Understanding why particular externalities occur, and the monetary value of such externalities, is important because they provide an example of a situation where government involvement can potentially be used to improve market outcomes. For example, estimates of the monetary value of externalities associated with energy development could be used to inform decisions about the locations, scale, scope, and technology choices when making public land use decisions. Should mining of coal, extraction of oil and gas, development of renewable energy, grazing, or timber harvesting activities be allowed in a particular area? Should the area be set aside for recreation use? While the National Environmental Policy Act (NEPA) compliance process is designed to disclose impacts resulting from federal actions, it does not provide a set of information that allows comparisons of impacts relative to a baseline across alternatives to be made with a common metric (such as dollars). Valuing all of the impacts, including those associated with external costs, would allow such comparisons to be made and could be used to inform land management decisions.

RECENT LITERATURE

An example of how externalities are addressed using economic analysis is provided by a recent report published by the National Research Council (NRC 2010). This study examined the external costs associated with various sources of energy, focusing on the costs associated with air pollution (such as sulfur dioxide from coal-fired electricity and emissions from cars and trucks) and on the costs associated with climate change.[37] The study did not evaluate the external costs associated with changes to ecosystem service flows during exploration, development, or extraction activities.

The table below summarizes the results from the National Research Council study. It shows the ratio of the estimated external or uncompensated costs of energy to the market price. For example, electricity generated from coal has an estimated external cost of 70 percent of its market price. Petroleum is used primarily for automotive fuels, and its social costs are one quarter of the price of gasoline. Electricity production from natural gas has among the lowest ratios of social cost to market price at 19 percent. These percentages can be used to estimate the dollar value of the external costs of energy. For example, the U.S. average sales price of coal in 2010 was $37.61 per ton. Assuming the external costs are 70% of the market price implies that the external costs are about $26.30 per ton.

Table 7-1. The External Costs of Energy

Sector and Fuel	External Costs as a Percentage of Market Price
Electricity generation—coal	70%
Electricity generation—natural gas	19%
Transportation—primarily automotive gasoline	25%
Heat production—natural gas	42%

Source: National Research Council, Hidden Costs of Energy, 2010.

In another study, Epstein et al., (2011) estimated that the negative externalities related to coal were $345.3 billion annually ($2008, ranging from a lower bound of $175.2B to an upper bound of $523.3B) using a process called "life cycle assessment" (LCA). Commonly used by USGS, LCA broadly accounts for the entire life cycle of a land use activity. In the case of energy, LCA includes exploration, development, and extraction of the energy source as it is found in nature; through conversion, transportation, and transmission to its point of use; and then to the ultimate fate of waste products from that use. The authors recommended that "[c]omprehensive comparative analyses of life cycle costs of all electricity generation technologies and practices are needed to guide the development of future energy policies" (pp. 93-94).

[37] Some of the externalities associated with the production and consumption of energy have been corrected, to some degree, through public policies. For example, coal mining and oil and gas extraction are subject to federal, state, and local regulations that are intended to limit the environmental damages associated with mining and oil and gas development. Air pollution emissions by power plants are regulated under the Clean Air Act, and tailpipe emissions from motor vehicles are regulated at the federal and state levels.

RELEVANCE FOR THE DEPARTMENT OF THE INTERIOR

Many land and water management decisions made by Interior involve some resources for which there is a market value (e.g., oil, gas, coal, electricity) and other resources where such values are not readily available (e.g., recreation, water quality, habitat for endangered or threatened species). For example, in considering whether an area should be leased for oil and gas development the market value of the oil and gas that might be extracted can be easily evaluated and displayed in monetary terms. However, the costs external to this decision, such as the effects of the oil and gas exploration, development and extraction on air and water quality, recreation opportunities, wildlife habitat, or energy security cannot be easily accounted for in dollar terms. Because the full costs of the decision cannot be easily displayed and compared, the information to make a fully informed decision is incomplete.

Similar considerations apply in decisions concerning renewable resources. The energy produced by wind and solar developments can be easily valued. However, the external costs—which arise because some renewable developments preclude other land uses—are less easily quantified and valued.

Examples of Interior's Environmental Cost Models

Offshore: *As an input into the decision making process for the offshore oil and gas 5-Year leasing program, the Bureau of Ocean Energy Management (BOEM) conducts a "cost-benefit" or "net benefits" analysis using a model that monetizes environmental and social costs associated with offshore oil and gas exploration and development and energy market substitutions in the absence of the offshore oil and gas. The model places monetary values on the following categories: recreation; air quality; property values; subsistence harvests; fiscal impacts; commercial fishing; and ecological impacts. The model compares a series of exploration and development scenarios to a no action alternative. The model's output allows BOEM to do a comparative analysis of all 26 "planning areas" comprising the outer continental shelf (OCS), accounting for the estimated environmental costs, and to then obtain the "relative ranking" of those planning areas required for the 5-Year Plan.*
Onshore*: BLM is currently investigating the feasibility of developing an environmental cost model for activities taking place on public lands.*

Because no fossil fuel is involved in electricity generation from renewable sources, no gases or other contaminants are released during the operation of a wind turbine or a solar collector. To the extent that renewable energy generation offsets energy imports, renewables can increase energy security. This may be seen as a positive externality of renewable generation. However, there are still potential negative externalities from wind energy developments, including adverse visual and noise effects, and the killing of birds and bats. FWS's Conservation Planning Assistance Program (CPA) typically becomes involved in the review of potential wind energy developments on public lands through NEPA. This may be as a cooperating agency or because of the Service's responsibilities under the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, the Endangered Species Act, or because of the Agency's special technical expertise. CPA may also become involved in the review of potential wind energy developments on private lands if their technical expertise in addressing wildlife issues is requested on a voluntary basis.

From an economic perspective, the negative externalities of wind energy development and eagle take from wind power operations could be internalized by the developers through mitigation. The FWS has recently finalized its Land-Based Wind Energy Guidelines. The Guidelines are voluntary and provide a

structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development.[38] In addition, Draft Eagle Conservation Plan Guidance was developed by FWS to provide interpretive guidance to wind developers, Service biologists who evaluate potential impacts on eagles from proposed wind energy projects, and others in applying the regulatory permit standards as specified by the Bald and Golden Eagle Protection Act and other federal laws. The guidance provides recommendations for the development of *Eagle Conservation Plans* (ECPs) to support issuance of eagle programmatic take permits for wind facilities. Programmatic take permits will authorize limited, incidental mortality and disturbance of eagles at wind facilities, provided effective offsetting conservation measures that meet regulatory requirements are carried out.

Solar energy developments on public land typically are not compatible with other uses of the land, thus some loss of ecosystem services accompanies large-scale solar developments. These losses would be considered external costs and in concept should be valued so they can be considered as part of the land use management decision. As renewable energy generation technology improves and penetration into the U.S. energy market grows, it will become more important that the external costs of these sources be evaluated.

CONCLUSIONS

Each stage in the life cycle of fossil fuel extraction, transport, processing, and combustion, generates a waste stream that can damage human health and the environment. The ability to evaluate these negative externalities is an important component to strengthening the set of information available to decision makers. The use of a common metric allows comparisons across alternatives to be made on a consistent basis. Specifically, engaging in full cost accounting of all energy sources—fossil fuels, wind, solar, and other forms of non-fossil fuel power generation—would help promote more cost-effective investments on public lands.

A useful step to consider in moving toward full cost accounting would involve the development of more robust underlying information. This could include better information on recreation use and users of BLM lands and information on baseline levels of ecosystem services on DOI lands.

[38] For additional details see http://www.fws.gov/windenergy/.

REFERENCES

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