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FEDERAL FOSSIL FUEL SUBSIDIES AND GREENHOUSE GAS EMISSIONS: A Case Study of Increasing Transparency for Fiscal Policy

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■ **Abstract** Growing international pressure to curb greenhouse gas (GHG) emissions has focused attention on existing policies that may, either by design or by effect, subsidize fossil fuel production and consumption. This paper reviews existing studies of fossil fuel subsidies within the United States, as well as assessments of the potential impact of subsidy reform on GHG emissions. Evaluating the differences across the studies, it highlights the most important disparities in subsidy definition and valuation in order to clarify the conclusions that can be drawn from this body of work. We then present some of the tools used to provide transparency in environmental regulation. We conclude that many of these approaches can be used to improve the transparency of fiscal policy, with important benefits within the context of climate change and beyond.

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1. WHY LOOK AT FOSSIL FUEL SUBSIDIES

Fossil fuel combustion is estimated to contribute more than 90% of gross domestic greenhouse gas emissions (1). To the extent that production and/or consumption of these fuels is subsidized, market transition to increased conservation or alternative fuels is slower than it would be in the absence of subsidies. The presence of baseline subsidies also makes achieving greenhouse gas reductions under the Kyoto Protocol and the Framework Convention on Climate Change more expensive. Renewable energy sources also receive subsidies, and policy transparency is equally important for them. However, most multi-fuel assessments have found fossil-based energy to receive the majority of federal subsidies (see Section II of Table 2), followed by nuclear energy. In addition, the environmental impacts of the renewable subsidies tend to be substantially smaller.

Evaluating fossil fuel subsidies involves two main steps: assessing subsidy scope and magnitude and evaluating the impact of these distortions on parameters such as trade, welfare, environmental quality, and energy markets. Critical elements in assessing the scope and magnitude of subsidies include defining what is and is not a subsidy (i.e., baseline conditions), and how to quantify a value for programs that meet the chosen subsidy definition. The impact analyses generally rely on partial or general equilibrium modeling, and the results are sensitive both to the model chosen and to the subsidy magnitude data used as model inputs.

1.1. Defining Subsidies

There is general agreement that subsidies represent a transfer of economic resources to market participants that affects either prices or production costs. However, there is fairly wide divergence in how this general concept is applied in practice.

- **Direct and Indirect Transfers** The narrowest definitions of subsidy are limited to transfers targeted to the energy sector directly, either through agency outlays or through tax relief. Most analysts have used a somewhat broader definition expanding both the type of policies evaluated and the stated target of the interventions. For example, policies that shift private financial and/or market risks onto the government or general public, such as subsidized lending, loan guarantees, and indemnification programs, would

all be included despite the lack of direct monetary transfers in a particular year. Programs that are not directly targeted, but are of substantial benefit, to the energy sector are also included but only on a prorated basis. Examples include the transport of bulk fuels and capital subsidies. The broader definition provides a truer picture of the economic transfers that occur.

- **Externalities and Subsidies to Complements** A subset of the studies has broadened the definition of subsidies still further to include externalities (benefits or costs shifted onto surrounding populations without compensation) and subsidies to close complements (goods or services that encourage the increased use of fossil fuels, such as general transportation infrastructure). Depending on the study, externalities related to environmental quality, health, materials damage, safety, and congestion may have been added. Studies incorporating values for externalities and complements have an extremely wide range of uncertainty, and the subsidy valuations for these categories tend to exceed fiscal subsidy values by a large margin.
- **Offsets** Analysts normally try to assess a net subsidy value, subtracting interventions that act as taxes on particular fuels, in order to accurately assess subsidy impacts on the environment and economy. Offsets include items such as energy excise taxes, though some authors have included regulatory burdens as well. The manner in which potential offsets have been treated varies widely across studies.
- **Level of Government** Authors sometimes include state or local subsidies or taxes in their assessments. If done comprehensively, such inclusiveness enhances data quality. When state and local taxes on fossil fuels are counted as subsidy offsets without parallel inclusion of state and local subsidies, the quality of results is greatly hampered.

1.2. Methods of Measuring Subsidy Magnitude

Efforts to assess subsidy magnitude have generally focused either on measuring the value transferred to market participants from particular programs (program-specific approach) or on measuring the variance between the observed and the "free-market" price for an energy commodity (price gap approach). One set of methods that captures both pricing distortions (net market transfers) and transfers that do not affect end-market prices (net budgetary transfers) is the producer subsidy equivalent (PSE) and consumer subsidy equivalent (CSE) metrics commonly employed in the agricultural sector. Use of these in the energy sector has thus far been limited to annual assessments of PSEs for coal in a handful of countries.

These approaches differ in the amount of data required to calculate them and in the degree to which budget transfers plus market transfers are successfully measured. Program-specific transfer assessments capture the value of government programs benefiting (or taxing) a particular sector, whether these benefits end up with consumers (as lower prices), producers (through higher revenues), or resource

TABLE 1 Overview of subsidy measurement approaches

Approach/Description	Strengths	Limitations
Program-specific Quantifies value of specific government programs to particular industries. Aggregates programs into overall level of support.	Captures transfers whether or not they affect end-market prices. Can capture intermediation value (which is higher than the direct cost) of government lending and insurance.	Does not address questions of ultimate incidence or pricing distortions. Sensitive to decisions on what programs to include. Requires program-level data.
Price-gap Evaluates positive or negative "gaps" between the domestic price of energy and the delivered price of comparable products from abroad.	Can be estimated with relatively little data; very useful for multi-country studies. Good indicator of pricing and trade distortions.	Sensitive to assumptions regarding "free market" and transport prices. Understates full value of supports by ignoring transfers that do not affect end-market prices.
PSE/CSE Systematic method to aggregate transfers plus market supports to particular industries.	Integrates transfers with market supports into holistic measurement of support. Separates effects on producer and consumer markets.	Data intensive. Little empirical PSE/CSE data exist for fossil fuel markets.

owners (through higher rents). Unless integrated into a macroeconomic model, this information tells little about the ultimate incidence of the subsidy programs and their effect on market prices. By definition, the price gap metric highlights observed price distortions, though it misses the often substantial fiscal supports that do not affect consumer energy prices but do affect the structure of supply. The combination of PSE and CSE data provides insights into both. This review focuses on presenting subsidy estimates and identifying the key drivers of variance. As a result, a detailed presentation of subsidy classification or measurement is beyond the scope of this paper. However, Table 1 briefly summarizes the main approaches that have been used in both domestic and international subsidy assessments as well as their respective strengths and limitations.

2. EMPIRICAL ASSESSMENTS OF FOSSIL FUEL SUBSIDIES IN THE UNITED STATES

Using a literature review and direct polling of those active in the field, we identified 10 studies evaluating domestic subsidies to fossil fuels conducted over the past 23 years. Each evaluated at least one fossil fuel in detail, and attempted to identify

and quantify subsidies to the entire fuel cycle. Six of the assessments attempted to measure subsidies to all fuels; the remainder focused on oil alone. All used the program-specific approach.

Three assessments were excluded from quantitative comparison either because they focused on a handful of specific programs rather than the entire fuel cycle (the Green Scissors assessments) (2) or because they were focused on rebutting earlier studies and did not provide comprehensive quantitative estimates of their own [American Petroleum Institute (3) and Sutherland (4)]. Several of these reports are, however, discussed in the text of this paper.

Section I of Table 2 provides an overview of the basic study characteristics. More than half of the assessments were prepared for environmental nongovernmental organizations (NGOs). Three were conducted for the federal government. None were conducted by industry, though one was done internally by a consulting firm with many energy industry clients. Potential bias in the results is addressed in a number of the studies through the use of independent consultants or academics as authors and through the use of a diversified external peer review panel. The size and scope of peer review varied widely. Four of the studies (EIA 2000, Koplow & Martin, Koplow, and PNL) had more than 10 external reviewers. Only two (Koplow & Martin, Koplow) had reviewers from a full range of interests, including government, environment, academia, industry, and finance. Five studies, as well as API, had no formal external review at all; Sutherland had only a single external reviewer.

2.1. Aggregate Subsidies to Fossil Fuels

Sections II and III of Table 2 summarize the findings of each of these studies. To facilitate comparison, all data have been converted into 1999 dollars. Two studies (MISI and PNL) presented multi-year aggregate subsidy values; the average annual value is shown.

Aggregate subsidies to fossil fuels ranged from a low of $200 million per year in EIA92 to a high of $1.7 trillion (ICTA), a span of nearly four orders of magnitude. Considering that the high value included only oil while the low value included all fossil fuels, this range is all the more remarkable. Nonetheless, a handful of factors explain most of this difference. At the high end, the inclusion of externalities is the single largest influence, comprising between 46% and 84% of the total subsidies reported in the studies that included them. Other factors are the inclusion of roadway construction, maintenance, and operation; some state and local subsidies; and attribution of the entire cost of a military presence in the Persian Gulf as a subsidy to oil.

Low-end values are also driven by a handful of decisions about what to include. Studies in this range generally exclude any support for oil security, tax preferences for international operations, and more broadly targeted programs that may provide disproportionate benefits to fossil fuel industries or consumers. A number of these assessments also improperly calculate the subsidy offset associated with fuel excise taxes.

TABLE 2 Detailed comparison of US subsidy assessments

Author (Reference)	EIA 1999–2000 (5) (6)	MISI, 1998[a] (7)	ICTA, 1998 (8)	Koplow/ Martin, 1998 (9)	Wahl, 1996 (10)
I. Overview					
Fuels included	All[c]	All[c]	Oil[b]	Oil	Oil[b]
Data year(s)	1998–99	1950–1997	1998	1996	1996–97
Author(s)/ affiliation	Hutzler et al., government	Bezdek et al., consulting	ICTA, ENGO	Koplow & Martin, consulting	Wahl, academia
Client(s)/ affiliation	DOE Office of Policy, government	None	None	Greenpeace, ENGO	Institute for Local Self Reliance, ENGO
Number of external reviewers	1999: None 2000: >10	None	None	>20	None
Mix of external reviewers	1999: n/a 2000: Gov., Ind.	n/a	n/a	Gov., Ind., Acad., ENGO, FNGO	n/a
Detailed back-up data provided?	Yes	No	Some	Yes	Some
II. Findings					
Net subsidies, all fuels (bil. 1999$)	6.2–9.6[d]	13.8	574–1736	16.6–37.4	58–367
Fossil fuels only, bil. 1999$ (% of total)	2.5–2.9 (41–30%)	10.1 (73%)	100%	100%	100%
Fossil breakout by fuel (midpoint % of total fossil)	Oil: 22.5% Coal: 17.5% NG: 60% Mixed: 0%	Oil: 66% Coal: 16% NG: 18% Mixed: 0%	Oil: 100%	Oil: 100%	Oil: 100%
III. Composition of fossil fuel subsidies, billions of 1999$ (percent shares of total fossil subsidies)					
General fiscal and tax provisions	2.6–2.9 (100%)	6.81 (67.2%)	8.4–15.8 (1.5–0.9%)	3.9–6.8 (23.2–18.3%)	3.5–11.4 (6.0–3.1%)
General transport. infrastructure	0 (0%)	Not evaluated	64.9–154.2 (11.3–8.9%)	Not evaluated	Not evaluated
Energy security	Not evaluated	Not evaluated	63–105 (11.0–6.1%)	12.8–30.1 (76.8–81.7%)	27.8–77.3 (48.0–21.0%)
Externalities	Not evaluated	Not evaluated	433–1,456 (75.4–83.9%)	Not evaluated	26.6–278.7 (46.0–75.9%)
State and local programs[g]	Not evaluated	Not evaluated	4.93 (0.9–0.3%)	Not evaluated	Not evaluated
Other[h]	Not evaluated	3.32 (32.8%)	Not evaluated	Not evaluated	Not evaluated

Abbreviations: NG = natural gas; n/a = not applicable; ENGO = environmental non-governmental organization; FNGO = fiscal non-governmental organization; Ind. = industry.

Notes:

[a]Multi-year studies. Values presented here are annual averages.

[b]Some provisions contained in study benefit both oil and natural gas, but were not allocated within the report.

[c]Studies differed in how they treated federal subsidies to electricity. EIA 1992 and EIA 1999–2000 evaluated the subsidies, but did not include them in their reported totals. MISI did not include general subsidies to electricity at all. Heede et al. allocated subsidies to fossil fuels in general, while Koplow allocated them to specific source fuels. PNL included them as a separate subsidy category.

[d]EIA high estimates include values for subsidies evaluated within the report (e.g., public power), but not reported in EIA's printed summary charts.

TABLE 2 (*Continued*) Detailed comparison of US subsidy assessments

Author (Reference)	Hwang, 1995 (11)	Koplow, 1993 (12)	EIA, 1992 (13)	Heede et al, 1985 (14)	PNL, 1978[a] (15)
I. Overview					
Fuels included	Oil[b]	All[c]	All[c]	All[c]	All[c]
Data year(s)	1990–91	1989	1989–92	1984	1933–78
Author(s)/ affiliation	Hwang, ENGO	Koplow, consulting	Anderson et al., government	Heede et al., ENGO	Cone et al., government
Client(s)/ affiliation	Union of Concerned Scientists, ENGO	Alliance to Save Energy, ENGO	US Congress, government	Center for Renewable Resources, ENGO	US Department of Energy, government
Number of external reviewers	None	>20	<5; informal only	None	Estimate >30
Mix of external reviewers	n/a	Gov., Ind., Acad., ENGO, FNGO	Not available	n/a	Gov., Ind.
Detailed back-up data provided?	Some	Yes	Yes	No	Some
II. Findings					
Net subsidies, all fuels (bil. 1999$)	103–343	26.5–45.1	5.6–13.5[d]	64.0	16.1–17.8
Fossil fuels only, bil. 1999$ (% of total)	100%	16.5–26.3 (62–58%)	0.2–0.8 (3–6%)	38.8 (61%)	10.4 (65–58%)
Fossil breakout by fuel (midpoint % of total fossil)	Oil: 100%	Oil: 42% Coal: 40% NG: 18% Mixed: 0%	NMF[e]	Oil: 32% Coal: 13% NG: 17% Mixed: 38%[f]	Oil: 80% Coal: 7% NG: 13% Mixed: 0%
III. Composition of fossil fuel subsidies, billions of 1999$ (percent shares of total fossil subsidies)					
General fiscal and tax provisions	3.6–4.1 (3.5–1.2%)	14.3–23.8 (86.8–90.2%)	3.7–4.3 (% NMF)[e]	38.8 (100%)	8.0 (77.2%)
General transport. infrastructure	28.8–45.8 (28.0–13.3%)	Not evaluated	−3.56 (% NMF)[e]	Not evaluated	Not evaluated
Energy security	0.8–8.77 (0.8–2.6%)	2.2–2.6 (13.2–9.8%)	Not evaluated	Not evaluated	Not evaluated
Externalities	65.1–279.4 (63.2–81.5%)	Not evaluated	Not evaluated	Not evaluated	Not evaluated
State and local programs[g]	4.8 (4.6–1.4%)	Not evaluated	Not evaluated	Not evaluated	Not evaluated
Other[h]	Not evaluated	Not evaluated	Not evaluated	Not evaluated	2.4 (22.8%)

[e]EIA 92 fossil estimates are dominated by a $3 billion offset credited to oil. As a result, the net calculated fossil subsidies are very low, and the respective percentage shares of total fossil fuels relatively meaningless.

[f]Value dominated by unallocated subsidies to fossil electric. During this time period, most would have been associated with coal-fired generation.

[g]Does not include state and local spending and tax collections related to road construction. These are included under the General Transportation Infrastructure category.

[h]Primarily exemptions from price controls.

Although five of the studies examined all fossil fuels, there is no consistent trend in the pattern of support among them. Rather, the relative shares seem primarily a function of program-specific decisions. For example, the two studies where oil dominated by a large margin [MISI (7) and PNL (15)] both treated exemptions from oil price regulations for certain types of oil wells as a subsidy to the fuel; price caps are normally treated as de facto taxes. The preponderant share for natural gas in EIA99/00 (5, 6) stems from a large alternative fuel production tax credit. Benefiting primarily gas, the credit dominates the small number of interventions EIA included within its report. Studies that did not prorate supports for electricity generation and transmission to source fuels [e.g., Heede et al. (14) and MISI (7)] show artificially low shares for coal.

2.2. Fiscal Subsidies to Fossil Fuels

Though still large, the range of estimates drops by two orders of magnitude once fiscal subsidies alone are evaluated—to between $2.6 and $121 billion. Fiscal subsidies include tax preferences, general agency support for energy, and spending related to energy security. Offsets related to energy rather than to transportation infrastructure would also be included. We assess the largest sources of fiscal variance in detail below:

2.2.1. ENERGY SECURITY There are two components of energy security commonly evaluated, both relating to oil: the cost of defending oil shipments through the Persian Gulf and the cost of building and maintaining our domestic Strategic Petroleum Reserve (SPR). These programs are the largest source of variance in the fiscal estimates. Half of the studies did not evaluate energy security subsidies in sufficient detail to include valuations in their subsidy totals. Koplow included only SPR, not Persian Gulf oil defense. However, even when excluded from totals, all of the analysts (including API and Sutherland) acknowledged that these programs do, in part, benefit oil markets. The key area of disagreement has been on measuring the magnitude of support.

ICTA (8) and Wahl (10) attribute large portions of the military costs of being in the Persian Gulf to oil. Hwang (11), API (3), and Sutherland (4) incorporate only the very small marginal cost of protecting oil as a benefit to the sector, arguing that the other regional objectives would require a military presence anyway. Koplow & Martin (9) challenge the marginal cost attribution, pointing out that the marginal costs of all of the Persian Gulf missions are small and that equivalent arguments could be made for each mission area. They argue instead for treating the military presence through the lens of joint costs and allocating a reasonable portion (in this case one third) to the oil sector.

2.2.2. CAPITAL FORMATION Accelerated depreciation schedules allow taxpayers to write off certain equipment from their taxes more quickly than it actually wears

out. Seven of the ten studies have attributed large benefits from these schedules. Three studies (MISI and the two by EIA), as well as API, have argued that because the tax subsidy is generally available to all industries (not just energy producers), it does not distort capital allocation across sectors. This argument has two potential weaknesses. First, because some forms of energy use (such as demand-side behavior change—turning off your lights or replacing your light bulb with a more efficient one, for example) are much less capital intensive, capital subsidies can potentially skew market decisions away from demand reduction. Second, the details of the tax code suggest the benefits of the subsidy are distributed unequally, even among capital owners, depending on their industry. Three sectors of relevance to energy (electric light and power; gas facilities; and mining, shafts, and wells) benefit from capital write-downs that are 28%, 45%, and 44% faster than the actual economic depreciation of their assets.[1] Of the 36 sectors evaluated by the US Treasury, these energy sectors had the fourth, fifth, and eighth most heavily subsidized capital, as measured by the difference between the tax and actual service life (16).

2.2.3. SUBSIDIES TO WATER INFRASTRUCTURE While all modes of transport continue to be oil-intensive, many studies make a distinction between subsidies to water infrastructure and those to other modes of transit. This is because in addition to fueling the vessels, transport of the fuels themselves relies heavily on the inland waterways and coastal ports and harbors. Coal and oil shipments alone have historically comprised nearly 50% of the total tonnage moved through domestic waterways and are often the driver of channel- or port-deepening projects (12). Subsidies to this infrastructure have the potential to reduce the delivered cost of coal and oil. For this reason, a prorated share of water infrastructure subsidies is included in the fiscal category, while spending and taxes related to roads are classified as general transportation infrastructure development.

Seven of the ten studies included support for inland waterways, ports, and harbors in their totals. All prorated the values based on the coal and oil share of total tonnage moved through the systems. The Wahl study did not include this item because no general agency spending was included in the report. Only the two EIA studies evaluated agency spending but excluded water infrastructure subsidies—on the basis that they are not targeted directly at the energy sector. Neither API or Sutherland addressed the issue of waterway infrastructure subsidies.

2.2.4. TAX-EXEMPT DEBT Industrial-development bonds and private activity bonds provide tax-exempt debt for certain energy-related purposes. All of the studies included tax-exempt debt for privately owned facilities in their totals, though the MISI report appears to do so only for coal. In contrast, tax preferences for publicly

[1]These values assume 3% inflation; the benefits would be even higher with lower inflation levels.

owned fossil fuel infrastructure, such as municipal power plants or pipelines, were often excluded. These preferences come in the form of the general tax-exempt status for municipal utilities and through their ability to issue tax-exempt municipal debt. Where these subsidies were excluded purposefully (e.g., with the two EIA studies), it was on the grounds that municipal debt is available to many public purposes, not just energy (M. Hutzler, US EIA, personal communications, October 3 and 6, 2000). Although this is true, historical data suggests that energy gets a substantial portion (nearly 25%) of the total municipal debt issued (12). These tax preferences (worth billions of dollars per year) may therefore contribute to reducing the incentives for demand-side management.

2.2.5. OFFSETS While most of the analysts agreed with the general principle that certain taxes are properly offset against subsidies, decisions on how to treat specific energy taxes show little consistency across studies. Koplow & Martin developed a number of guidelines to systematize the evaluation of these taxes. First, diversion of earmarked tax collections, or failure to pay interest on accrued balances in earmarked collections, both constitute a net tax on the fuel. Second, any net tax must be offset against general spending for the same purpose as the trust fund in order to conclude whether a net offset exists or not. Third, trust fund balances need to be evaluated against the time horizon of the problem for which the fund was created, often a multiyear period. Short-term surpluses are not relevant. Fourth, inclusion of offsets from different levels of government (i.e., state and local) is appropriate only if both the tax and the subsidy side from that level have been equally evaluated.

Where authors improperly evaluated offsets, their decisions had very substantial effects on their results. For example, the single largest item included in the EIA92 study was a $3.6 billion credit to oil for motor fuel excise taxes used for deficit reduction rather than highway construction, a value five times as large as their reported net subsidies to all fossil fuels. Although EIA was correct in identifying this as an area of potential offset, it neglected to reduce the offset by the substantial general revenues expended each year on purposes normally funded by the highway trust fund.

A similar problem applies to the conclusions reached by API and Sutherland. Both credited very large state and local motor fuel excise taxes against federal subsidies to oil, concluding that oil actually paid higher taxes than other sectors. Because neither balanced this offset with a similar analysis of state and local subsidies to oil (primarily widespread exemptions from state sales taxes and general revenue-financed road construction), their conclusion is inaccurate. Independent assessments by Loper (20) and the US Department of Transportation (21) suggest that oil actually receives substantial net subsidies at the state and local level as well.

2.2.6. TIMING OF STUDY AND DATA SOURCES CHOSEN The time of analysis and the data sources relied on also proved a significant source of variance. Because the

studies span more than 20 years, changes in government policy and economic conditions affect the size of the subsidy. For example, the alternative fuel production credit has grown substantially, benefiting natural gas. Tax preferences for capital investment have been greatly scaled back. Government support for energy research and development has also shifted somewhat away from fossil fuels and toward renewables during the period.

Differing treatment of variance across data sources is a large contributor to differing subsidy magnitudes among studies of the same vintage. Many of the authors dealt with this problem by establishing a range estimate rather than a point estimate. When this was not done, results were sometimes skewed. Tax preference estimation is one example. Although both the Joint Committee on Taxation (JCT) and the US Treasury estimate tax expenditures each year, their estimates for the same provision can differ greatly. During the 2000–2004 time period, for example, the Treasury (22) valued the ability of oil and gas producers to expense (rather than capitalize) exploration and development costs at −$30 million (nominal gain to Treasury, but present value loss). In contrast, the JCT (23) projected that the provision would yield a $2.4 billion loss to the Treasury over the same time frame, nearly $500 million per year.[2] Had EIA used both Treasury and JCT sources, rather than Treasury alone, this item would have become the fourth largest fossil fuel subsidy item in its 1999/2000 report.

2.3. Summary

The ten studies of fossil fuel subsidies in the United States convey an extremely wide range of results. Assessments that exclude programs of substantial, though not sole, benefit of the fossil fuel sector conclude that energy subsidies are insignificant. There is a strong basis for including a prorated portion of these multibeneficiary programs. Once such subsidies are included, the overall supports are large enough to affect the marketplace viability of substitute fuels and the emissions profile of the country.

The inclusion of externalities greatly magnifies both the potential impacts of subsidy reforms and the uncertainty of the estimates. Additional work, perhaps through the application of the tools discussed in Section 5 (e.g., subsidy justification assessments) is needed to reduce this uncertainty to manageable levels.

[2]Estimates differ so widely due to three main reasons. First, JCT uses the Congressional Budget Office baseline while Treasury often uses an Office of Management and Budget baseline. This can mean different distributions of income across taxpayers and different interest rate assumptions. Second, the estimates are made with different models (there is often scant empirical data on take-up and utilization rates). Third, specific estimates are refined and updated at different times, depending on other work load. While there is dialogue between JCT and Treasury, differences in approach and implementation remain (Thomas Barthold, Joint Committee on Taxation, personal communication, January 12, 2001).

3. CLIMATE CHANGE BENEFITS OF SUBSIDY REFORM

Using price gap, program-specific, and PSE data as inputs, a number of efforts have been made to model the impacts of subsidy reform on GHG emissions, welfare, and trade. Most of these efforts relied on general equilibrium models (albeit different ones); two of the nine evaluated were partial equilibrium assessments. All of these studies compare projected emissions under reform to a "business as usual" (BaU) baseline. Unlike the detailed domestic subsidy studies where NGOs dominated, academics and international agencies have predominated with the modeling studies. We summarize first the US-specific studies, followed by the international assessments.

3.1. Impacts of Domestic Reforms

We identified two US-specific assessments of the benefits of subsidy reform. Conducted for the US Environmental Protection Agency by Decision Focus, Inc. (DFI) and Dale Jorgenson and Associates (DJA), the assessments adopted the very narrow subsidy definition developed in EIA92 for its baseline conditions. Under these baseline conditions, reforms were projected to reduce CO_2 emissions between 0.7% and 4% by 2010; methane emissions (evaluated only by DFI) were expected to drop 1% by 2010 and 3% by 2035.

Using the DFI Gemini model, Shelby et al. expanded the definition of subsidies to include prorated programs of joint benefit to energy and other sectors. These expanded runs, conducted for carbon only, suggest overall reductions of 6% by 2010 (86 million metric tons of carbon equivalents, or MMTCE) and 8% by 2035. Carbon sequestration within the United States has been projected to meet 4% of the 7% reduction from 1990 levels that the United States would need to achieve in order to meet the terms of the Kyoto Protocol. This translates to a total remaining reduction of 485 MMTCE from projected levels in 2010 (24, 25), of which subsidy reform could achieve nearly 18%.

The US studies provide a number of other useful insights as well. First, projected carbon reductions from subsidy reform tend to rise over time as the markets have a chance to adjust and energy-related capital stock turns over. Second, removal of subsidies to carbon-intensive coal not surprisingly has a relatively larger benefit than removal of subsidies to oil and natural gas. Third, there is some evidence that even subsidy reform in nonfossil fuel energy sectors can contribute to GHG emission reductions. According to Shelby et al., the change in enery prices overall is anticipated to cause more conservation (including by users of fossil fuels) than the relative price increase in nuclear or other nonfossil-electricity would contribute to shifting to fossil-fuel based electricity.

Finally, subsidy-specific model runs by DFI demonstrate the importance of including all programs conferring significant benefits to fossil fuels in any reform plan. Including programs determined by most analysts (see Section 2) to benefit fossil fuels, carbon reductions from reforms increase more than eightfold.

Programs benefiting energy, but excluded from the narrow subsidy definition employed in the EIA program-specific studies, contributed reductions of 34.7 million metric tons of carbon per year by 2035 according to GEMINI model simulations, or nearly 30% of total subsidy-related reductions.[3]

3.2. Impacts of Global Reforms

Domestic reforms are only part of the story, since global subsidy reforms could affect the world price of some fossil fuels. Table 3 provides an overview of the assessments evaluating the impacts of subsidy reform both within the United States and internationally. Normalizing the results is not possible because each used a different economic model and included different mixes of fossil fuels, economic sectors, and countries. Many also relied on data more than five years old, a particular problem for economies such as Russia and China that have undertaken more recent price reforms.

Despite all of this variability, there are some consistent trends. First, all of the assessments project some global reductions in GHG emissions (0.2% to 8.0% by 2010), with the largest reductions occurring in the transition economies that currently have the least accurate pricing regimes. Many of the studies also predict that some of the developed countries will actually increase emissions slightly following reforms. Lower prices from removal of high domestic energy taxes, combined with worsening terms of trade for exporters (as demand drops sharply in the many exporting nations with very large domestic subsidies) lead to this outcome. Finally, there is also general consensus that reforms will lead to increased economic efficiency and little or no change in economic welfare at the national level, though impacts on specific regions or industrial sectors were not evaluated and could well be higher.

The lower-bound studies may also be overly pessimistic in their projections. Two of the lowest (Light and DRI, for example) include only coal reforms and do not capture the benefits of reforms to all fossil fuel prices. In addition, their characterization of coal markets predicts nearly complete replacement of uncompetitive domestic coal with imports rather than with cleaner fuels following subsidy reform. Actual market experience in the United Kingdom following coal subsidy reform did show substantial gains in the share of natural gas at the expense of coal, a process that could well be repeated elsewhere (R. Steenblik, OECD, personal communication, November 2, 2000).

Reconciling the international results with the US-specific modeling efforts is not straightforward. A number of factors argue in favor of the domestic studies. First, the much more precise data used in the domestic runs (data for many countries in the international models are entirely lacking) suggest that the US-specific results

[3]These programs (and reductions in MMT carbon) include tax exempt municipal bonds (10.3), subsidies to federal power marketing administrations (0.9), Rural Utility Service subsidies (10.5), energy share of full user fee financing of water infrastructure (6.3), and user fee financing for the Strategic Petroleum Reserve (6.7). (DFI, 1995).

TABLE 3 Overview of GHG reductions from subsidy reform

Study	Coverage	Reductions from reforms	Commentary
Saunders & Schneider, 2000 (27) *Data Years*: 1995-96 *Model*: ABARE GTEM *Input*: price gap (World Bank data)	*Fuels*: oil, coal, natural gas *Sectors*: industry, power, and households. *Countries*: world (12 countries, 5 regions, plus rest of world).	1.1% reduction in global GHG emissions by 2010.	Evaluates CO_2, methane, and nitrous oxides.
Koplow et al., 2001 (28) *Data Year*: 1996 *Model*: OECD GREEN *Input*: price gap (Composite: World Bank data with OECD updates)	*Fuels*: oil, coal, natural gas *Sectors*: industry and power only *Countries*: 28, including United States, OECD, major energy producing and consuming nations.	1.9% reductions in global CO_2 by 2000; 6.2% by 2010.	Includes not only removal of subsidies, but reform of excess taxes as well. Neutral or slightly positive with respect to welfare impacts.
IEA, 1999 (29) *Data Years*: 1997-98 *Model*: partial equilibrium analysis *Input*: price gap subsidies (IEA data)	*Fuels*: oil, coal, natural gas *Sectors*: all *Countries*: China, Russia, India, Indonesia, Iran, S. Africa, Venezuela, Kazakhstan	4.6% annual reductions in global CO_2; 16% reductions within countries reforming prices.	Inclusion of more countries and regional spillover effects of reforms would yield larger reductions. Concurrent removal of special energy taxes would yield lower reductions.
Light, 1999 (30) *Data Year*: 1995 *Model*: Global Coal Model *Input*: price gap subsidies (IEA data)	*Fuels*: steam coal only *Sectors*: power and industry *Countries*: Japan, Germany, Spain, France, UK	0.2% reductions in global CO_2	Model includes coal trade and concludes that most coal displaced by subsidy reform in Europe and Japan

			would be replaced by imported coal rather than different fuels.
Anderson & McKibben, 1997 (31) *Data Year*: 1990 *Model*: G-Cubed *Input*: price gap (IEA and OECD data)	*Fuels*: coal only *Sectors*: all *Countries*: all (though some simulations include Japan and W. Europe only).	8% reduction in global CO_2 from global reforms; 5% reduction if reforms only within Japan, W. Europe (13% of domestic emissions).	Also project gains in economic efficiency.
Shelby et al., 1997; (32) Jorgenson, 1994 (33) *Data Year*: 1989–1992 *Model*: Jorgenson-Wilcoxen-Slesnick *Input*: US policy-specific (baseline data from EIA92).	*Fuels*: coal, oil, natural gas *Sectors*: all *Country*: United States	4.0–4.4% annual reductions in carbon emissions through 2050.	Subsidy reform comprises roughly 30% of the total reduction required to achieve stabilization. Small overall gain in welfare.
Shelby et al., 1997 (34); DFI, 1993 (35) and 1995 (36) *Data Year*: 1989–1992 *Model*: DFI Gemini *Input*: US policy-specific (baseline data primarily EIA92; enhanced case comes	*Fuels*: coal, oil, natural gas *Sectors*: all *Country*: United States	*Carbon*: 0.7% domestic reductions in 2010 in base case; 5.7% in expanded case. Values for 2035 are 2.2% and	Enhanced runs simulate removal of a larger set of energy subsidies, as well as the energy share of subsidies to parking,

(*Continued*)

TABLE 3 (*Continued*)

Study	Coverage	Reductions from reforms	Commentary
from other sources as well).		8.1% respectively. *Methane*: 2.7% reductions in 2035 in base	housing, transport, and waterway infrastructure. Enhanced runs were not done for methane.
DRI, 1997 (37) *Data Years*: 1991–1992 *Model*: DRI proprietary coal model *Input*: price gap	*Fuels*: coal only *Sectors*: power and industry *Countries*: UK, Germany, Spain, France, Turkey, Japan, Canada, United States	<1% reduction in CO_2 emissions by 2010.	Analysis found subsidies in Canada and United States to be zero, and therefore no benefits from reform.
Larson, 1994 (38) *Data year*: 1991 *Model*: Partial equilibrium analysis *Input*: price gap (World Bank data)	*Fuels*: coal, oil, natural gas *Sectors*: all *Countries*: ~20 of the largest fossil fuel producing and consuming nations (excluding the United States)	7% reduction in global carbon emissions; 20% reduction in domestic carbon loadings for some countries.	Modeled reforms apply only to subsidies. Cases where fossil fuel prices exceed the world price are left unchanged.

Source: Expanded from (28).

Abbreviations: ABARE: Australian Bureau of Agricultural and Resource Economics; DFI: Decision Focus, Inc.; DRI: Data Resources, Inc; GTEM: Global Trade and Environment Model; GREEN: General Equilibrium Environmental model; EIA: US Energy Information Administration.

are more likely to be accurate. The international models also tend to do a poor job incorporating US markets. Most price gap assessments use the US prices as the reference prices for key fuels, yielding a zero subsidy value for the domestic market, and hence no benefit from reforms. Similarly, where alternatives such as PSE or program-specific assessments are used, there is either no information on US subsidies or the program-specific data used in model runs incorporate only the narrowest definition of subsidy (e.g., DJA). Second, the many gaps in fuels, sectors, and countries covered in the international modeling efforts tend to understate the emissions reductions from reforms. However, because the US efforts do not incorporate any terms of trade improvements for domestic consumers that may come from global reforms, the impetus to increase domestic consumption as world prices fall is not captured.

We conclude that using more refined subsidy inputs in the global modeling efforts would likely demonstrate declines in GHG emissions even within the United States, though the declines are perhaps not as large as projected in the enhanced DFI model runs of US-only subsidy reform.

4. DISPARITY IN PROCEDURAL TREATMENT OF SUBSIDIES AND ENVIRONMENTAL REGULATION

Empirical evidence suggests that reform of fossil fuel subsidies would yield reductions in global emissions. US-based studies suggest such reductions could be a significant component of the overall reduction strategy. Implementing any type of reform, however, requires much greater transparency of information about subsidy policy than currently exists. The methods already employed to add transparency to environmental regulation provide a useful framework to identify possible improvements.

4.1. Procedural Differences

Basic procedural disparities exist between the development and implementation of environmental regulation and the development and implementation of subsidies. These differences are summarized in Table 4 and include greater public oversight and procedural consistency for regulations than for subsidies. These differences are not unique to climate change; they are generally true of any other policy area for which the government has adopted social regulations (e.g., environmental, labor, or health) and has also provided subsidies to activities that may give rise to problems. One exception is the environmental impact statement requirement, which applies only when there are likely to be significant environmental impacts and would not ordinarily be required in other policy areas. These differences also suggest several possible procedural reforms, which are discussed in the next section.

TABLE 4 Summary of major procedural differences between regulatory and fiscal processes

Core element	Use in regulatory process	Use in fiscal process
1) Public availability of basic information	Text of all final regulations is collected in Code of Federal Regulations	Some but not all subsidies identified in annual federal budget
2) Public justification		
Public notice of proposal	Publish proposal with explanation in Federal Register	No advance notice required
Required justification	Agency must explain basis and purpose of proposal Agency must analyze costs and effects, and consider regulatory alternatives	Early analysis of proposals contains only budgetary impact; often proprietary with no public access No information on other impacts
Public comment process	Public comments solicited on proposed rulemaking Agency must respond to significant comments	No public comment process prior to passage
Final result	Publish final rule in Federal Register with changes and explanation	Cost impacts are in budget (including analytical Perspectives chapters) descriptive definitions, but little evaluation of broader impacts
3) Analysis of environmental effects	Environmental impact statement, including consideration of alternatives Public notice and comment	No review or comment

4.1.1. PUBLIC AVAILABILITY OF BASIC INFORMATION Environmental regulation is conducted under the umbrella of a broader set of procedural requirements that apply to actions by all federal administrative agencies, including environmental agencies. The Administrative Procedure Act (APA) of 1946, whose relevant provisions have not subsequently been amended, is the primary legal source for these requirements (40). For example, all administrative rules that will have a binding effect are routed through a single process, regardless of the agency promulgating them. The APA requires the public availability of the text of administrative regulations that are adopted under that process. While it is relatively easy to find the text of environmental and other regulations and to determine which agency is implementing them, comparable information about subsidies is not available.

Under the APA, all regulations that are intended to have a binding and future effect are collected and codified in one place—the Code of Federal Regulations. The Code of Federal Regulations is published and updated on a regular basis by the federal government, is available in hard copy in law and other libraries throughout

the country, is also available on the World Wide Web, and can be accessed through various commercially available computerized data bases. Prior to adoption of the APA, regulations were often scattered in agency practice and guidance manuals, memos, desk drawers, and other odd places. As a result, it was often difficult for regulated parties, the public, and even agency personnel to be fully aware of all the applicable regulations.

Subsidies that increase greenhouse gas emissions are rather like regulations before the APA; they exist but they are often hard to find. As the preceding section demonstrates, such subsidies are scattered through the tax code, various government lending and insurance programs, government-owned enterprises such as federal power administrations, and to some extent in regulatory exemptions as well. Like administrative regulations before the APA, there is no one place to find them all. Although the federal budget provides an important starting point for assembling the fragmented spending and program data into a picture of the magnitude of support for particular activities, it leaves much out. Some subsidies aren't properly recognized in the budget; others require information that is contained only in the more detailed appropriation bills or internal agency documents or annual reports. Others, such as tax expenditures, are tracked in the analytical perspectives portion of the budget but are only cursorily evaluated to assess the beneficiary sectors, and sometimes have a wide range of estimates for their monetary value. The absence of a single location where basic information about subsidies is collected makes it hard to say for certain how numerous they are, how much money they involve, which parties they help or harm, and even whether they are internally coherent.

4.1.2. PUBLIC JUSTIFICATION PROCESS Democracy relies on public disclosure, discourse, and challenge to provide checks and balances to the rules of government. For example, before administrative agencies can adopt binding environmental regulations, they must go through an exhaustive, public, and often controversial process to ensure that their decisions are lawful and rational. There is no comparable process for the development and implementation of many subsidies that are overseen by administrative agencies in the form of grants and other direct financial assistance.

When an agency wants to adopt a binding regulation, the APA requires the agency to publish in the *Federal Register* a notice of proposed rulemaking that includes the text of the proposed regulation and an explanation of its basis and purpose. The *Federal Register* is the official bulletin board of the federal government; publication in the *Federal Register* is considered to provide notice to the world. The agency must then receive comments from interested persons for a specified period of time. At the close of the comment period, the agency must address all significant comments and make appropriate changes. It then publishes the text of the final regulation in the *Federal Register* along with an explanation of its responses to comments. None of these requirements, however, apply to an agency decision to adopt binding and future rules involving "loans, grants, benefits, or contracts" (41), the primary routes of subsidization. As a result, the administrative

rules governing grant programs and similar subsidies are less publicly visible and contain fewer legal obstacles to their implementation.

Congress has imposed other requirements on the rulemaking process. These requirements tend to track the APA exclusion of "loans, grants, benefits, or contracts" and thus accentuate the disparate treatment of conventional regulation on one hand and subsidies on the other. The general effect of these requirements is to subject regulation to higher levels of justification, while leaving subsidies alone.

The Unfunded Mandates Reform Act (42) generally requires federal agencies to prepare an informational statement before proposing or finalizing any regulation that includes a federal mandate that is likely to result in the total annual expenditure of $100 million or more by state, local, and tribal governments and the private sector. Among other things, the statement must include a qualitative and quantitative assessment of costs and benefits, including those relating to health, safety, and the environment; and estimates of compliance costs. It must also include estimates of the effect of the regulation on the national economy. Agencies are obliged to consider reasonable regulatory alternatives and select the "least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule" (43). Other statutes require agencies proposing administrative rules to consider the effect of their proposal on particular constituencies (small business) (44) or issues (paperwork reduction) (45).

Still another statute (46) provides for congressional review of proposed rules. The basic idea behind this statute is to require administrative agencies to submit the text of proposed agency regulations, as well as all required agency justifications, to Congress. Under this legislation, Congress may prevent a proposed rule from going into effect by enacting an appropriate joint resolution. To be legally effective, the joint resolution would have to be passed by both houses of Congress and either signed by the president or approved by two-thirds majorities in each house over the president's veto. Although Congress could have passed such resolutions before this legislation, the statute makes it easier by establishing a process for their expedited review. Perhaps more fundamentally, the legislation is another effort by Congress to make rulemaking more difficult and costly. The antiregulatory meta-message in the legislation is so dominant that its drafters appear not to have noticed that the statute defines "rule" to include "loans, grants, benefits, or contracts" (47). While Congress could therefore use the legislation to review proposals involving agency subsidies, there is little evidence that Congress had that intent.

Administrative regulations are also subject to considerable scrutiny from within the executive branch. Executive control over rulemaking is based on the president's ultimate responsibility for the actions of all administrative agencies. Such control reduces the likelihood of proposals that would be difficult to justify from a legal or political perspective, including proposals that would attract legitimate criticism from Congress. Executive Order 12866 (48) requires agencies to "assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs."

For "significant regulatory actions" an agency must submit to the executive Office of Management and Budget a detailed analysis of costs and benefits, including effects on the natural environment. Significant regulatory actions include rules that would have an annual effect on the US economy of $100 million or more, or would adversely affect, among other things, the economy, competition, or the environment. The order also requires agencies to periodically review their existing significant regulatory actions to determine if they could be made more effective and less burdensome.

The requirements of these statutes and the executive order may seem somewhat duplicative, but they raise a more important issue. This system creates considerable disparities between the justification required for administrative regulations and the justification required for other government actions, including subsidies.

4.1.3. REQUIREMENT TO CONSIDER ENVIRONMENTAL EFFECTS Decisions by administrative agencies are also subject to greater scrutiny for environmental effects than decisions by Congress. The primary mechanism for this is the National Environmental Policy Act (NEPA), which requires every federal agency proposing "legislation and other major Federal actions significantly affecting the quality of the human environment" to first prepare a statement of the environmental impacts of that action as well as alternatives to it (49). The effectiveness of the statute is premised on the value of requiring agencies to consider environmental impacts and alternatives, and on public disclosure of that information. Agencies are required to publish proposed environmental impact statements, take public comment on those statements, and then publish final statements before proceeding.

NEPA does not apply to Congress, however, because legislation proposed by individual members of Congress is exempt from the requirement for an environmental impact statement. For most proposed legislation that is intended to protect the environment, the absence of an environmental impact statement is not ordinarily a problem because environmental issues are reasonably well addressed by the legislative process. When legislation has another purpose, however, and may adversely affect the environment, environmental effects may or may not be brought to Congress's attention by nongovernmental organizations and citizens. Even if this information is raised, it is not likely to be in the form of a detailed examination of effects and alternatives. In addition, these organizations and citizens effectively have the burden of persuasion on environmental matters. The environmental impact statement process, by contrast, tends to put the burden on the governmental proponent of a particular action and requires the analysis to be systematic. Because virtually all tax law is made directly by Congress, for instance, subsidies that encourage greenhouse gas emissions are virtually exempt from NEPA if they are based on the Internal Revenue Code. The federal budget process, moreover, contains no counterpart to NEPA for subsidies or other provisions of the budget. As a result, outside of the administrative rulemaking domain, many environmentally damaging actions, including the creation and continuation of subsidies, proceed without any formal requirement to consider environmental impacts or alternatives.

4.2. Why These Differences Matter

The disparities between the procedural treatment of environmental regulation and subsidies exist despite the reality that regulations and subsidies have equivalent effects. To begin with, both affect costs of doing business and competitiveness. Environmental regulation imposes those costs directly, in the form of prohibitions and procedural restrictions. Subsidies can have the same types of effects. They transfer rights and responsibilities across groups and can affect the markets for particular goods or services, often tilting the competitive "playing field" against other participants.

Subsidies are also as capable as environmental regulation of producing particular policy outcomes. Environmental regulation is ordinarily intended to protect human health and the environment in specific ways; fiscal policies may be implemented to spur economic development. In addition, both may fail to meet their intended objectives as well as achieve unintended results.

These similarities in potential economic impact and efficacy become even more important when there are conflicts between the purpose or effects of regulation on one hand and subsidies on the other. In the environmental arena, federal regulations and subsidies affecting environmental quality should be reasonably consistent to ensure the effectiveness and efficiency of the measures, to give affected parties a clear signal of what is expected of them, and to engender public support for the effort required to develop and oversee the policies.

Finally, regulatory oversight is justified in large measure to ensure that use of public moneys to support the regulatory process is warranted. Subsidies also tend to impose direct costs to taxpayers. Oversight to protect the fiscal interests of the public is equally important for both.

Economic effects, efficacy, policy coherence, and fiscal prudence are particularly important in the context of climate change. Of the many policy issues presented to the federal government, climate change is one of very few that affects every sector of the economy, has significant domestic and international implications, and is likely to be present in serious policy discussions for decades. The projected costs to stabilize atmospheric levels of greenhouse gases at a level that will not cause significant harm to humans or the environment are considerable. Although models produce varying results depending on the assumptions used (50) (51), two recent estimates of US costs to comply with the Kyoto Protocol range from 0.1% of projected annual GDP by 2018–2012 (52) to 0.4 to 0.8% of projected annual GDP in 2010 (53). Even more significant reductions will be required to stabilize greenhouse gas levels in the atmosphere. Existing subsidies to fossil fuels make stabilization even more difficult. As a result, the reduction or elimination of any governmental impediments to the effectiveness of actions to reduce greenhouse gas emissions should be seriously considered.

The costs of not reforming are important to acknowledge. Were the United States to implement a cap-and-trade system for carbon or carbon dioxide, as seems possible, the system would require a detailed set of ground rules. Under a cap-and-trade system, each of certain facilities emitting carbon dioxide would be

obliged to reduce its emissions by a specified amount. Ordinarily, it will cost some facilities more to achieve the required cap or reduction than others. Facilities that reduce their emissions more than required can sell or trade their excess reductions to other facilities in the form of allowances or credits. The latter can then use these allowances to help meet their cap. The ground rules for a cap-and-trade system would include baselines, procedures and methodologies for measuring reductions, and specific monitoring methods, and thus would be technical in nature. When Congress established the overall framework for such a system, it would likely leave such details to administrative rulemaking, subject to all of the oversight mechanisms described above. Yet, when the cap-and-trade system finally made it through this process, it would risk being undermined by federal programs that directly or indirectly subsidize the very emissions the system is trying to control—all without any public notice or detailed analysis.

5. PROCEDURAL OPTIONS FOR INCREASING TRANSPARENCY OF SUBSIDIES THAT CONTRIBUTE TO GREENHOUSE GAS EMISSIONS

It will be difficult for the federal government to move toward substantive consistency unless it provides some semblance of procedural consistency. Process affects substance, and different processes are likely to lead to different substantive outcomes. Consequently, this section identifies several procedural reforms that could lead to more coherent policy making concerning climate change by increasing the transparency of subsidy policies. These options do not exhaust the possibilities; they simply illustrate the utility of importing ideas from administrative and environmental law into a discussion of subsidy reform. By focusing on procedural reforms, we recognize that perfect consistency is not possible and that Congress may want to continue certain programs that lead to greenhouse gas emissions because the programs provide other benefits. The procedural reforms suggested here would not prevent Congress from making such judgment calls.

Behind the suggested tools is the idea that basic information on subsidies should be just as available to the public as basic information about administrative actions. Although administrative regulation is not perfect, the disparity in procedural treatment of administrative regulation and subsidies creates significant risks of policy bias. These options should apply to all types of subsidies, whether they are contained in the tax code, are based on administrative agency activities, or occur in another manner, because the environmental damage they cause is basically the same regardless of their form.

Based on experience in the regulatory arena (54), there is reason to believe that subsidy reform, through the increased use of tools from environmental and administrative law, would not only increase the pressure to eliminate damaging subsidies already in place but would make implementation of new damaging subsidies much more difficult. Administrative law's role in establishing standard public

information about decisions and the decision-making process has very clearly improved both the quantity and quality of information available to the public. Laws standardizing the process of administrative rule making have also helped ensure that agencies follow the law and adequately justify their proposed actions. There is general agreement that these factors have improved both the equity and the quality of government decisions.

This section discusses three possible reforms. In the context of this article, these suggestions would apply to fossil fuel subsidies that foster greenhouse gas emissions. Because the procedural requirements suggested here for subsidies mirror those for administrative and environmental law, these suggestions would lead to the development of information about subsidies that is comparable in form and content to information required by environmental regulation. As a result, it would be easier for decision makers to integrate subsidies into a broader discussion of their overall objectives for mitigating climate change and to provide the best means of achieving them. These suggestions also could be applied more widely to all subsidies, with potentially large benefits, although further analysis of the implications of that approach would be required.

5.1. Public Registry of Basic Information About Subsidies

Congress could require the creation of a registry or list of subsidies believed to cause or contribute to greenhouse gas emissions, the manner in which they are implemented, citations to relevant legal authority, their annual cost to the federal budget, and their implementing agency. To keep the list manageable and meaningful, Congress could include only those subsidies whose direct or indirect fiscal costs are anticipated to exceed a minimum dollar amount. Like the effect of the Code of Federal Regulations on the public availability of regulations, the registry would make subsidies much easier to find by putting them all in one place. Congress should also consider a rule prohibiting any such subsidy (including an existing subsidy) from being implemented unless it is first identified on the registry. The prohibition would provide a largely self-implementing means of ensuring the enforcement of the registry requirement.

The subsidy registry would differ in important respects from the annual federal budget provided by the Office of Management and Budget. First, it would provide a greater level of programmatic detail, where such detail is needed to determine the beneficiary sector(s). Second, it could be sorted topically, rather than organized solely by administrative unit as is the case in most existing budget documents. Third, it would provide integrated information on programs, such as tax expenditures, that are currently separated into different and unlinked portions of the document.

5.2. Subsidy Justification Analysis

The development and continued implementation of subsidy programs by administrative agencies could be subject to the same kinds of procedural limits as

administrative regulations. This analysis would be similar to the kinds of analysis required for administrative rulemaking but tailored more particularly to subsidies. Those proposing a new subsidy or the continuation of an existing subsidy listed on the registry would be obliged to prepare an analysis of the need for the subsidy, the fiscal impact of the subsidy, an analysis of whether the subsidy is still needed, and, if so, an analysis of whether there are any less costly or more effective alternatives to achieving the purpose of the subsidy. Although resolution of the methodological differences in subsidy analysis identified in Sections 2 and 3 is beyond the scope of this paper, a criterion for including the discussion of a particular issue in the subsidy justification analysis should be the usefulness of that issue to the public and decision makers. Except when methodological disagreements have trivial consequences, the existence of such disagreements, as well as the strengths and weaknesses of competing positions, should be discussed. Although such disagreements may be complex, administrative rulemakings routinely require resolution of complicated issues (including differences in quantitative estimates); complexity is not ordinarily considered a sufficient reason for preventing public disclosure of information with significant policy consequences. Both existing and new policies would need to be subjected to this requirement in order for it to be effective. Subsidies that entail direct or indirect budgetary costs in excess of $100 million per year should be subjected to a higher level of analysis than those with lower costs.

After a draft subsidy justification analysis is completed, it would be made public and subject to notice and comment. Completion of the notice-and-comment period, response to comments, and finalization of the subsidy justification analysis would be required before Congress could enact the program. In the rulemaking and environmental impact statement arenas, public input provides an opportunity for new information and ideas to be brought to the decision-making process. More broadly, public information in the environmental context opens the relationship between the regulator and the regulated to other parties (55). Similarly, the analysis would provide the public with detailed information about particular subsidies, with an opportunity to comment on those subsidies.

The registry is necessary to know what subsidies exist, but the justification analysis and the notice-and-comment process would provide the public with an opportunity to understand in detail the effects of these subsidies. Because much of this analysis has not yet been done or is not easily accessible, the analysis would provide a more reasoned basis for decision making about subsidies, including which should be continued or modified. The process would also open the relatively closed relationship between provider and recipient that also exists for most subsidies. Over time, standardized assessment methodologies would evolve, greatly reducing the fiscal variance contained in the existing set of subsidy assessments.

Once the comment period was concluded, the analysis and a recommendation would be finalized. The final document would be made public and sent to Congress. Although the justification process would open subsidies to more scrutiny, the process would not prevent Congress from enacting or re-enacting a provision after

completion of the subsidy justification analysis even if the subsidy is likely to entail significant environmental costs. The analysis would make costs, effects, and alternatives clearer, however, and would likely result in modifications to the subsidy that would not otherwise have occurred. Moreover, subsidy analyses will likely show that some subsidies are more justifiable than others. An analogous situation exists under NEPA, where it is possible for decision makers to proceed with a project, but the environmental impact statement process likely means that the agency action will have fewer environmental impacts. More basically, both kinds of analysis increase the ability of affected parties to create political opposition to environmentally questionable actions.

5.3. Environmental Impact Analysis

There is little rationale for making some federal activities (such as new infrastructure projects) subject to broad oversight, while imposing no such requirements on federal subsidies that may also contribute to substantial environmental harm. Congress could require that subsidies on the registry be subject to an environmental impact analysis that includes a detailed examination of their environmental effects or externalities. The analysis would be required only for subsidies that are likely to have significant effects. Such an analysis would be conducted at the same time and for the same subsidies as the subsidy justification analysis and would be subject to the same procedure. Such information would be available to Congress before it decided whether to continue or modify the subsidy. Again, when methodological differences suggest a range in the type or size of externalities, those differences and the merits of competing projections should be disclosed.

For all subsidies, the analysis would mirror most of the requirements of NEPA. It may, however, be appropriate for Congress to tailor this analysis more precisely for certain types of subsidies, particularly if Congress develops a comprehensive response to climate change. For example, Congress could decide to expressly require consideration of climate change impacts. While regulations adopted to implement NEPA require the assessment of environmental consequences to include a discussion of "[e]nergy consequences and conservation potential of various alternatives and mitigation measures" (56), there is no specific requirement for an analysis of climate change impacts. In addition, Congress might consider requiring an analysis of the effect of the subsidy on the overall climate change legislation. Unlike the first requirement, which focuses on climate change effects, this requirement would assess the extent to which the subsidy undermines national goals to reduce greenhouse gas emissions. Finally, to ensure consideration of all subsidies, Congress may want to apply these requirements to all subsidies, even subsidies that are not the result of agency actions. Under this approach, these requirements would apply to subsidies directly from Congress or contained in the Internal Revenue Code.

The environmental impact analysis would not preclude Congress from enacting or re-enacting subsidies, but it would force the development and public dissemination of information that has rarely been generated, even for multibillion dollar

subsidies. It would also slow down the process of implementing new subsidies by making it difficult to place them in active legislation as appropriation riders. Finally, it would educate the public about the extent to which specific subsidies may undercut national legislation to address global warming.

6. CONCLUSION

Subsidy reform offers opportunities for reducing government costs and for making government actions more consistent and coherent. In specific contexts, such as climate change, subsidy reform may also reduce costs and increase the benefits of ongoing and sometimes conflicting government actions to reduce greenhouse gas emissions. The first and most important step is to ensure that basic information about subsidies and their effects is made available to the public as well as to government decision makers. Many of the approaches already applied in the regulatory arena could be applied to the fiscal arena as well to achieve this objective.

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