

## 1. Introduction

### Background and Purpose

In May 2007, Senator Lamar Alexander asked the Energy Information Administration (EIA) to develop an analysis of Federal energy-specific subsidies that provide a financial benefit with an identifiable budget impact. His request letter of May 12, 2007, provided as Appendix H, asked EIA to focus particularly on subsidies directed to electricity production, including an estimate of electricity subsidies on a per unit basis.

In 2000, EIA enumerated and summarized energy subsidies and support generally; this report focuses on electricity production, specifically those subsidy and support programs that affect the production of primary fuels used to generate electricity (coal, natural gas, petroleum, and nuclear fuel), and the development of generating technologies including renewable generating technologies, and the development and maintenance of the electricity infrastructure.

### Scope of the Report and Measurement of Subsidies and Support

Federal energy subsidies discussed in the body of this report take four principal forms:

- **Direct Expenditures.** These are Federal programs that provide direct financial benefits to targeted producers and consumers of energy to promote investment in critical infrastructure, develop and diversify domestic energy supplies, foster efficient end-use consumption, and reduce energy costs incurred by economically-disadvantaged consumers.
- **Tax Expenditures.** Tax expenditures are provisions in the Federal tax code that reduce the tax liability of firms or individuals who engage in specific economic activities that affect energy production, consumption, or conservation in ways deemed to be in the public interest.
- **Research and Development (R&D).** Federal R&D spending focuses on a variety of goals, from increasing U.S. energy supplies, to improving the efficiency of various energy production, transformation,<sup>7</sup> and end-use technologies. R&D expenditures do not directly affect current energy production, prices, and environmental quality, but, if successful, they could affect future energy production, prices, and environmental quality.
- **Federal programs that indirectly support electricity production.** Through the Tennessee Valley Authority (TVA) and the Power Marketing Administrations (PMAs), which include the Bonneville Power Administration (BPA) and three smaller PMAs, the Federal government brings to market large amounts of electricity, stipulating that "preference in the sale of such power and energy shall be given to public bodies and cooperatives."<sup>8</sup> The Federal government also provides direct financial support and credit enhancement for construction and generation, transmission, and distribution facilities by entities eligible to participate under the U.S. Department of Agriculture's Rural Utilities Service (RUS) loan programs.

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<sup>7</sup> Energy transformation consists of network infrastructure and delivery systems. Electricity is the primary transformation sector analyzed in this report. The electricity sector consists of generation, transmission, and distribution.

<sup>8</sup> Flood Control Act of December 2, 1944 (58 Stat. 890; 16 U.S.C. 825s). Surplus Federal utility power is sold to investor-owned utilities.

In measuring the cost to the Federal government of the subsidies (and financial support provided TVA and PMA customers and RUS borrowers) this report uses the measure of budget cost or revenue losses to the greatest extent possible; in some cases, budget outlays—the actual expenditures by Federal agencies—are cited. For many R&D programs, however, the available outlay data are less disaggregated than the appropriations data. Hence, using the appropriations data provides a more detailed understanding of Federal R&D efforts by type of energy supported. There are also several programs for which the Federal budget itself is not a meaningful measure of the concept of budget costs. Tax expenditures are not line items in the budget. The Treasury Department estimates the cost of tax expenditures as revenue foregone as a result of a provision in the tax code that reduces or defers tax liability and, therefore, tax receipts. The Treasury Department's estimated revenue losses associated with energy-related tax expenditures are used in this study.<sup>9</sup> EIA measures support provided by Federal electricity programs through a cost-of-capital analysis.

Using the Federal budget has the advantage of ease of measurement; however, budget values may understate both the economic costs and the market impacts of specific programs, especially where small subsidies are applied to large existing markets.<sup>10</sup> On the other hand, some large subsidies are applied to small markets and have a substantial impact on certain forms of energy production and consumption. Some subsidies offer relatively large payments to producers using certain energy technologies that otherwise would be uneconomical at present. In these cases, the immediate effects on markets may be small, but the impact on specific technologies may be significant now and in the future.

### **Definition of Subsidy and Types of Subsidies and Support Addressed**

There is no universally-accepted definition of subsidy. For the purposes of this report, a subsidy is defined as a transfer of economic resources by the Federal government to the buyer or seller of a good or service that has the effect of reducing the price paid, increasing the price received, or reducing the cost of production of the good or service with incentives that reduce the producers' taxable income. A subsidy is conditioned on a particular economic outcome. The net effect of such a subsidy is to alter the production or consumption of a commodity over what it would otherwise have been.<sup>11</sup> In some instances subsidies may also result in a transfer of wealth because they change the behavior of the recipient of the subsidy.<sup>12</sup> Subsidies are measured in terms of monetary value. They exist when government intervention either lowers energy prices for consumers or supports producers when their production costs prohibit sales at market prices. There are a number of Federal interventions in energy markets that fall outside the framework of this report, an important one being government regulation. The cost of spillovers, such as the effects that certain forms of energy production and consumption have on the environment and public health, is another.

This report quantifies direct and indirect energy subsidies and support to Federal electricity programs. Direct subsidies include (a) payments from the government directly to producers or consumers and (b) tax expenditures. Tax expenditures are provisions in the tax code that reduce the Federal tax liability of qualifying firms or individuals who have undertaken particular

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<sup>9</sup> Previously, the Treasury Department estimated revenue impacts using an additional method, outlay equivalents. EIA used outlay equivalents to measure budget impacts in its previous reports.

<sup>10</sup> This is true particularly in the context of comparing the aggregate and the relative share of subsidies for a long-standing energy supply chain (e.g., coal) versus a nascent energy supply chain (e.g., bioenergy).

<sup>11</sup> See C. Shoup, *Public Finance* (Chicago, IL: Aldine Publishing Company, 1969), p. 145.

<sup>12</sup> Direct assistance provided by the Low Income Heating Assistance Program (LIHEAP) could be viewed as falling into this category, since the primary purpose of the program is to assist the economically disadvantaged in meeting high energy bills. Thus, this element of the LIHEAP program is not for the purpose of inducing a change in behavior, e.g., conservation or investment in energy efficiency.

actions. Energy-related examples include tax credits for certain kinds of activity (e.g., producing refined coal) or favorable treatment of capital recovery (e.g., excess of percentage over cost depletion for independent oil producers).

Indirect energy subsidies consist of other forms of Federal financial commitment that affect the cost of consumption or production of some form of energy. Indirect subsidies include the provision of energy or energy services at subsidized prices through several means: loans or loan guarantees; insurance services; R&D activities and expenditures; and the unreimbursed provision by the Federal government of environmental, safety, or regulatory services. The market risk and opportunity cost of capital borne by the Federal government through the Federal electricity programs is estimated as the difference between the incurred cost of capital relative to a range of risk adjusted market interest rates.

The budgetary cost of government-funded R&D is relatively easy to measure. Determining the extent to which government R&D is a subsidy to energy is more problematic. Although R&D funding often consists of direct payments to producers or consumers, the payments are not tied to the actual production or consumption of energy in the present, and thus do not fall within the definition of direct energy subsidies. Federal funding for energy R&D may, in some instances, act as a subsidy to the extent that it serves as a substitute for private R&D expenditures that would have been made in the absence of government outlays. This is why much Federal government-funded R&D is directed at the early stages of technological advances which are undertaken long before any resulting innovative good makes its way into the marketplace.

In addition to quantified energy subsidies and support for Federal electricity programs, this report discusses other indirect subsidies in Appendix A (Fact Sheets), which include descriptions of programs such as loan guarantees, insurance programs, and certain trust funds. When the Federal government assumes actual or potential liabilities of private-sector entities or government entities that compete with private sector entities, it transfers risk to the government. For instance, the default risk associated with loan guarantees represents a potential cost to the government if the borrower defaults and the government must honor the guarantee.<sup>13</sup> In the case of trust funds and insurance programs the funds needed to cover the liability may be collected through a levy on the industry. If the expected present value of the cost of the liability assumed by the government exceeds the present value of the levy on the industry, it is considered to be an indirect subsidy.

This report provides a snapshot of Federal subsidies and support for Federal electricity programs in domestic energy markets. To be included in this report, a subsidy or support must derive from a Federal program, be specific to energy markets, and provide a financial benefit to its recipients.

Certain programs considered as subsidies by others are not included. Because this report focuses exclusively on subsidies and support for Federal electricity programs that involve direct intervention in markets for primary energy sources and electricity, Federal regulatory activities are excluded from the analysis.<sup>14</sup> State and local government programs are excluded by

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<sup>13</sup> Under the Federal Credit Reform Act of 1990 (Public Law 101-508), the budgetary cost of Federal loan and loan guarantee programs are measured in terms of the present value of debt service payments based upon the government's cost of capital, the default risk associated with the borrower or class of borrowers, and loan recovery rate. This measure also includes the Treasury's exposure to duration risk, i.e., the subsidy is recalculated annually to adjust for changes to Treasury Constant Maturities applicable to the cohort of loans.

<sup>14</sup> For example, the Price-Anderson Act, which provides liability limits for nuclear plant operators, is excluded from this analysis (See Appendix A). Other examples include the import tariff on ethanol, and the statutory mandate for blending alternative fuels with gasoline.

definition. Subsidies which arise from broad provisions in the Federal tax code are not considered to be "energy specific." Therefore, for example, economic impacts from accelerated depreciation and tax exempt status for municipal entities are not analyzed. Since trust funds are funded by user fees, they are not included in the analysis.<sup>15</sup> Tax-free bonds used by municipal electric utilities are excluded because non-energy companies such as municipal water and sewer facilities can also use them. Similarly, accelerated depreciation used by investor-owned utilities is also excluded because of its use by non-energy companies. However, tax exempt bonds that are targeted to specific types of energy entities, which are available to multiple-ownership classes, are included in the study.<sup>16</sup>

Public interest in energy subsidies arises in part from concerns that the subsidies may affect competition between energy and non-energy investments or between different forms of energy. Concerns also arise when subsidies lead to higher prices or taxes, either direct or indirect. Because all government programs have costs and benefits, there has been a tendency for the term "subsidy" to lose specificity and acquire derogatory connotations. This study does not ascribe normative values (negative or positive) to subsidies. The report does not attempt to weigh the benefits of each subsidy, nor does it revisit the original considerations—correcting perceived market problems or achieving social objectives—which are the domain of policymakers. It should be noted that in the U.S. economy a wide array of industries and individuals benefit from various subsidies, not just energy producers and consumers. This study identifies and attempts to quantify certain energy subsidies for fiscal year (FY) 2007. For FY 2007, this report used the value of energy-specific subsidies and R&D expenditures from actual budget data and estimates of tax expenditures prepared by the Treasury Department and the congressional Joint Committee on Taxation (JCT).<sup>17</sup> Once the subject of these energy subsidies in FY 2007 is identified and quantified, the study concludes with an examination of fuel-specific impacts of these subsidies on electricity production.

## Valuing Energy Subsidies and Support: Theoretical Issues

EIA considered several theoretical issues in developing an analytical approach that would provide information responsive to the request for this report. Those theoretical issues included:

- The Incidence Theory, which recognizes that the statutory beneficiaries of a subsidy or support may not necessarily be the economic beneficiary. The division of benefits between statutory and economic beneficiaries is dependent on economic behavior that requires an analytical assessment generally beyond the scope of this report.
- Marginal versus inframarginal benefits of subsidies and supports addresses the extent to which a subsidy induces the marginal behavior intended by the particular subsidy or simply transfers wealth to an entity already behaving in the "desired" manner. EIA

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<sup>15</sup> For example, nuclear decommissioning trust funds for which the plant owner is responsible for funding from revenue collected from wholesale and retail customers are excluded.

<sup>16</sup> In this report two tax expenditures take the form of bond issuances, both of which are specifically directed towards energy entities, i.e., the exclusion of interest income on certain energy facility bonds from taxable income and the tax credit to holders of Clean Renewable Energy Bonds.

<sup>17</sup> The use of JCT estimates was limited to certain tax expenditures directed at the electric utility industry in EPACT2005 that were not itemized by the Treasury Department in FY 2007 budget documents. The JCT prepares annually a 5-year projection of tax expenditures. Other than for the exception noted, EIA relied on the Treasury Department estimates and determined that a comparison of Treasury Department and JCT tax expenditure estimates would not be appropriate because, according to the JCT, they are not "necessarily comparable." The methods and assumptions used by the Treasury Department differ from those used by the JCT. For example, the JCT uses an economic forecast by the Congressional Budget Office, whereas the Treasury Department relies on the Administration's economic forecast. See, "Estimates of Federal Tax Expenditures for Fiscal Years 2007-2011," Staff of the Joint Committee on Taxation, (Washington, DC, September 24, 2007), pp. 21-22.

recognizes that benefits may be divided in this fashion. However, an analysis of marginal and inframarginal effects was beyond the scope of this analysis.

- The study examines the market risk and opportunity costs to the Federal government incurred through its participation in Federal electricity programs. While these programs may not be reflected in the Federal budget as direct expenditure line-items, market risk and opportunity costs, while difficult to quantify, are real.

### The Incidence Theory

A rigorous economic and financial analysis of energy-related subsidies that directly impact electricity production requires an empirical examination of the underlying behavior of market participants in the product markets to which a subsidy is directed to determine who ultimately receives the benefit.<sup>18</sup> In other words, the statutory beneficiary of a tax or direct subsidy may not be the economic beneficiary, depending on economic behavior of market participants. The literature on public finance and taxation refers to this as the Theory of Incidence.<sup>19</sup>

Subsidies for which fuel producers or transporters (e.g., natural gas pipelines) are the statutory beneficiaries may pass forward, i.e., transfer, in whole or part to electricity generators based on a variety of economic circumstances. EIA recognizes that a pass forward of economic incidence may occur with many subsidies described in this report. The number and variety of subsidies provided to segments of the energy industry that are upstream of electricity production makes it impractical to perform a quantitative estimate of tax incidence on a subsidy-specific basis which distinguishes between statutory and economic incidence for subsidies. Accordingly, for purposes of this report, EIA adopted an allocation method based on fuel consumption by the electric industry to allocate the value of these subsidies to electric generation by fuel-type as described in Chapter 5. This method was adopted in recognition of the potential presence of economic incidence, but should not be construed as being an estimate of actual economic incidence.

### Marginal Versus Inframarginal Effects of Subsidies and Support

A second economic consideration associated with subsidies is the extent to which the subsidy leads to the desired marginal behavior such as increased production of a preferred fuel or renewable resource, or a subsidy that results simply in a transfer of resources or wealth, often described as an inframarginal effect. For example, ethanol producers and fuel blenders benefit from three Federal interventions: (1) a tariff imposed on ethanol imports, (2) a mandate that requires the blending of renewable fuels with gasoline, and (3) the Volumetric Ethanol Excise Tax Credit (VEETC). While the latter is a tax subsidy estimated by the Treasury Department

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<sup>18</sup> Methods include partial equilibrium analyses, static general-equilibrium analyses, dynamic equilibrium analyses and empirical analyses using micro-data sets to investigate the impacts of an individual subsidy on behavior. These alternative methods are described in the context of examining where the ultimate burden of a tax falls, as opposed to a tax subsidy in the article "Incidence of Taxes" written by George Zidrow that appears in the Urban Institute *Encyclopedia of Taxation and Tax Policy*, <http://www.urban.org/UploadedPDF/1000534.pdf>.

<sup>19</sup> A cogent example of the difference between statutory and economic incidence, and the quantitative analysis (regression analysis) required to thoroughly investigate this issue appears in a recently published paper that examined the hybrid vehicle tax credit included in the Energy Policy Act of 2005. The author used data on the sales of the Toyota Prius to assess whether consumers (the statutory beneficiary) of the tax credit realized the benefit, or whether it was transferred to Toyota as a result of its economic behavior in response to the tax credit. Specifically, the author sought to quantitatively determine whether Toyota raised prices to clear the market and capture the majority of the benefit of the tax credit that statutorily was directed to consumers. Based on the results of the analysis, the author concluded, that Toyota did not raise prices, despite capacity constraints out of a concern that raising current prices would dampen future demand. See, Sallee, James M. "The Incidence of Tax Credits for Hybrid Vehicles," University of Michigan, January 22, 2008, <http://www-personal.umich.edu/~jsallee/Homepage/Home.html>. The Incidence Theory suggests that normally when a product market is supply or capacity constrained, a supplier receiving a tax credit is likely to retain the benefit of the tax credit. If the product market is not constrained and market entrance is relatively easy for new suppliers seeking to capture the tax credit, i.e., statutory incidence, the price of the product will be bid down by competition. This economic behavior results in the transfer of the benefit to consumers, i.e., economic incidence.



and discussed in Chapter 2, the first two interventions are not assumed to be subsidies in this report. Interactions between these three interventions in ethanol markets, or other energy products and services for which multiple subsidies may be available under Federal law, are not analyzed in this report, and the extent to which the current level of ethanol production would have occurred in the absence of VEETC because of the tariff on ethanol imports and the renewable fuels mandate is not addressed. To the extent the current levels of production could have been achieved without VEETC, it would result in a wealth transfer to the beneficiaries of the excise tax credit. EIA considered the examination of the marginal and inframarginal effects of energy-related subsidies to be outside the scope of this report.

### **Measurement of Financial Support to Federal Utilities' Customers and Rural Utilities Service Borrowers**

A final consideration relates to the inclusion of Federal financial support to Federally-owned utilities and direct loans and loan guarantees provided by the Rural Utilities Service (RUS) to eligible borrowers for investment in generation, transmission and distribution facilities. RUS borrowers are primarily generation and transmission cooperatives (G&T) and distribution cooperatives. The Federal utilities included in this report include the Tennessee Valley Authority (TVA), a wholly-owned government corporation, and the Federal Power Marketing Administrations (PMA), which include the Bonneville Power Administration (BPA), the Western Area Power Administration (WAPA), the Southwestern Power Administration (SWPA) and the Southeastern Power Administration (SEPA). For convenience, WAPA, SWPA and SEPA are collectively referred to as the small PMAs.

As discussed in more detail in Chapter 4, the PMAs market electricity from hydroelectric facilities owned by the Army Corps of Engineers and the Bureau of Reclamation. These facilities were financed by the Federal government. The small PMAs finance capital improvements with internally generated funds and limited, but ongoing borrowing from the Treasury. BPA continues to maintain a revolving fund with the Treasury for financing certain capital activities. However, the bulk of its outstanding debt was restructured pursuant to the Bonneville Administration Refinancing Section of the Omnibus Reconciliation Act of 1996,<sup>20</sup> which required that it pay a higher ongoing rate of interest. The economic effect of the restructuring reduced BPA's outstanding principal, but increased its interest expense such that the present value of debt service payments, plus a required \$100 million upfront payment equals its original outstanding obligations. TVA has refinanced its Federal debt with bonds sold to private investors, and meets its incremental capital requirements through the issuance of bonds to private investors. It is important to note that while Federal utilities have had access to low-cost Federal financing; it is pursuant to a statutory framework that requires them to operate on a cost-basis, such that any Federally-provided financial benefit is reflected in the cost of power charged to their customers.<sup>21</sup>

The statutory provisions under which Federal utilities operate provide them with independent authority to establish electric rates on a cost basis, including the repayment of debt. Therefore, it can be argued that the benefit of low-cost capital that flows through to their customers is not a

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<sup>20</sup> 16 U.S.C. 838(l).

<sup>21</sup> From their inception and over time, Congress has defined the duties of TVA and the PMA's, particularly BPA, to include non-electric related functions ranging from supporting agriculture, industrial development, and environmental stewardship. These activities have resulted in Federal investment in non-electric facilities and the incurrence of ongoing operating expense. Some of these costs are joint and common that may or may not be recovered through electric rates. For example, BPA operates Federally-financed irrigation projects for which it is not fully compensated by irrigation customers. However, it is required to make payments to the Treasury for the original construction costs only if in doing so it does not require an increase in electric rates. These payments are made from accumulated net revenues. According to BPA's 2007 Annual Report, these payments could total \$689 million over time. The analysis in Chapter 4 has not excluded the portion of financial support associated with joint and common costs.

subsidy in the absence of a default. The contrary argument is that notwithstanding the statutory framework under which the Federal utilities operate, their customers are receiving financial support because there is neither explicit recognition of the market risk that is borne by the Federal government in the event of a default, nor of the opportunity cost to the Federal government's stakeholders, i.e., taxpayers which include the customers of the Federal utilities. The value of this financial support is a cost to the Federal government which is not quantified and assigned to the Federal utilities in the budget. To the extent it is a significant and measurable cost, it is reflected in the interest rate set in the market for Treasury securities and in the annual interest expense on Federal debt included in the budget.

In order to estimate the value of the financial support provided to the customers of the Federal utilities, EIA has adopted a cost-of-capital approach that estimates the value based on the difference between the interest expense that Federal utilities actually paid in 2006 versus what they would have paid by applying a range of contemporaneous interest rates to their outstanding debt. The interest rates range from the risk-free Treasury rate to the full range of interest rates for investment grade investor-owned utility (IOU) bonds. In order to express the value of Federal financial incentives provided directly and indirectly to electricity production on a unit of production basis, EIA compared Federal utilities' weighted average cost-of-capital to the market interest rate associated with an A-rated IOU bond.

The analysis is a snapshot that compares the current interest expense based on the average cost of outstanding debt to a hypothetical interest expense that applies a contemporaneous market interest rate to the outstanding debt. In effect, this implies the debt is being refinanced. A more accurate measure would have been to estimate the value based on the sum of the difference between the face amount of each original loan or bond and present value of each loan or bond issue at the market rate of interest at the time the obligation was incurred. The data required to perform this analysis were not available to EIA.

Opinions vary with respect to the extent to which there is a significant risk premium between the risk-free Treasury rate and the market rate of interest that Federal utilities would be required to pay in the absence of their ownership status and the statutory framework under which they operate. This is true with respect to TVA and BPA, both of which have received ratings ranging from AA- to AAA from the nationally recognized credit rating agencies. As discussed in Chapter 4, the nationally recognized credit rating agencies have issued credit rating reports that offer different perspectives on this issue. For example, Fitch Ratings stated in a January 2008 issue rating for TVA Global Power Bonds that:

“TVA's outstanding debt is not a full faith and credit, or limited obligation of the U.S. Government. However, Fitch believes that U.S. authorities would use extraordinary efforts to support their operations and senior debt obligations in the unlikely event that TVA encountered financial difficulties. This analysis takes into account TVA's ownership by the U.S. government, the sizeable role that TVA plays in the Tennessee Valley and broader economies, and the level of its obligations that are held by domestic and other foreign based investors (similar to that of government sponsored entities (GSE)).”<sup>22</sup>

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<sup>22</sup> “Fitch Rates Tennessee Valley Auth's \$500MM Global Power Bonds 2008 Series A 'AAA',” BusinessWire, January 18, 2008, [http://www.businesswire.com/portal/site/google/index.jsp?ndmViewId=news\\_view&newsId=20080118005746&newsLang=en](http://www.businesswire.com/portal/site/google/index.jsp?ndmViewId=news_view&newsId=20080118005746&newsLang=en), Accessed February 23, 2008.

In order to develop a point estimate of the value of the support provided to the customers of the Federal utilities, EIA performed a financial ratio analysis that compared TVA and the PMAs to comparably structured governmentally-owned wholesale power suppliers. The financial ratios measure an entity's ability to meet its debt and fixed obligations, i.e., liquidity and cash flow. This approach was adopted in order to neutralize any actual or perceived credit enhancement that financial markets attribute to Federal ownership and/or the ability to borrow at the Federal government's cost of funds or at interest rates comparable to GSE interest rates. This resulted in the adoption of a market interest rate associated with an A rating. Limiting the derivation of the market interest rate to consideration of only financial ratios allowed for uniformity in EIA's analysis and eliminated the effects of actual or perceived credit enhancement attributed to Federal support provided in accordance with Federal statutes applicable to the Federal utilities. Therefore, the rating used to develop a point estimate of the value of Federal support should not be construed as an alternative to actual credit ratings issued by the nationally recognized credit rating agencies. The rating agencies consider a multitude of factors in addition to financial performance in developing credit ratings that were not considered by EIA.

### **Impacts of Subsidies and Support in Electricity Markets**

The process of transforming a primary fuel to electricity is not uniform. Electric generators acquire input fuels in a variety of markets<sup>23</sup> using delivery systems that differ by fuel type (e.g., coal transported by rail or barge; natural gas by pipeline; or oil by pipeline or tanker trucks). Once at the electric plant, different technologies convert the fuels with different rates of efficiency.<sup>24</sup> Certain primary fuels used in electricity production are consumed broadly, while others have no practical application other than electricity production. Most electricity is produced for retail sale, but some electricity is produced at regulated prices to maintain system reliability. These factors make it difficult to state with certainty the exact impacts of the subsidies that are the subject of this report on production by each specific fuel type.

A simplified approach is adopted in this analysis to assess the impacts arising from subsidies to primary fuels used in electricity generation. All primary fuel subsidies are assumed to impact electricity production in proportion to the amount of primary fuel consumed by electricity producers, unless it is clear that the entire subsidy should be directly assigned to a specific fuel type. Most coal is consumed for electricity generation, but only an estimated 29 percent of natural gas consumption and estimated 1 to 2 percent of petroleum consumption are used to generate electricity. All nuclear fuel is consumed by the electric power industry. Power sector consumption of renewable fuels varies greatly by type of fuel.<sup>25</sup>

Many subsidies are directed to aspects of the electricity industry which occur after the electricity is produced, such as conservation programs, programs directed to energy efficiency (end-use R&D), or direct grant programs such as the Low Income Home Energy Assistance Program (LIHEAP), which provides States with funds to help defray the heating and cooling bills for lower-income households. Since these programs do not affect electricity production directly, they are classified as non-electricity subsidies.

Four electricity subsidies are associated with transmission: a tax expenditure program which enables transmission companies to defer income realized from the sale of transmission property; an accelerated investment recovery period; a 5-year net operating loss carryforward for transmission investment; and an R&D program directed toward improving transmission

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<sup>23</sup> Long-term contracts, spot markets, tolling agreements, and options.

<sup>24</sup> Identical technologies may also differ in their relative efficiency due to the quality of fuel (i.e., coal), ambient atmosphere conditions, and quality of equipment and facility maintenance.

<sup>25</sup> Wind energy is consumed wholly in the power sector, but solar energy is consumed almost entirely in the residential sector.



infrastructure reliability and performance. Since electricity consumption and production occur with rough simultaneity, and since transmission directly enables ultimate consumption, transmission activities are included as non-fuel specific electricity production subsidies. Similarly, support to Federal electricity programs are generally realized as benefits to ultimate consumers of Federal power. Federal electricity programs involve all three segments of the electricity industry (generation, transmission, and distribution), and it is not always feasible or informative to allocate all aspects of these subsidies to fuel specific groups. Therefore, some of the support associated with Federally-owned and RUS-financed transmission and electric plant are analyzed as non-fuel specific support.

Although electricity prices are affected by Federal intervention in energy markets, the impact of this intervention is not always clear. A consumer surplus arises when Federal utilities price power at below market prices. This creates additional demand, a point evidenced by the high concentration of aluminum smelters receiving electricity from Federally-owned utilities in the Pacific Northwest. On the other hand, government intervention in global fuel markets probably has little impact on electricity prices or on demand. This is particularly true of petroleum, and, to a lesser extent, coal. Today, Canadian and American natural gas markets are relatively integrated and current liquefied natural gas developments portend a future global natural gas market.

It is unclear as to how much the value of a particular subsidy will benefit producers or consumers.<sup>26</sup> In most States, ultimate consumers of electricity face cost-of-service tariffs, so that most electricity is sold at average cost rather than marginal cost. Because so little electricity is sold at market-based rates to retail consumers, it is not clear what effect a subsidy to primary fuel has on consumer behavior. In those regions of the country where competitive centralized wholesale markets and competitive retail markets co-exist (e.g., California, New England, and Texas), the effects of subsidies may be more pronounced than in other areas. In regions of the country where retail markets remain regulated or are returning to rate regulation, producers may attempt to engage in rent-seeking by trying to capture the producer surplus related to a particular subsidy. This is more likely to occur if the retail supplier purchases wholesale power from an independent power producer at a market-based wholesale rate, as opposed to building a plant and placing the asset in the rate base itself. In the latter case, State regulators are likely to set retail rates that transfer potential producer surplus to ultimate consumers.

However, some electricity subsidies and support could affect long-term decision making in the selection of generation technologies. They could also affect retail consumption decisions to the extent customers receive inefficient price signals. For instance, the production tax credit,<sup>27</sup> which provides producers with a credit per unit of electricity production, is often recognized as having given rise to much of the recent additions to wind generation capacity. Still, given wind generation's small share of the overall electricity market, it is doubtful that this added capacity has had much of an impact upon overall electricity prices.

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<sup>26</sup> TVA and the PMAs are required to operate on a cost-basis. Similarly, electric cooperatives must operate on the basis of cost as that term is defined by the Internal Revenue Service in order to preserve their cooperative status. Accordingly, there is greater certainty that the benefits of Federal support to electricity programs are passed through to customers. However, an increase or decrease in one expense, such as interest expense, may be offset by a change in other expenses. Therefore, a rate change may not be necessary if borrowing costs go up or down.

<sup>27</sup> The new technology credit is a tax expenditure discussed in Chapter 2.

## **Organization of Report**

In addition to this introductory chapter, this report contains four chapters. Chapter 2 reports on energy-related tax expenditures and direct expenditures. Chapter 3 discusses subsidies which are listed in the Federal budget as R&D expenditures. Chapter 4 evaluates support associated with Federal electricity programs. Chapter 5 analyzes electricity subsidies and their association with specific fuel groups in electricity production.

The report also includes several appendixes. Appendix A contains Fact Sheets that summarize Federal energy-related programs and tax expenditures, not all of which are discussed in the body of the report. Appendix B provides alternative estimates of energy subsidies to Federal utilities. Appendix C provides an historical perspective on tax expenditures. Appendix D provides a description of credit ratings criteria and interpretation of credit ratings; Appendix E describes the RUS Electric Program, including direct and hardship loans and loan guarantee programs. Appendix F contains a list of energy-related statutes and Federal regulations referred to in this report. Appendix G contains a bibliography; and Appendix H contains the request letter from Senator Alexander.