A RAND NOTE

AN ANALYSIS OF THE DEPARTMENT OF ENERGY'S NONPRICE REGULATION OF INDUSTRIAL ENERGY USE

Leland L. Johnson, David Seidman

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This Note was funded under Contract DE-AC01-80PE70269 with the Office of Policy, Planning and Analysis (OPPA), U.S. Department of Energy (DOE). This contract covers a multiyear Rand study of issues in the formulation of national energy policies dealing with energy consumption and conservation. The goals of this study program are (a) to help determine how well private markets are working with respect to energy use, and (b) to illuminate ways in which the federal government might improve the efficiency of markets in allocating energy and other resources among alternative uses.

This study contributes to these goals by focusing on DOE-administered regulations covering industrial energy use. It concentrates on nonprice regulations, such as prohibitions on the consumption of oil and gas, as distinguished from price regulations, such as the control of natural gas prices. The study is concerned primarily with identifying the costs and benefits of specific regulations that OPPA has selected for Rand's attention, and with exploring relationships among them and with other regulations affecting the industrial sector.

This Note should be useful to a number of groups within DOE, including the Economic Regulatory Administration, the Office of Conservation and Renewable Energy, and the Office of the General Counsel, in addition to OPPA. Moreover, the discussion of the cogeneration provisions of the Public Utility Regulatory Policies Act should be of interest to the Federal Energy Regulatory Commission, to electric utilities, and to private firms engaged in cogeneration.
SUMMARY

This study analyzes Department of Energy (DOE) regulatory activities within the industrial sector. Since much attention has already been given to the price regulation of oil and gas, we focus here on nonprice regulations such as prohibitions on specific fuel use. Our objective is to provide basic analytic inputs into DOE's decisions about their future regulatory activities.

DOE's Office of Policy, Planning and Analysis selected six regulatory activities for our attention.

- The cogeneration exemption to prohibitions on use of oil and gas under the Powerplant and Industrial Fuel Use Act (FUA).
- The Industrial Energy Conservation Program on mandatory reporting and voluntary targets for conservation by large industrial energy users.
- Reporting guidelines for the Municipal Waste Reprocessing Demonstration Program, involving the conversion of waste to fuel used in industrial plants.
- The Manufacturing Industries Energy Consumption Survey, which requires mandatory reporting by firms to improve the basis for DOE's decisions about prohibitions of oil and gas use in major fuel-burning installations.
- State energy conservation plans, especially those elements required in state plans to qualify for federal funding.
- Guidelines on alternative fuels and technologies that must be considered in applying for exemptions from FUA's fuel-use prohibitions.

In addition, we examined the incentives for cogeneration under the Public Utility Regulatory Policies Act (PURPA), as implemented by the Federal Energy Regulatory Commission (FERC), because these incentives are closely related to FUA's cogeneration exemption.
The most significant of DOE's regulations affecting industrial energy use arises from the Powerplant and Industrial Fuel Use Act. Subject to exemptions, new powerplants and major fuel-burning installations are prohibited from burning petroleum or gas. Of central importance to this study are the provisions under which industrial and other cogeneration facilities may be exempt from those prohibitions if petitioners for the facility demonstrate that net savings of oil or gas would result. Cogeneration is defined as the coproduction of electricity and thermal energy (heat and steam) from a single heat source. For a given total output, cogeneration systems are estimated to yield substantial fuel savings over separate systems.

The benefits from FUA's cogeneration exemption are intimately tied to the benefits from FUA as a whole. The rationale for prohibitions assumes that the unregulated private marketplace encourages consumption of oil and gas that is judged excessive from the standpoint of the social interest. This situation arises from a disparity between social costs and private costs caused by: (a) distortions in prices of natural gas created by price controls, and (b) the "import premium" that reflects the social value of reducing oil imports, a cost not taken into account by the private sector. The speed at which distortions in natural gas prices disappear depends on how quickly natural gas prices are decontrolled--including prices of old gas that under the Natural Gas Policy Act of 1978 are to be controlled indefinitely. The quantitative importance of the import premium is difficult to assess. Its four components--the direct and indirect cost to society during normal periods and the direct and indirect cost imposed during supply
disruptions—are subject collectively to widely varying estimates ranging from near zero to over $50 a barrel. Unless one believes that the import premium is large or that serious distortions in natural gas prices will continue, there is little reason to retain FUA's basic prohibitions on the use of oil and gas. Without these prohibitions, the cogeneration exemption is irrelevant.

One of PURPA's objectives is to encourage development of decentralized power sources when the cost of doing so is no greater than relying on centralized facilities. Because owners of small powerplants and cogeneration facilities have previously encountered difficulties in buying from and selling to utilities, for those facilities that achieve status as "qualified facilities" (QFs), FERC has designed the following incentives:

- States must calculate avoided costs for utilities within their jurisdictions, with utilities required to purchase at these rates whatever power QFs offer to sell.
- Utilities must sell electricity to QFs under nondiscriminatory rates.
- Utilities must interconnect with QFs.
- QFs shall be exempt from certain state and federal regulations relating to public utilities.

In particular, the avoided-cost criterion is the subject of much controversy. Many utilities recommend as alternatives the "split-the-savings" approach, commonly used among utilities in buying and selling electricity among themselves, or a partial-avoided cost approach. We conclude that use of the full-avoided cost criterion encourages
economically efficient outcomes by minimizing the overall cost (including cogeneration and other generation inputs) of a given total output. The split-the-savings approach also leads to economically efficient outcomes but imposes a reporting burden on cogenerators that FERC has sought to avoid. Because it permits utilities to exercise monopsony power against cogenerators, the partial-avoided cost criterion fails to encourage economically efficient outcomes.

Net savings in oil and gas from cogeneration provisions and other incentives in PURPA depend on the relative fuel-use efficiency of cogenerators and utilities, the particular fuels used by cogenerators, and the kinds of fuels backed out of the utility sector through substitution of cogenerated electricity. Although FERC concludes that cogenerators will rely heavily on gas, evidence from facilities that have filed applications for qualifying status is ambiguous. Currently, coal-fired cogeneration makes up a large portion of the total.

The other regulatory activities mentioned on the first page of this summary are distinctly less important to industrial energy use than are the cogeneration provisions of FUA and PURPA. Because no penalty is assessed for failure to meet energy-use targets under the Industrial Energy Conservation Program, there is little reason to conclude that the program has a significant effect on industrial energy use. Reporting guidelines for the Municipal Waste Reprocessing Demonstration Program help ensure adequate information for potential adopters of the technologies being demonstrated, but they are only tangentially related to industrial energy use. The Manufacturing Industries Consumption Survey would be useful only if DOE seriously considered fuel-use
prohibitions for existing major fuel-burning installations; however, since DOE does not intend to mandate fuel switching in the foreseeable future, the value of this survey is questionable. The mandatory elements in state conservation plans have to do mostly with transportation and buildings rather than directly with industrial energy use. Finally, DOE has proposed guidelines for analyzing alternative fuels and technologies to help petitioners seeking exemptions from FUA's fuel-use prohibitions. But such guidelines are less useful than originally envisioned by DOE, since the fuel search needed for most exemptions requires analysis of only one alternative--solid coal.

We examined Title 10 of the Code of Federal Regulations to identify other DOE regulatory activities that may affect industrial energy use. We found very little. Some regulatory activities have nothing to do with industrial energy use; others involve no direct regulatory requirements but do receive federal funding for a variety of activities. DOE and Congress seem more concerned about the residential and transportation sectors than about the industrial sector, perhaps because consumers, often ill-informed about trade-offs between energy and other resources, may require more government assistance. With fairly well-informed participants in the industrial sector, however, a less strong case can be made for government intervention.

At the same time, some federal regulations outside of DOE's purview—and outside the scope of this study—have much to do with industrial energy use. Regulations imposed by the Environmental Protection Agency and by the Internal Revenue Service are leading examples. Thus, those generally concerned about the impact of government regulation of industrial energy use must go far beyond DOE's regulations.
ACKNOWLEDGMENTS

We appreciate the assistance of Sara Pease, who carefully gathered and interpreted information from a variety of sources and interviewed individuals knowledgeable about particular aspects of this study. We also benefited from discussion with Rand colleagues Stanley Besen, Frank Camm, Jr., and Rolla Edward Park.

Mr. Seidman's contributions to the study were completed before he left Rand in February 1982.
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I. INTRODUCTION

As part of the Reagan administration's efforts to reduce federal regulation, the Department of Energy has been reviewing its regulations to determine which should be retained, revised, or deleted. Accordingly, DOE's "Task Force on Regulation Unrelated to Decontrol" was established in 1981 to evaluate those regulations and to make recommendations. As its name suggests, the task force is concerned with regulations other than those dealing directly with price controls.[1]

To supplement the work of the task force, DOE's Office of Policy, Planning and Analysis (OPPA) sponsored this study on energy use in the industrial sector. Industrial energy use has been subjected to relatively little regulatory analysis, yet the industrial sector accounts for a large portion of total energy consumption.[2]

OPPA identified six specific regulatory areas for our attention:

- The cogeneration exemption from fuel-use prohibitions in the Powerplant and Industrial Fuel Use Act (FUA).
- Guidelines for examining alternative fuels and technologies for certain exemptions to fuel-use prohibitions under FUA.
- The Industrial Energy Conservation Program.
- Reporting guidelines for Municipal Waste Reprocessing Demonstration Program.

[1] Another task force, on price regulation, was established to address issues of oil and gas price decontrol.
- 2 -

- The Manufacturing Industries Energy Consumption Survey.

- State Energy Conservation Plans.

We have begun an analysis of these and related regulatory programs and requirements, concentrating on identifying their costs and benefits. Our objective is to provide basic analytic inputs to assist DOE's decisions about its regulatory requirements.

Of the six regulatory areas tabulated above, the first--FUA's cogeneration exemption--is by far the most significant for industrial energy use. Cogeneration is defined as the coproduction of electricity and thermal energy (steam or heat) from a single heat source. Producing two energy outputs, a cogeneration system can achieve greater fuel-use efficiency than a single-output conventional system. In conventional generating systems, only about 33 percent to 42 percent of the system's fuel input is converted into electricity, the rest becomes waste heat. Industrial boilers and furnaces that produce process heat and steam sustain energy conversion losses in excess of 50 percent. For a given total output, cogeneration systems are estimated to yield fuel savings of 10 to 30 percent over separate systems.[3]

In analyzing related regulations, we found that the incentives in the Public Utility Regulatory Policies Act (PURPA) for development of cogeneration are especially important. Implementation of PURPA is not DOE's responsibility but that of the Federal Energy Regulatory Commission (FERC)--a semiautonomous agency within DOE. Although implementation of PURPA lies outside DOE's responsibilities, PURPA's

cogeneration regulations are so closely related to FUA's cogeneration exemptions that we treat them together here.

This study is organized as follows: Sec. II describes the basic statutory and regulatory framework of FUA that is related to the cogeneration exemption. We find that the potential costs and benefits of the cogeneration exemption depend heavily on the magnitude that one ascribes to the "import premium"--the value to society in excess of the value to individuals accruing from an incremental decrease in oil imports--and to differences between market prices and social costs caused by price control of natural gas. Because of their key role in assessing the merits of the FUA cogeneration exemption and most of the other regulatory activities treated in this study, we treat in some detail the import premium and price distortions in natural gas markets.

Section III focuses on the incentives for cogeneration that are a part of PURPA. Under PURPA's statutory authority, FERC has established four requirements to encourage development of cogeneration: (a) the states must calculate the "avoided costs" to utilities of purchasing electricity from cogenerators, and utilities must offer to buy electricity at these avoided costs, (b) utilities must sell electricity to cogenerators at nondiscriminatory rates, (c) utilities must interconnect with cogenerators, and (d) cogenerators must be exempt from certain state and federal regulations. Because the avoided-cost criterion is highly controversial, Sec. III examines whether, compared to other alternatives, its use encourages economically efficient outcomes. It also examines conditions under which it, along with other incentives, discourages oil and gas consumption.
Section IV examines the remaining five regulatory areas listed above, distinctly less important to industrial energy use than FUA and PURPA's provisions for cogeneration. Three of those areas address reporting requirements (the Industrial Energy Conservation Program, the Manufacturing Industries Energy Consumption Survey, and reporting guidelines for the Municipal Waste Reprocessing Programs). The fourth (State Energy Conservation Plans) looks at activities required of the states as a condition for federal grants. The fifth (guidelines for use of alternative fuels and technologies) is not itself a regulatory requirement, but helps prepare applications for exemptions from FUA's prohibition on the use of oil and gas.

Section V brings together key characteristics of those regulatory activities to support conclusions about the rationales for government intervention in private markets, and about the costs and benefits of such intervention. Finally, it briefly examines a possible explanation for DOE's lack of regulatory involvement in the industrial sector.
II. COGENERATION AND THE POWERPLANT AND INDUSTRIAL FUEL USE ACT

THE BASIC STATUTORY AND REGULATORY FRAMEWORK

FUA is the most important DOE statute directly affecting industrial energy use. [1] Its primary objectives are to:

- Reduce the dependence of the United States on imported petroleum.
- Conserve petroleum and natural gas for essential use (i.e., for which no feasible substitutes exist.
- Encourage the use of coal and other alternative fuels as primary energy sources in new and existing electric power plants and major fuel-burning installations (MFBIs). [2]

FUA provides that "natural gas or petroleum shall not be used as a primary energy source in any new electric powerplant," [3] and that "natural gas or petroleum shall not be used as a primary energy source in a new major fuel-burning installation consisting of a boiler," unless such uses are authorized by DOE. Thus, as described below, DOE is

[2] For purposes of FUA, a powerplant is a stationary electric generating unit consisting of a boiler, a combustion turbine, or combined cycle unit that produces electric power for purposes of sale or exchange and has a design fuel-heat input rate of 100 million BTUs per hour or greater, or operates with other electric generating units at the same site that have an aggregate fuel-heat input rate of at least 250 million BTUs per hour. An MFB is a stationary unit consisting of a boiler, gas turbine unit, combined cycle unit, or internal combustion engine that has a design fuel-heat input rate of 100 million BTUs per hour or greater, or operates with other such units at the same site that in aggregate have a fuel-heat input rate of at least 250 million BTUs per hour. 42 U.S.C. Sec. 8302 7(A) and 10(A) (Supp. III, 1979).
authorized to grant temporary and permanent exemptions from the basic prohibitions. FUA also authorizes DOE to implement, by rule, comparable provisions for MFBIs that do not consist of a boiler--authority that DOE has announced it will not exercise.[4]

As originally written, FUA also prohibited existing electric powerplants from (a) burning natural gas as a primary energy source as of January 1, 1990; (b) burning natural gas as a primary energy source before that date unless it used natural gas for that purpose in 1977; and (c) increasing the proportion of natural gas to other fuels over the proportions used by the powerplant during a base period.[5] DOE was also given the authority to prohibit electric powerplants and MFBIs meeting certain specified criteria from using either petroleum or natural gas as a primary energy source.[6] In brief, FUA was a mandate for fuel switching.

More recently, however, fears of a natural gas shortage have subsided, and U.S. dependence on imported oil has become less worrisome because of declines in U.S. oil imports.[7] In 1981, Congress amended FUA. The amendments sharply limit FUA's impact on existing powerplants. Under the amended FUA, DOE was given authority to prohibit use of natural gas or petroleum as a primary energy source only if the owner or operator of an existing powerplant had previously voluntarily certified to DOE that certain preconditions had been met.[8]

Why would the owner of an electric powerplant voluntarily provide the certification necessary for DOE to prohibit him from using petroleum or natural gas? A powerplant subject to a DOE prohibition order may delay compliance with provisions of its State Implementation Plan under the Clear Air Act,[9] or may obtain an exemption from otherwise applicable New Source Performance Standards under the same act.[10] Therefore, the owner of a powerplant who wants to convert from petroleum or natural gas to coal might well prefer to do so pursuant to DOE orders and thereby delay or avoid the need to comply with certain air pollution control requirements.[11]

FUA does allow a number of temporary and permanent exemptions from its fuel-switching requirements. Among the permanent exemptions are those relating to (a) lack of alternative fuel supply at a cost that does not substantially exceed the cost of using imported petroleum; (b) site limitations; (c) inability to comply with applicable environmental requirements; (d) inability to obtain adequate capital; (e) state and local requirements; (f) lack of alternate fuel supplies for the first two years of useful life; and (g) cogeneration that reduces use of oil and gas. The cogeneration exemption is of concern here because of its potential impact on industrial energy conservation and its relationship to PURPA regulations (discussed in Sec. III).

[11] This example illustrates how environmental regulations may influence industrial energy conservation. Modification of a major stationary source of air pollution may bring it under certain requirements of the Clean Air Act that do not apply to existing unmodified sources. (See 42 U.S.C. Secs. 7411, 7470-7503 (1979).) Because of the increased cost resulting from environmental controls, firms may not make otherwise cost-effective modifications that would conserve energy.
The Cogeneration Exemption

A cogeneration facility is "an electric powerplant or a major fuel-burning installation which produces (A) electric power; and (B) any other form of useful energy (such as steam, gas, or heat) that is, or will be, used for industrial, commercial, or space heating purposes."[12] FUA authorizes exemptions from its basic prohibitions when the benefits of cogeneration cannot be obtained without use of natural gas or oil. In the words of the statute:

After consideration of a petition (and comments thereon) for an exemption from one or more of the prohibitions of subtitle A [the prohibitions applicable to new facilities] for a cogeneration facility, the Secretary [of DOE] may, by order, grant a permanent exemption under this subsection with respect to natural gas or petroleum, if he

(1) finds that the petitioner has demonstrated that economic and other benefits of cogeneration are unobtainable unless petroleum or natural gas, or both, are used in such facility, and

(2) includes in the final order a statement of the basis for such finding.[13]

The cogeneration exemption may be obtained in one of two ways. The petitioner may "certify" that "oil or gas to be consumed by the cogeneration facility will be less than that which would otherwise be consumed in the absence of the cogeneration facility. . . ." To support the certification, the petitioner must provide "exhibits containing the basis for the certification required . . . including those factual and analytical materials deemed by the petitioner to be sufficient to support the granting of this exemption." Or the petitioner may obtain

the exemption by "demonstrating that it would be in the public interest to grant an exemption to the cogeneration facility because of special circumstances such as technical innovation or maintaining industry in urban areas."[14]

DOE has recently established rules that simplify administrative procedures and exemption criteria applicable to powerplants and MFBIIs to reduce the burden on powerplant and MFBI operators.[15] Costs to both ERA and operators should now be lower. Of course, the simplified process may lead to exemptions granted in error.

Issuing an exemption is a federal action requiring compliance with the National Environmental Policy Act (NEPA). Therefore, the applicant must examine the "direct and indirect environmental impacts of the proposed action including impacts of alternative fuel scenarios, and no build alternatives."[16] This examination may involve no more than a few pages describing generally why the cogeneration facility would have a favorable effect, or at least not an unfavorable one, compared to alternative actions. We are told by the issuing office that ERA has considerable latitude in complying with NEPA.[17]

For the petitioner, the administrative process of securing an exemption may be a difficult procedure, possibly involving lengthy reviews and requests for additional information, and imposing costs in

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[17] As a practical matter, it would be difficult for ERA to examine the supporting evidence in depth as well as to carry out its other responsibilities. According to the Administration's FY 1983 budget submitted to Congress in February 1982, ERA's budget is to be drastically cut, from $71 million in 1981 to $14 million in 1983. Energy Daily, February 9, 1982, pp. 2-3.
time and effort. Delays may increase with cuts in ERA's budget and
staff. On the other hand, if the evidence offered in support of a
petition is plausible, ERA could approve the petition quickly.

By the end of 1981, ERA had received 44 petitions for exemptions
for new MFBIs, of which twenty-three had been approved.[18] The
published data do not categorize the petitions by type of exemption or
disclose the number of petitions for cogeneration exemptions that are
based on oil and gas savings or on public interest criteria.

From this description of the statutory and regulatory framework,
two basic policy questions arise:

- Under what conditions does society benefit from a cogeneration
  exemption based on a showing of net oil and gas savings?

- Under what conditions does the public interest criterion for
  exemption confer social benefits without oil or gas savings?

THE OIL AND GAS SAVINGS CRITERION FOR COGENERATION EXEMPTIONS

Two questions are relevant to this criterion:

- Despite use of this criterion, under what conditions will oil
  or gas savings not be achieved?

- When oil and gas savings are achieved, what are the benefits to
  the public?

Failure to achieve savings in oil or gas could result if the
petitioner gains an exemption based on a defective showing, either
accidental or deliberate, of fuel-use estimates. Erroneous estimates

[18] Department of Energy, Economic Regulatory Administration,
16.
occur in part because, as discussed in Sec. III with regard to PURPA, the oil and gas savings from cogeneration critically depend on the types of fuels backed out of the utility sector that result from purchases of electricity from cogenerators. ERA's rules to the petitioner say, "You may include the oil or gas that would be consumed by powerplants to generate electricity supply to the grid to the extent that such electricity, if you cogenerate, will no longer be supplied by the grid. The oil or gas portion must be based on a 10 year forecast that includes new construction and retirement of plants within those 10 years."[19]

However, examination of a utility's investment plans may be insufficient to determine its fuel use, which is subject to incremental changes in demand. Although a utility may be primarily dependent on oil-fired facilities, the utility-supplied electricity replaced by a particular cogenerator could come, say, from distant coal-fired facilities owned by others. Unless the petitioner or ERA knows how the utility in question meets its variety of incremental demands, the evidence in the application could be misleading.

The simplified review and approvals process discussed above may also pose problems. To the extent that ERA easily accepts an application showing plausible estimates, the possibility of approving exemptions that fail to meet their claims increases. The outcome will depend on ERA's willingness and ability to scrutinize applications, given the recent self-certification revisions in its administrative rules and the constraints imposed by budget and staff cuts.

With respect to the second question, it is important to explore the benefits to society of oil and gas savings. What are the consequences

for society if the cogeneration exemption fails to achieve savings for reasons just discussed? This question can best be addressed by examining the rationale for the basic prohibitions imposed by FUA. Why should the government restrict or prohibit the use of oil and gas in either new or existing powerplants and NFBIs? The rationale for prohibitions rests on the assumption that the private marketplace, left to itself, excessively consumes oil and gas, to the detriment of broader social or national interests. Limitations on oil and gas use may be justified if the cost to society is greater than private costs measured by market prices. If social costs exceed market prices, consumption of oil and gas is encouraged beyond the socially optimal level. Thus, a cogeneration exemption that saves oil or gas would benefit society by helping to curb excess consumption.

Disparities between social and private costs can arise from various sources, including monopoly and oligopoly power enjoyed by private firms, government subsidies, taxes, and regulation. Justifying government interventions in any market requires demonstrating not only that disparities ("market imperfections") exist, but also that the disparities are larger than the cost of government intervention, which is itself subject to imperfections.[20]

Two important sources of potential imperfections in oil and gas markets are (a) the continued price control of natural gas that maintains prices at levels below the social cost of replacing gas, and (b) the "import premium" that reflects benefits to the U.S., beyond the market price, of foregoing the importation of a barrel of oil. Because

of the fundamental importance of these two factors (especially the import premium) to both FUA and other regulations treated in this study, we shall address them in some detail.

Price Control of Natural Gas

Under FERC regulation, gas that enters interstate markets is priced at a rolled-in average cost to the pipelines so that with an appropriate mark-up, the pipeline firms are left with no more than a "fair" return on their investment. Because gas distribution companies are similarly allowed to earn only a fair rate of return, the retail price of gas reflects average rather than social or replacement cost.[21] FERC has implemented a "Phase I" incremental pricing program under which the price of gas used in "large boiler" industrial facilities is set to equal the price of residual fuel oil, rather than at the lower, controlled level (reflecting an average of low- and high-cost sources) charged by gas utilities to other customers. The intent is that certain users pay for gas approximately what they would pay for an alternative fuel.[22] Other users, including residential and agricultural customers, pay lower rates that reflect rolled-in average cost.

On the current phased decontrol schedule in the Natural Gas Policy Act of 1978, most new gas will be decontrolled by 1985, but most old gas will continue to be controlled indefinitely. The price of old gas, sold

[22] FERC has told us that in most parts of the country this incremental cost exceeds other gas prices by perhaps 10 percent. FERC does not have data showing the percentage of total industrial gas consumption accounted for by large boiler users. Large boilers are defined as those that burn an average of more than 300,000 cubic feet per day.
at controlled levels far below replacement cost, will continue to be rolled in to keep the price of gas below replacement cost to those users not subject to incremental pricing.

The Reagan administration, interested in accelerating the decontrol of gas, has been considering alternative decontrol schedules. But concerns about the effect on consumers of rapid increases in gas prices, and hardships that might be imposed on some pipelines and high-cost gas producers have forced postponement of legislative action, at least until 1983.

In any event, the disparity between social and private costs for industrial uses is smaller than that for residential and agricultural purposes, since large boiler users are subject to incremental pricing. Thus, there is less justification for industrial prohibitions on gas use under FUA than for gas conservation measures aimed at other sectors.

The Oil Import Premium

Probably more important to the industrial sector than gas price control (which could be abolished by legislative action) is the oil import premium—a factor that could pose problems indefinitely. (A more detailed discussion of the import premium may be found in the Appendix.) The overarching difficulty is that no satisfactory quantitative estimate exists for the import premium to make it a useful tool for policymaking. Estimates of the premium varies from mean zero to over $50 per barrel, depending on assumptions about the effects on world oil prices of a fall in U.S. imports, and on probabilities assigned to the timing and severity of future supply disruptions. Therefore, the benefits of FUA as a whole and of the cogeneration exemption in particular would be
subject to great uncertainty, even if the quantitative oil and gas savings resulting from FUA were precisely known.

Because of the bewildering assortment of difficulties enumerated in the Appendix, the value to policymaking of the concept and attempted measurement of the import premium is questionable. Impressed by the size of the estimated premiums, some may conclude that reductions in the use of oil would achieve large social benefits well in excess of the cost of government intervention. For example, they might recommend a tariff on imported oil in addition to the continuation or even strengthening of FUA's prohibitions. Others, impressed with the need to reduce disruption costs, might advocate measures directly related to a disruption (such as increased stockpiling), rather than adopting fuel-switching requirements and other demand-management measures used during predisruption periods.[23] Yet others, concluding that any results from analysis of the premium are hopelessly conjectural, may regard the premium as not sufficiently different from zero to warrant government intervention of any type. For them, the private marketplace, despite its imperfections, leads to better expected outcomes than does government intervention.

In conclusion, fuel-use benefits from FUA's cogeneration exemption are intimately tied to the benefits for FUA as a whole. If decisionmakers conclude that the import premium is a significant factor and hence that the benefits of FUA are substantial, the cogeneration

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exemption would also carry expected benefits, since it saves additional oil and gas whose value to society would be expected to exceed private costs. In contrast, those who attach a zero or low quantitative estimate to the import premium and are not disturbed by price distortions in natural gas markets (perhaps because they believe that full price decontrol will be implemented soon) would view FUA as conferring few benefits. Any oil and gas savings would have little value beyond that already taken into account by private parties. In that case, no basis would exist for continuing FUA's prohibitions. If they were abolished, the cogeneration exemption, as well as the other exemptions, would become irrelevant.

However, consider the following possibility: Suppose that the import premium and price distortions in natural gas markets are essentially zero, or that imperfections in the method of government intervention exceed those from a significant import premium and from gas price distortions. Further, suppose that FUA's basic prohibitions nevertheless remain in force. In that case, the cogeneration exemption (as well as others) would confer benefits by providing loopholes to compliance with prohibitions that impose costs on society. Here, economic inefficiencies would arise from prohibitions that restrict industrial fuel choice. To the extent that these prohibitions are relaxed through exemptions, firms would be less constrained in their fuel choices, thereby reducing the degree of economic inefficiency.

In sum, if FUA's prohibitions confer social benefits by reducing excessive consumption of oil and gas, the cogeneration exemption improves the outcome by helping to further reduce consumption. If FUA
confers no benefits, any exemption or failure to enforce increases social welfare.

THE PUBLIC INTEREST CRITERION FOR COGENERATION EXEMPTIONS

Even if the petitioner demonstrates no oil or gas savings, he may nevertheless obtain an exemption if he can show persuasively that the public interest would be served. As discussed above, this exemption would benefit society (even if the application were defective) if FUA's basic prohibitions confer no social benefits.

However, if FUA's basic prohibitions do confer benefits, the social cost of public interest exemptions resulting from increased oil and gas consumption must be compared with the benefits alleged in the petitioner's application. Comparisons are complicated by uncertainty surrounding any estimate of the social costs of increased oil and gas consumption. Comparisons are further complicated because of the difficulty of quantifying public interest benefits. ERA's rules are not specific about what constitutes the public interest but, as noted earlier, they mention only such things as "technical innovation or maintaining industry in urban areas." How one quantifies the benefits of maintaining an industry in urban areas is unclear. Here as elsewhere ERA must exercise subjective judgment.

Demonstrating that technological innovation will be stimulated may be a satisfactory basis for exemption since, as discussed in Sec. IV, with respect to federal support of technology demonstration programs, the market may not reach the socially appropriate level of technological innovation so that those who fund the innovations cannot themselves
accrue the full benefits. But the degree to which a particular exemption will stimulate innovation, and the value of that innovation to society, remains difficult to evaluate.

CONCLUDING REMARKS

A recurring theme is the irreducible uncertainty about the benefits of FUA's prohibitions and its cogeneration exemption. The existing regulatory framework may constitute a reasonably satisfactory response to this uncertainty. On one hand, if market signals are seriously distorted because of a large import premium and controlled gas prices, FUA's basic prohibitions could confer substantial benefits. The cogeneration exemption, based on demonstrated gas and oil savings, would contribute further to those benefits. Based on public interest grounds, the exemption would also contribute if those public interest benefits more than offset the social cost of increased oil and gas consumption. On the other hand, if benefits from FUA's prohibitions are few or nonexistent, the cogeneration exemption, based either on demonstrated oil and gas savings or on public interest grounds, would reduce the cost to society of the basic prohibitions.
III. COGENERATION AND THE PUBLIC UTILITY REGULATORY POLICIES ACT

THE BASIC STATUTORY AND REGULATORY FRAMEWORK

The Public Utility Regulatory Policies Act (PURPA) is one of five statutes[1] included within the National Energy Act of 1978. As one of its objectives, PURPA seeks to encourage development of decentralized power, particularly since operators of small powerplants and cogeneration facilities had previously encountered a number of difficulties in buying from and selling to utilities. As described by the Federal Energy Regulatory Commission (FERC):

Prior to the enactment of PURPA, a cogenerator or small power producer seeking to establish interconnected operation with a utility faced three major obstacles. First, a utility was not generally willing to purchase the electric output or was not willing to pay an appropriate rate. Secondly, some utilities charged discriminatorily high rates for back-up service to cogenerators and small power producers. Thirdly, a cogenerator or small power producer which provided electricity to a utility's grid ran the risk of being considered an electric utility and thus being subjected to extensive State and federal regulation.

Sections 201 and 210 of PURPA are designed to remove these obstacles. Each electric utility is required under Section 210 to offer to purchase available electric energy from cogeneration and small power production facilities which obtain qualifying status under Section 201 of PURPA, and to provide back-up power and other services to such facilities on a non-discriminatory basis. . . . the Commission can exempt qualifying facilities from State regulation regarding utility rates and financial organization, from federal regulation under the Federal Power Act (other than licensing under Part I), and from the Public Utility Holding Company Act.[2]

Thus, PURPA's cogeneration provisions contain the following key components to be discussed in turn: (a) the criteria that must be satisfied to attain status as a "qualifying facility" (QF) to enjoy the benefits of PURPA, (b) rules governing utility purchases of electricity from QFs, (c) rules governing rates for utility sales of electricity to QFs, (d) provisions regarding interconnection between QFs and utilities, and (e) exemptions of QFs from certain state and federal regulations.

Qualifying Facilities

Two types of facilities are included within PURPA's cogeneration provisions: small powerplants and cogenerators. To attain status as a QF, a small powerplant facility must satisfy three criteria. First, its production capacity "together with the capacity of any other facilities that use the same energy resource and are owned by the same person and are located at the same site" must not exceed 80 megawatts. Second, the facility's primary energy source must be "biomass, waste, renewable resources, or any combination thereof." Although fossil fuels may be used (e.g., for start-up and flame-stabilization purposes) the aggregate use of oil, natural gas, and coal may not exceed 25 percent of the facility's total fuel input. Third, no more than 50 percent of the equity interest in the facility may be held by "an electric utility or public utility holding company or any person owned by either."[3]

A cogeneration facility may be a QF if it meets the same ownership requirement as small power production facilities and meets operating and fuel efficiency standards established by FERC.[4] Section 201 of PURPA

[4] Similar to the definition of cogeneration in FUA, PURPA defines a cogeneration facility as one that produces "(i) electric energy, and (ii) steam or forms of useful energy (such as heat) which are used for
authorizes FERC to determine "such requirements (including requirements respecting minimum size, fuel use, and fuel efficiency) as the Commission may, by rule, prescribe." But FERC has not imposed fuel-use restrictions on cogenerators because FUA, enacted along with PURPA, already authorizes DOE to prohibit the use of oil and gas in new cogeneration facilities exceeding a specified size.[5] As discussed earlier, DOE has, at the same time, provided for a cogeneration exemption to its basic prohibitions. This situation raises the question, discussed below, about the effects of FERC's implementation of PURPA's cogeneration provisions on oil and gas use.

Because this study focuses on industrial energy use, we concentrate on cogenerators rather than on small power production facilities, since they are less directly related to industrial activities. FERC expects that through 1995, small power-production facilities will consist almost exclusively of municipal solid waste, small-scale hydro power, and large wind systems. Many of these, built expressly to sell power to utilities, will affect industrial energy use only by affecting electricity prices.[6] In contrast, cogeneration affects the industrial sector through both the price of electricity and the cost of heat and steam.

Rates for Utility Purchases of Electricity

For electricity purchases by a utility from a QF, the statute specifies that rates

(i) shall be just and reasonable to the electric consumers of the electric utility and in the public interest, and

(ii) shall not discriminate against qualifying cogenerators. . . No such rule prescribed . . . shall provide for a rate which exceeds the incremental cost to the electric utility of alternative electric energy.[7]

This incremental cost is defined as "the cost to the electric utility of the electric energy which, but for the purchase from such cogenerator . . . such utility would generate or purchase from another source."[8]

FERC has ruled that these conditions are satisfied if rates are set equal to the utility's full-avoided costs. Accordingly, it requires state regulatory agencies to calculate avoided costs for utilities within their jurisdictions and to require utilities to purchase, at these rates, whatever power qualified cogenerators wish to sell. For qualifying facilities whose construction was commenced before November 9, 1978 (the date PURPA was enacted), state regulatory authorities may set lower rates after determining, among other things, that the rates are "sufficient to encourage cogeneration."[9] The purpose of the exception is, roughly speaking, to prevent cogenerators which predate PURPA from garnering excessive economic rents.[10]

Determination of avoided costs is left to the states, with implementation to take place no more than one year after FERC's rules took effect (i.e., no later than March 20, 1981). Because FERC has allowed states flexibility in complying, state response has varied widely. Some state public utilities commissions have set up specific guidelines for calculating avoided costs; others have let utilities and cogenerators negotiate and rule only on cases that come before them.[11]

Rates for Electricity Sales by Utilities

Utilities are required to sell electricity to QFs at rates that "(i) shall be just and reasonable and in the public interest; and (ii) shall not discriminate against any qualifying facility in comparison to rates for sales to other customers served by the electric utility." FERC has ruled that rates based on "accurate data and consistent system-wide costing principles" are nondiscriminatory "to the extent that such rates apply to utilities' other customers with similar load or other cost-related characteristics."[12]

On this basis, QFs are assured of buying electricity at the retail rate accorded to similar customers. Since this retail rate, regulated by the states, generally reflects the average rather than the marginal cost of producing electricity, it is usually lower than the rate at which QFs sell electricity to the utility.

Other Provisions

Since purchase and sale of power requires physical interconnection of the buying and selling entities, PURPA also allows FERC to order interconnection.[13] In response, FERC promulgated a rule specifying that "any electric utility shall make such interconnections with any qualifying facility that may be necessary to accomplish purchases or sales."[14] Thus, each QF must reimburse any electric utility for interconnection costs associated with the purchase of electricity from a QF. If a QF is already connected to the utility for sales by the utility, interconnection costs are limited to any additional expenses borne by the utility to permit purchases from the QF.[15]

Moreover, qualifying cogenerators are exempt from (a) most provisions of the Federal Power Act, (b) all provisions of the Public Utility Holding Company Act of 1935 related to public utilities, and (c) state laws and regulations regarding the rates or financial organization of electric utilities.[16] These exemptions may provide a powerful impetus to cogeneration development. One study concludes that none of the industrial cogeneration systems in the United States were exporting electricity even as late as 1979 because of the threat of regulation.[17]

[13] 16 U.S.C. Sec. 824i (Supp. III, 1979). It could be argued that the power to require interconnection is included within the power to require purchase and sale, so that the separate statutory provision is not normally to be the basis for allowing FERC to require interconnection. The FERC staff has so argued. Memorandum to the Commission from John B. O'Sullivan and Robert E. Gackowski, in 44 Fed. Reg. 38863, 38866 (July 3, 1979).
COURT CHALLENGES

At this writing, the future of this statutory and regulatory framework is uncertain because FERC's implementation of the statute and the constitutionality of PURPA itself have been challenged in court. In 1981, a federal district court ruled that most of PURPA's provisions were an unconstitutional intrusion on state prerogatives. FERC appealed the ruling directly to the Supreme Court, which heard oral arguments in January 1982. A decision is not likely before the summer of 1982.

A second action before the Court of Appeals for the District of Columbia circuit involves the manner in which FERC has exercised its authority under PURPA.[18] The petitioners challenged FERC on several issues, including its full-avoided cost rule and its rule that electric utilities interconnect with cogenerators. The court vacated both rules.

The court concluded that the full-avoided cost rule was only one of several that FERC might have adopted in complying with the statute, and that FERC had failed to persuasively demonstrate why it had selected this particular one. The court noted that if Congress wished to require rates to be at full-avoided cost, it could have simply specified the rule in the statute. But it established three criteria to be considered in setting rates: the "public interest," the "interests of cogenerators," and the interests of "electric consumers of electric utilities." The court concluded that

It is apparent the Commission did not do this, or at least if it did its rationale and process of consideration were never made explicit. Instead the Commission came to the simplistic

and uniform conclusion that the full avoided cost standard would be just and reasonable in every case and that this was necessary to encourage cogeneration in every case.[19]

The court stated that "it is possible that if cogeneration becomes substantial, a rate uniformly set at the statutory ceiling may be quite costly to electric consumers."[20] The implication is that use of the full-avoided cost criterion, even if it is an accurate measure of cost savings to society, may have undesirable distributional consequences.

The court also expressed concern that the rule could lead to high rates, thus harming both the "public interest" and "electric consumers." It noted that this situation could arise "where the utility is subject to higher pollution control standards than are cogenerators, or when it pays taxes at a higher rate than will cogenerators." Or if the utility has "excess capacity," purchases from cogenerators at full-avoided cost "will result in higher rates from all remaining customers of the utility, because the cogeneration will reduce the number of customer-purchased kilowatt hours over which the utility can spread a share of the fixed costs of that extra capacity."[21] The implication here is that the full-avoided cost criterion may fail to measure the cost savings to society.

The court noted in conclusion that "on remand we expect the Commission to take a harder look at, especially, the percentage of avoided-cost approach. Such an approach might, for example, entail FERC setting a specific percentage or FERC might permit state commissions to

set within a range—e.g., 80-100 percent—authorized by the Commission."[22]

Moreover, the court vacated FERC’s rule that any utility must interconnect with any cogenerator designated by FERC, on grounds that, by doing so, the cogenerator would in effect be exempted from procedural and substantive requirements in sections 210 and 212 of the Federal Power Act (FPA). In response to FERC’s concerns that a strict interpretation of the FPA would result in undue additional administrative burdens on cogenerators, the court replied that the Commission could adopt "streamlined" procedures or seek an amendment from Congress.[23]

The court has denied FERC’s petition for a rehearing, but FERC may file a petition for certiorari to the U.S. Supreme Court. In any case, the controversy surrounding the avoided-cost approach raises important issues to which we now turn.

INDUSTRIAL COGENERATION, ECONOMIC EFFICIENCY, AND OIL AND GAS USE

The effect of PURPA’s cogeneration provisions on industrial fuel use will depend on many factors. These include the ways in which PURPA’s provisions are implemented (depending in part on outcomes in court), the future prices of fuel and other industrial inputs, and the change in the level and composition of consumer demand for industrial products as well as other goods and services.

Although estimates are uncertain, FERC states that the national potential for cogeneration in the industrial sector could be 16,000 megawatts by 1995, of which PURPA’s incentives might contribute about

[22] Idem at 13.
[23] Idem at 25.
3410 megawatts. Pulp and paper, chemicals, and petroleum refining are the industries most likely to be affected.[24] FERC expects pulp and paper plants to utilize steam-topping facilities, fueled by wood and other processed byproducts, augmented with oil or gas.[25] The chemical industry is expected to use either gas-fired combustion turbines or steam-topping installations that use process-derived fuels or natural gas. Petroleum refineries will generally use refinery products and off-gases in topping systems.[26]

Although expanded use of cogeneration as foreseen by FERC will likely lead to increased energy efficiency in the industrial sector, measured by the reduction in energy inputs per unit of output, clearly one must go beyond this observation in judging whether the incentives offered by PURPA lead to socially desirable outcomes. Two questions are of particular concern: First, if we assume that the avoided-cost criterion accurately reflects cost savings to society, does use of this criterion encourage an economically efficient outcome? That is, will it produce an outcome in which the combined cost of cogeneration and other power generation is minimized for any given total level of electricity


[25] Cogeneration systems are categorized as topping cycles or bottoming cycles. In the topping cycle, the combustion gases or steam (most commonly from a steam or combustion turbine) are used first to generate electricity. The exhaust is then used for industrial applications requiring heat or steam. In the bottoming cycle, heat or steam are produced first for industrial processes, and the residual thermal energy is used to generate electricity.

[26] In contrast to the promise of topping systems, FERC expects little additional growth of bottoming cycle cogeneration, because industries can generally find other ways to use waste heat (such as in preheating combustion air) that cost less than bottoming cycle equipment. 45 Fed. Reg. 23680 (April 8, 1980).
produced? This question is crucial to the debate about whether FERC's approach encourages too little or too much investment in cogeneration facilities. Second, to the extent that use of particular resources should be singled out, under what conditions will PURPA's encouragement of cogeneration likely increase, rather than decrease, overall oil and gas consumption?

Avoided Cost and Economic Efficiency

In response to the first question, the following theoretical analysis shows that use of the avoided-cost criterion does lead to an economically efficient outcome. Figure 3.1 shows the marginal costs of cogeneration $\text{MC}_c$ and the marginal costs, $\text{MC}_u$, of the utility's alternative "own" source of electricity, for a fixed total level of electricity production, $Q_3$. The analysis is based on the assumptions that (a) all power is homogenous (the issue of reliability does not enter here); (b) cogenerated electricity is supplied by perfectly competitive firms to a single utility; (c) the price paid by cogenerators for electricity they purchase from the utility is unaffected by the price paid by the utility for cogenerated electricity; and (d) all inputs are purchased in competitive markets (which does not account for price distortions in gas markets discussed earlier as well as from substantial tax subsidies such as in coal markets). Moreover, with this static rather than dynamic analysis, we do not take into account uncertainties, some of which may be important in judging the wisdom of fuel use and cogeneration policies.

$\text{MC}_c$ slopes upward from left to right to show that cogeneration output can be expanded only by using progressively more expensive facilities and practices. Similarly, curve $\text{MC}_u$ slopes upward from right
Fig. 3.1—Use of monopsony power

Purchases from cogenerators →

← Production from own facilities
to left to show that as production is increased from own facilities, marginal costs also rise. If the utility seeks to minimize the total cost of producing quantity $Q_3$, it combines $Q_2$ of cogeneration and $Q_3 - Q_2$ of its own production, where the marginal costs of the two sources are equated at $P_2$. In the absence of cogeneration, the total cost of producing $Q_3$ would be equal to the area under the entire curve $MC_u$ from 0 to $Q_3$. Substituting $Q_2$ of purchases from cogenerators, the utility reduces total cost by the triangular area $afj$.

However, in this economically efficient arrangement, the utility does not enjoy the full benefits of the reduction in total cost, but must share them with cogenerators. The utility receives the portion of benefits shown by the area $adf$ (the utility's "surplus"), while cogenerators receive benefits equal to the area $dfj$ (the cogenerators' "surplus"). The utility can do even better by exercising monopsony power against cogenerators to capture some of their surplus. The marginal expense to the utility of buying cogenerated electricity at $Q_2$ is not equal to price $P_2$. Instead, its marginal expense is higher, shown by the curve $MC^*_c$, because the utility's expense for the marginal unit purchased includes not only the higher price paid for the marginal unit, but also the higher price it must pay for all other units as well. $MC^*_c$, drawn to maximize the transfer of cogenerator's surplus to the utility, bisects the line segment $df$. Therefore, the utility can improve its position by reducing its purchases from cogenerators to $Q_1$ and reducing the price paid to $P_1$. The utility thereby increases benefits to itself, equal to the difference between the area of the triangle $adf$, and the larger area $aghc$. Although it loses the
triangular area cef, its gain of dghe more than compensates. Cogenerators lose not only the area dghe to the utility, but an additional amount ehf as well.

The suboptimal character of the monopsony outcome arises because the cost of producing $Q_3$ is no longer minimized. By substituting $Q_2 - Q_1$ of own production for cogeneration, the total cost of producing quantity $Q_3$ rises by the area chf—a "deadweight" loss to society. The utility makes this choice, however, because the portion of the deadweight loss it bears, equal to cef, is more than offset by the surplus, degh, the utility extracts from cogenerators. However, society is worse off since cogenerators lose more than the utility gains; that is, the cogenerator's loss of surplus to the utility plus their portion of the deadweight loss exceeds the net gain of the utility.

Several possible remedies come to mind. The first involves the ownership of cogeneration facilities by the utility itself. By internalizing the cogenerator surplus (i.e., by buying from itself), the utility would move to the economically efficient solution at point $f$, since it would seek to maximize the gains to itself shown by the triangular area afj. This remedy raises the serious issue of permitting regulated firms to enter competitive markets.[27] The restrictions on utility ownership of qualifying facilities specified in PURPA, noted earlier, is Congress' response. However, deregulation and independent ownership of all generating facilities—cogeneration, small power plant, and central power plant alike—might be a better solution.

[27] The opportunities and the problems posed by permitting a firm to offer both monopoly and competitive services are well illustrated by the history of American Telephone and Telegraph, most recently marked by the well-publicized settlement in an anti-trust suit brought against it by the U.S. Department of Justice.
The second remedy involves reducing or eliminating monopsony power by permitting cogenerators access to all utilities so that they can seek out those willing to pay the highest prices. The utility in Fig. 3.1 would no longer have a captive cogenerator industry, but would face competitive cogenerator prices over which it could exercise little control. However, while utilities are required by FERC to buy from cogenerators at avoided costs, they are not required to wheel the electricity of local cogenerators to other utilities.

A third remedy involves resort to FERC's avoided-cost rule. With the utility exercising its full monopsony power at \( Q_1 \), its avoided cost is equal to \( P_3 \). Under the FERC rule the utility must buy at price \( P_3 \) rather than at price \( P_1 \). The immediate effect is that cogenerators benefit, shown by the area bcgh, at the expense of the utility. The difference between the marginal cost of cogeneration production \( P_1 \) and the sales price \( P_3 \) induces additional cogenerator production and sales to the utility. As this expansion occurs, the utility's avoided costs fall along curve \( MC_u \) to the economically efficient level of cogenerator sales at point \( f \). Thus, use of the avoided-cost rule encourages expansion of cogeneration sales to the economically efficient level.

However, achieving an economically efficient outcome requires the reduction in calculated short-run avoided costs as cogenerated electricity is progressively substituted for the utility's own generation toward \( Q_2 \). Time lags by the states in adjusting avoided cost calculations would benefit cogenerators at the expense of the utility. In the extreme case of long lags, sales by cogenerators would overshoot the efficient level at \( Q_2 \).
Opposing the full-avoided cost rule, some utilities have suggested the alternatives of "split-the-savings" and "percentage of avoided costs."[28] Using the split-the-savings rule would also lead to the economically efficient outcome. As long as cogeneration sales lie to the left of $Q_2$, potential joint savings equal to the difference between $MC_u$ and $MC_c$ would remain. Since any portion of the joint savings will lie above $MC_u$, the split-the-savings rule would encourage cogenerators to expand sales to $Q_2$. The difference in outcomes between the full-avoided cost and split-the-savings approaches is purely in terms of the distribution of benefits between the utility and cogenerators. Under split-the-savings, the utility enjoys a portion of the benefits of purchasing from cogenerators as the cogeneration industry expands. Under the full-avoided cost rule, cogenerators reap all the benefits. The difficulty posed by the split-the-savings approach lies in the requirement that cogenerators disclose reliable cost data for the computation of joint savings. This requirement imposes a utility-like burden upon cogenerators that FERC has sought to avoid.

The percentage-of-avoided-cost rule does not require cost disclosure by cogenerators, but it fails to encourage the economically efficient outcome. As long as utilities are required to pay only a percentage of avoided cost, they retain some monopsony power. The equilibrium level of cogenerator purchases in Fig. 3.1 would lie to the left of $Q_2$ at the point where the ratio of avoided costs to fuel-avoided costs that the utility is required to pay is equal to the ratio or the

vertical distance between the $MC_c$ curve and the horizontal axis to the vertical distance between the $MC_u$ curve and the horizontal axis.

However, nagging issues of distribution of benefits arise, apart from questions of economic efficiency, especially for "electric consumers of the electric utility" for whom the D.C. Court of Appeals expressed concern. In other words, how would customers fare in the absence of any rule regarding utility purchases of cogenerated power compared to using the full-avoided cost rule? The effects on customers are difficult to trace because they depend on the degree to which state regulation of rates to consumers affect the distribution of benefits between the utility (or its stockholders) and its customers.

Although a rigorous treatment would go beyond the scope of this study, we offer some conjectures about the outcomes of two cases: (a) the utility is wholly owned by its customers and is free to operate in a way that maximizes their collective benefit; (b) the utility is unregulated (or ineffectively regulated) and is therefore free to maximize profits as a monopolist. In the first case, consumers as a group benefit from the utility's exercise of monopsony power. The loss to them from suboptimal use of cogenerated power is more than offset by the surplus they extract from cogenerators.[29] In the second case, the profit-maximizing monopolist sets output where its marginal revenue is equal to marginal cost. If it exercises monopsony power on the input side, its marginal costs of production will rise, again because of the suboptimal use of cogenerated power. This rise will cause a reduction in output and, necessarily, an increase in prices to customers. Unlike

[29] To support this conclusion, imagine that the utility in Fig. 3.1 is wholly owned by its customers. For the fixed total quantity of electricity Q3, they gain by exercising monopsony power for the reasons discussed earlier.
the previous case, consumers receive none of the surplus extracted from cogenerators. Here, both cogenerators and consumers are worse off, with benefits flowing to the utility's stockholders.

We should also consider the customers of the cogenerators. The higher the prices paid by utilities to cogenerators, the larger are the cogenerator's revenues. This, in effect, would reduce the total cost of heat and steam jointly produced with a given quantity of electricity. This reduction would induce a reduction in the costs of final products using steam and heat as inputs and, to the extent that final product prices are reduced, consumers would benefit.

Finally, recall that the preceding analysis is based on the assumption that calculated avoided costs are equal to cost savings to society. However, differences between these costs could arise from a number of sources, such as through the effects of differential regulatory and tax treatment, and biases that emerge from the sheer complexity of calculating avoided costs. These difficulties are shared by the split-the-savings and percentage of avoided cost as well.

Although analysis of these difficulties lies beyond the scope of this study, we emphasize that problems will continue in estimating avoided costs. The appropriate avoided-cost estimate for purchases from a particular cogenerator depends on many factors, including whether the cogenerated power is available for peaking purposes or for baseload demand. Several methodologies have been developed for estimating avoided cost but none are fully satisfactory.[30] The issue is not

[30] A discussion of these methodologies as well as the general problems of estimating avoided costs is contained in Roger McElroy, et al., Marginal Cost Rate Making for Cogeneration, Interruptible, and Backup Services, The National Regulatory Research Institute, Columbus, Ohio, February 1981.
whether errors will be made--for surely they will be--but whether biases persist. If avoided costs are systematically overestimated, utilities will face increasing financial strain because of excessively priced procedures required by cogenerators, while systematic underestimates will contribute to economic inefficiencies, as described previously. In any event, controversies between utilities and state regulatory bodies will undoubtedly continue as long as states strive to comply with FERC's mandate.[31]

Oil and Gas Savings

In addition to questions about the relationship between the avoided-cost criterion and economic efficiency, it is important to explore the effects of PURPA on oil and gas use. Gas, in particular, is an attractive cogeneration fuel because it is easy to use and less polluting than coal, for instance. The advantage of gas is further enhanced by the cogeneration exemption provisions of the Natural Gas Policy Act. As mentioned in Sec. II, FERC has implemented a "Phase I" incremental pricing program under which the price of gas used in "large boiler" industrial facilities is set to equal the price of residual oil, rather than at the lower, controlled level. However, exemptions from incremental pricing are granted for gas used in existing boiler facilities, new, small boiler facilities, and in "qualifying" cogeneration facilities.[32]

[31] For one example, see the complaint by the San Diego Gas and Electric Co. about the allegedly excessive avoided-cost estimates of the California State Public Utilities Commission, "Motion for Rehearing and Reconsideration of D-82-01-103 of the Final Order in OIR-2 and Request for Stay," February 1982.

[32] 44 Fed. Reg. 57746 (October 5, 1979). Existing small boiler facilities are defined as those in existence on November 9, 1978. Small boilers are those that "did not consume more than an average of 300
FERC reasons that gas use encouraged by the incremental price exemption will be more than offset by the relatively high fuel efficiency of qualifying cogeneration facilities. FERC estimates that after implementing Sections 201 and 210 of PURPA (which refer to cogeneration), "An estimated 40,000 bbl/day of oil will be conserved, plus an additional 40,000 bbl/day equivalent of natural gas and 120,000 bbl/day equivalent of coal by 1995."[33]

Using a large computer model, another study concludes that PURPA's incentives, particularly use of the avoided-cost standard, will result in substantial oil savings, but an increase in natural gas consumption. That outcome results from increased use of gas by industrial cogeneration facilities in selling electricity to utilities that, in turn, reduce their use of oil. To the extent that reduced oil consumption is more valuable than reduced gas consumption, the study concludes that FERC and the PUCs should set avoided-cost rates "as high as feasible" to back out as much oil as possible by encouraging industrial and other cogeneration.[34]

However, these estimates were made before the 1981 Congressional amendments to FUA that abolished fuel-use prohibitions on existing powerplants, and before ERA's revised rules that simplify administrative procedures and exemption criteria under FUA.

MCF/day for boiler fuel during any calendar month of the year 1977."
Exemptions are also provided for gas used in agriculture, schools, hospitals, and in power generation by electric utilities. To qualify, new cogeneration facilities must meet certain fuel efficiency standards established by FERC. 45 Fed. Reg. 17966 (March 20, 1980).
[34] Resource Planning Associates, Inc., The Potential for Industrial Cogeneration Development by 1990, Cambridge, MA, July 31, 1981. However, such arguments may encourage overestimates of avoided costs, leading to overinvestment in cogeneration facilities and an increased burden on already financially troubled electric utilities.
Although it is beyond the scope of this study to reestimate the net savings in oil and gas, we will briefly discuss three factors:

- PURPA's effects on the direct use of oil and gas by cogenerating firms.
- The effects on utilities' fuel use of substituting cogenerated electricity for other sources.
- The effects of constraints imposed by FUA, discussed in Sec. II.

The Effects of PURPA on Direct Oil and Gas Use by Cogenerating Firms. According to a FERC study, the expansion of cogeneration that PURPA encourages will rely heavily on the use of oil and gas, since (a) PURPA itself imposes no fuel-use restrictions, and (b) coal requires more costly environmental controls than does oil or gas. The major use of biomass in cogeneration--mostly in the pulp and paper industry--is not likely to be significantly increased because "the economically available wood residue is already being used for cogeneration."[35]

This conclusion is partially supported by evidence from applications for qualifying status as cogenerating facilities previously filed with FERC. Table 3.1 shows that 44 percent of the total capacity relies on gas, and only 17 percent on biomass and waste. However, it also shows prominent use of coal and little use of oil.[36] Moreover, the figure for gas-fired cogeneration is dominated by two filings for

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[36] The low figure for oil probably reflects the relatively low controlled price for gas. Some facilities have dual burner capabilities so that depending on relative prices and environmental regulations, they can switch between oil and gas.
Table 3.1
APPLICATIONS FOR QUALIFYING STATUS AS COGENERATION FACILITIES
(OCTOBER 1979-DECEMBER 1981)

<table>
<thead>
<tr>
<th>Number of Applications</th>
<th>Fuel</th>
<th>Capacity (KW)</th>
<th>Percent of Total Capacity by Fuel Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Coal</td>
<td>737,000</td>
<td>34</td>
</tr>
<tr>
<td>24</td>
<td>Nat. Gas</td>
<td>954,866</td>
<td>44</td>
</tr>
<tr>
<td>12</td>
<td>Biomass</td>
<td>209,368</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Waste</td>
<td>143,280</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Oil</td>
<td>28,325</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Other</td>
<td>107,300</td>
<td>5</td>
</tr>
<tr>
<td>Total 53</td>
<td></td>
<td>2,180,139</td>
<td>100</td>
</tr>
</tbody>
</table>

SOURCE: FERC, Quarterly Report on Qualifying Small Power Production and Cogeneration Facility Filings, January 1, 1982, Table III.

exceptionally large facilities with a total capacity of 670,000 Kw.
Total gas use of 284,000 Kw in the remaining 22 applications lags far
behind the total for coal-fired cogeneration and is not far above the
total for biomass.

If we assume that the use of steam, heat, and electricity by
cogenerators for their industrial processes are unaffected by PURPA, any
increase in gas and oil use by cogenerators would be attributable to
generation of electricity (as a joint product with steam and heat) sold
to utilities. Depending on the fuel efficiency of cogeneration
facilities, the amount of oil and gas burned to produce this electricity
will be less than the amount of the fuel used (in BTU equivalent) by
utilities for the same quantity of electricity. Whether PURPA induces
an overall savings of oil and gas will depend critically on relative
fuel efficiencies of cogenerators and utilities and on the types of fuel utilities would otherwise have used.

The Effects of PURPA on Utilities' Fuel Use. Assume cogenerators use only oil and gas. If the utilities also use only oil or gas, the expansion of cogeneration would result in an overall reduction in oil and gas use, because of cogenerators' higher fuel efficiency. If utilities would have only used other fuels, overall use of oil and gas would expand. That is, the relative fuel efficiencies of utilities and cogenerators determine the amount of oil and gas (as a percentage of the total fuel backed out of the utility sector) required to offset the increase in oil and gas used by cogenerators. Were their fuel efficiencies identical, 100 percent of the fuel backed out of the utility sector would have to be oil and gas to offset the expansion of oil and gas use by cogenerators.

The Relationship of FUA to PURPA. As discussed in Sec. II, new powerplants and major fuel-burning installations consisting of a boiler are prohibited by FUA from burning oil and gas. By itself, the ban would assure a reduction in overall oil and gas consumption in new cogeneration facilities that use boilers and exceed a minimum size (i.e., a design heat-input rate of at least 100 million Btu per hour).

As discussed earlier, however, there are various exemptions from the ban, including one for cogeneration. An applicant may obtain the exemption by certifying that overall oil or gas savings will result from use of the cogeneration facility in question. As long as use of exempted facilities does result in a net savings, FUA assures that cogeneration encouraged by PURPA will not result in an increase in oil and gas use. The outcome will depend on (a) petitioners' making
accurate estimates of the savings, including the effects on fuel use by electric utilities with whom they deal, and (b) ERA's review of those petitions for cogeneration exemptions. If approval is a rubber-stamp process, FUA will provide little safeguard against the possibility of increased oil and gas use with cogeneration.

CONCLUDING REMARKS

For PURPA, as with FUA, achieving oil and gas savings depends on individual estimates of the import premium and on distortions caused by natural gas price-control. If the premium is not used to guide policymaking, and is not disturbed by gas price-distortions, there is little reason to be concerned about the outcome. Only the effect on overall costs would be relevant, not the effect on the use of particular resources. In this case, FUA's continued existence and its cogeneration exemption would become irrelevant. Similarly, PURPA's fuel efficiency standards for cogeneration and its restrictions on fuel use for small powerplants would make little sense.

Finally, the basis for PURPA's cogeneration provisions is different from that of FUA. Even without an import premium or distortions in natural gas prices, PURPA's cogeneration provisions could be defended as a way of improving overall economic efficiency by reducing institutional and legal barriers to cogeneration. However, PURPA's provisions are not the only way to seek improved economic efficiency. Deregulation of generation facilities within the electric utility industry is one alternative. With this approach, all generation technologies would compete equally, with no need to apply for qualifying status. The prices at which the distribution portion of the industry purchases electricity
would be determined by market forces rather than through complex and controversial administrative procedures.[37]

IV. OTHER REGULATORY ACTIVITIES

In this section we discuss and briefly analyze five regulatory activities that OPPA has singled out for our attention. As will be shown, those five activities are distinctly less important in affecting industry’s use of energy than are FUA's and PURPA's treatment of industrial cogeneration. Nevertheless, the analysis may be useful to DOE in its energy regulation decisions.

The activities discussed below fall into three categories:

- Mandatory reporting of fuel use and other characteristics of plant and equipment: The Industrial Energy Conservation Program; reporting guidelines for the Municipal Waste Reprocessing Demonstration Program; and the Manufacturing Industries Energy Consumption Survey.
- Federal funding tied to specific requirements: State Energy Conservation Plans.
- Required action by petitioners seeking DOE approval for exemption from other regulation; guidelines on the use of alternative fuels and technologies under FUA.

THE INDUSTRIAL ENERGY CONSERVATION PROGRAM

Background

This program, administered by the Office of Industrial Programs, Conservation and Renewable Energy, was designed to improve industrial energy efficiency. Its objectives are to (a) accelerate the marketing of new and emerging technologies and practices, (b) encourage the substitution of alternative fuels for oil and gas, and (c) encourage the recovery of energy and materials from industrial waste streams.

The most visible element of this program—and the only one that has a regulatory component—is the Industrial Energy Efficiency Reporting Program. Consequently, discussion will be limited to this element.
Reporting of industrial energy use began in 1974 as a voluntary effort jointly administered by the Federal Energy Administration (FEA) and the Department of Commerce. The Energy Policy Conservation Act (EPCA), passed in 1975, called for establishment of the Industrial Energy Conservation Program, with a provision for mandatory reporting.[1] The purpose was "to promote increased energy efficiency by American industry, and . . . to establish voluntary energy efficiency improvement targets for at least the 10 most energy-consuming . . . industries."[2] EPCA specified that targets be established and reporting be conducted as follows:[3]

- FEA identifies and ranks major energy-consuming industries.
- For the top 10 industries in the ranking, FEA sets "industrial energy efficiency improvement targets" at the level "which best represents the maximum feasible improvement in energy efficiency which such industry can achieve by January 1, 1980 . . ."[4]
- Within each industry, FEA identifies each corporation that meets two criteria: (1) consumes 1 trillion Btu's per year; (2) is one of the 50 highest consumers in the industry.
- Each corporation in the top ten industries with targets that meets the above criteria must report annually on its progress in improving energy efficiency, and provide information required by FEA.
- A corporation may be granted an exemption from these reporting requirements if it participates in an adequate,

[3] This description is paraphrased from the statute. Although organizational references are to FEA, DOE later assumed responsibility for the program.
voluntary industry reporting program and reports its progress to a trade association or other entity.

- Industry reporting is mandatory. Progress in reducing energy consumption is not mandatory. There is no penalty for failure to meet the targets.

In 1978, Congress expanded the program to include the following:[5]

- All corporations consuming 1 trillion Btu's per year in major energy-consuming industries, not just the top 50, are to be identified.

- Reporting requirements are extended to all corporations identified, regardless of whether targets are set for that corporation's industry.

At the same time, Congress created a similar program for "energy-saving recovered materials" in four industries: metals and metal products, paper and allied products, textile mill products, and rubber. For these industries, DOE is to set "targets for increased utilization of energy-saving recovered materials."[6] Each corporation that meets the 1 trillion Btu criterion is subject to reporting requirements similar to those for industrial energy conservation. Whether this program should be considered part of the Industrial Energy Conservation Program is not clear, but DOE has set rules for those two programs in a single rulemaking proceeding.[7]

Currently, the energy reporting program includes about 1,000 corporations in 20 industries as defined by 2-digit SIC codes (though

there are efficiency targets for only 10 of these). The program office informs us that roughly two-thirds of these corporations report through trade associations and the like; the rest report directly to DOE. Table 4.1 shows the most recently reported results through 1979 for the ten industries for which targets have been set. The table shows, not surprisingly, that some industries had already exceeded their 1980 targets by the end of 1979, while others had fallen short.

Analysis and Conclusions

It is difficult to demonstrate that this program brings about significant benefits. The setting of voluntary targets is itself an

Table 4.1

IMPROVEMENT IN ENERGY EFFICIENCY:
TEN MAJOR ENERGY-CONSUMING INDUSTRIES

<table>
<thead>
<tr>
<th>Industry</th>
<th>Reduction in Energy Use Per Unit of Output (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1980 Target</td>
</tr>
<tr>
<td>Chemicals</td>
<td>14</td>
</tr>
<tr>
<td>Metals</td>
<td>9</td>
</tr>
<tr>
<td>Petroleum</td>
<td>12</td>
</tr>
<tr>
<td>Stone, Glass and Clay</td>
<td>16</td>
</tr>
<tr>
<td>Paper</td>
<td>20</td>
</tr>
<tr>
<td>Food</td>
<td>12</td>
</tr>
<tr>
<td>Fab. Metal</td>
<td>24</td>
</tr>
<tr>
<td>Transportation</td>
<td>16</td>
</tr>
<tr>
<td>Machinery</td>
<td>15</td>
</tr>
<tr>
<td>Textiles</td>
<td>22</td>
</tr>
</tbody>
</table>

exercise of questionable value. Whether an industry in 1980 meets a target set in the mid-1970s depends, among other things, on the degree to which target setters accurately predict future energy prices. An industry may easily exceed its target if energy price increases are higher than anticipated. Even if target setters accurately predict future prices, the disparity among the industries in meeting targets (shown in Table 4.1) may be explained by their delayed adjustments to fuel price increases during 1973-74--before the targets were established.

Since failure to meet targets carries no penalty, there is little reason to believe that industry behavior has been affected. DOE found that during 1972-79 those ten industries had enjoyed a "2.2 percent reduction in actual energy consumption [which] equates to an annual energy savings equivalent to 60 million barrels of crude oil."[8] Though this finding may be interesting in tracing the reduction of national energy consumption as distributed by sectors and subsectors of the economy, it does not measure reporting program benefits.

Skepticism about the value of the program to industrial energy conservation is not new. When DOE proposed expanding the number of industries with reporting requirements from 10 to 20, observers argued against it. As DOE summarized one of the arguments: "The present reporting program has not been proven to have had a positive significant effect on industrial energy conservation efforts; thus an expansion of this effort is not justified." Instead of suggesting there was a

positive significant effect, DOE relied on higher authority: "Congress . . . has not questioned the effectiveness of its legislated reporting requirements. Indeed, in passing NECPA it obviously sought to expand these requirements."[9] In other words, DOE relied solely on the statutory requirement to justify the expansion and not on a claim of program benefits.

Some evidence suggests that the data collected in the program are useful. They are combined in an annual report to the President and to Congress, and according to the program office, copies are eagerly sought: 2,500 copies of the 1979 Annual Report were printed and quickly sold. Although the program may be cancelled (depending on the 1983 budget), the program office says that some industries have decided to continue reporting. Their willingness to bear the costs of reporting presumably is offset by the value of having access to the aggregate results across industries.

These benefits need not be great, since the costs of reporting are apparently small. According to the program office, one large firm claims that after the first year (when start-up costs must be included), reporting requires only about four person-hours of work.

Thus, although the program has not been shown to bring about significant benefits, it does not impose heavy costs. Perhaps the most important lesson here is that government can serve a useful role in compiling, analyzing, and disseminating information voluntarily submitted by the private sector.

REPORTING GUIDELINES FOR THE MUNICIPAL WASTE REPROCESSING DEMONSTRATION PROGRAM

Background

Insofar as waste products converted by reprocessing facilities substitute for industry's conventional fuels, waste reprocessing activities affect industrial energy conservation. The degree of oil and gas savings depends on relative fuel prices and on environmental and health restrictions on the use of reprocessed waste fuel.

The Municipal Waste Reprocessing Demonstration Program, administered by the Office of Conservation and Renewable Resources, was created in 1974.[10] It has two purposes:

- To ensure adequate federal support for demonstrations of municipal waste reprocessing in the production of fuel and energy-intensive products.
- To gather information about the technological, economic, environmental, and social costs, benefits, and impacts of such demonstration facilities.

The first purpose is served by statutory authorization of a program of "grants, contracts, price supports, and cooperative agreements . . . for the establishment of municipal waste reprocessing demonstration facilities."[11] The term "municipal waste" includes but is not limited to municipal solid waste, sewage sludge, and other municipal organic wastes. The facilities in question must be owned or operated by municipalities.

The second purpose is served by two statutory provisions. One requires DOE to "establish such guidelines as [it] deems necessary for purposes of obtaining pertinent information from municipalities funded under the program." The information is to include "methods of assessment and evaluation."[12] The second requires DOE to submit to Congress an annual report on the demonstration projects.

DOE published guidelines, essentially a set of proposed rules, in a Notice of Proposed Rulemaking.[13] The content of the proposed reporting requirements derives from the "methods of assessment and evaluation" language in the statute and from the information requirements of DOE's annual report.

A brief outline of the major reporting provisions of the proposed guidelines is as follows:

**Monthly Reports During Construction**
- Significant changes in project
- Effects on waste processing operations and energy recovery elements

**First Periodic Report**
- Case history
- Outline of feasibility study and significant conclusions
- Summary of marketing studies
- Economic analysis
- Site plan
- Process flow diagrams
- Outline of sampling, monitoring, and testing protocols
  (The remaining items are the same as those in subsequent periodic reports.)

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Subsequent Periodic Reports[14]

Data Analysis and Evaluation

- Analysis and evaluation of data obtained through above protocols.
- Technical information about characteristics of the municipal waste, energy consumption, furnace characteristics, and emissions.

Municipal Waste Analysis

- Characteristics of reprocessed wastes.
- Characteristics of wastes rejected from the plant; changes in waste collection and disposal practices in service area, including changes in the fees charged for waste collection and disposal services.

Operation and Maintenance Data

- Modifications in equipment and operation.
- Analysis of differences between actual operating performance and design specifications.
- Maintenance procedures.
- Description of causes and severity of each breakdown or malfunction.

Management and Staffing Information

- Number and labor costs for each employee or category.
- Reason for management and staffing changes.
- Number, name, and cost of contractors.

Financial Information

- Income and loss statement.
- Statement of financial position.
- Financial status report required by OMB.

[14] These are computed annually or quarterly, depending on the assistance agreement.
Marketing Information

- For each category of customer and service, the quantity sold, intended use, unit sale price, and total income.
- For each new supply contractor, information on purchaser and terms for determining unit sales prices, and other charges.

Environmental Impact Data

- Copies of any reports submitted to relevant federal, state, and local agencies.

Community Impact Data

- Copies of newspaper articles, letters, and other documents about complaints and responses.

According to the program office, there is now only one demonstration project within the program, which will be terminated before the end of 1983. Initiation of new projects will depend on the budget, if any, for the federally supported program from municipal waste demonstrations.

Analysis and Conclusions

Receiving information about a demonstration project during its construction and operation is important for at least three reasons. First, the information helps outsiders decide whether to adopt the technology in question. Since the goal of a demonstration project is to show both the benefits and the problems associated with using the technology in a working environment, potential users need to know about construction and operating delays and possible remedies, costs of construction and operation, including comparisons between actual and estimated figures, prices of output, and other factors.
Second, the information helps current users decide whether to continue, modify, or abandon the demonstration project in question. Some demonstration projects would be worth pursuing even if the technology is not adopted elsewhere, because its benefits exceed costs. Other projects may yield benefits, but only if modifications are made early. In other projects, poorly conceived from the start, adequate information helps make the difficult but necessary decision to abandon the project.

Third, standardized information from all projects helps DOE to rank projects by their degree of success, and to pinpoint characteristics that affect their success. This comparative analysis can help design new projects and modify existing ones.

However, one must keep in mind that inadequate information results not only from weak reporting requirements but because the demonstration project itself is not designed and operated to provide, under any conceivable set of reporting requirements, information that would be required by potential users of the technology. For example, a technology demonstrated on a small scale may not provide adequate information about adapting the technology for full-scale operation. Or a demonstration project may be located in a part of the country where geographic, demographic, and climatic conditions are such that the conditions could not be applied elsewhere. Thus, although well-designed reporting guidelines can aid decisions, by themselves they cannot ensure adequate information to potential users.[15]

[15] Case studies and overall analyses of several federally funded demonstration projects, illustrating the importance of adequate information flows for decisionmaking, is found in W. S. Baer, L. L. Johnson, and E. W. Merrow, Analysis of Federally Funded Demonstration Projects: Final Report, R-1926-DOC, The Rand Corporation, April 1976;
Of course, these general remarks say nothing about the merits of the particular proposed guidelines discussed above in comparison with other such guidelines. The most appropriate guidelines are ones that maximize the difference between the benefits and cost of complying with the guidelines. To determine the appropriateness of DOE's guidelines would require a separate study on the technical and economic characteristics of waste reprocessing facilities and on the kind of information most useful to the federal government and to potential users of the technologies.

If federal funding for demonstration programs is not continued, however, the rationale for the guidelines themselves would be erased. Analyzing the merits of federal funding for municipal waste reprocessing demonstrations is beyond the scope of this study. However, it is worth noting that the rationale for federal support has been predicated on the notion that these demonstration projects provide greater benefits than those of potential nonfederal sponsors. Left to themselves, private entrepreneurs or municipalities presumably underinvest in demonstration activities because some of the benefits would have value to outsiders who would not have helped fund the activities. In such cases, a central "agent"--here the federal government--representing all potential beneficiaries may compensate for underinvestment in promising areas by contributing additional funds. It is for this reason that the federal government has supported a wide range of demonstration projects in energy, transportation, and other fields.

Note that the rationale here is different from that underlying FUA and other regulatory activities discussed in this section. Even without an import premium and price distortions in natural gas markets, there is a basis for federal assistance to demonstration programs because the net benefits of these programs cannot be fully appropriated by those who fund them.

In conclusion, if federal funding continues for the Municipal Waste Reprocessing Programs, mandatory reporting guidelines would enhance the usefulness of project information, not only to the funding agency but to potential users of the technologies. The remaining issue is whether the cost of compliance would exceed the benefits.

ENERGY CONSUMPTION SURVEY FOR MANUFACTURING INDUSTRIES

Background

This survey consists of a questionnaire form EIA-463 that is sent by the Energy Information Administration to industrial establishments to determine the nature of their energy consumption. Originally, response by the firms was mandatory. The Task Force on Regulation Unrelated to Decontrol describes this survey as a
discretionary data collection project to collect data on energy consumption by selected manufacturing operations and create an inventory of large industrial boilers (those greater than 50 MM Btu/hr). The project is a one-time data collection exercise designed to collect specific baseline data [by fuel type and by plant size] that is presently unavailable to DOE. The Form 463 is a multiple user project that will provide data to many different DOE offices. . . .

The data will be used in developing an inventory of large industrial boilers and identifying fuel switching capability. Specifically, ERA will use the data to determine coal capability at major fuel burning installations and implement energy supply emergency contingency plans.[16]
After the Office of Management and Budget (OMB) cleared the form in October 1980, the Energy Information Agency mailed it "to 10,000 establishments within Standard Industrial Classified Codes 20 to 39 that are likely to have a boiler, gas turbine, combined cycle unit, or internal combustion engine with a maximum design [sic] firing rate of 50 million Btu per hour or greater."[17] (The sequence beginning "boiler" and ending "combustion engine" is part of the statutory definition of a major fuel-burning installation under PIFUA.)[18] The figure of 50 million Btu per hour comes from then effective DOE rules for determining whether an installation consisting of an aggregate of individual units constitutes a "major" fuel-burning installation.[19]

In February 1981, DOE received notice that OMB had withdrawn approval of the form. "As a result, those industrial establishments which have not yet responded are no longer required to do so."[20]

Analysis and Conclusions

The primary purpose of Form EIA-463 was to inform DOE about characteristics of existing MFBIs to mandate fuel switching under FUA. It makes sense to collect information about capacity for fuel switching only if there is an expectation that DOE will attempt to mandate such switching, either under FUA or as part of government oil or gas conservation efforts during a fuel emergency.

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[16] Files of the Task Force on Regulation Unrelated to Decontrol.
Currently, there is little reason to believe that DOE intends to mandate further fuel switching by existing MFBIs. It follows that any benefits that might be obtained from the information are at best limited. Even if one assumes that in the future DOE might decide to mandate fuel switching by MFBIs, the benefits of a one-shot data collection effort would be limited, because the number of MFBIs capable of switching could change substantially. Even if DOE intended to mandate fuel switching, the benefits of the information collected would be difficult to separate from the benefits of the basic fuel-switching requirement.

In addition to questions about benefits, we have sought to determine how much of a burden the reporting requirements have been to responding firms. Contacts with the appropriate program office and a review of the documentation footnoted in this section did not disclose serious complaints by firms that the reporting was excessively burdensome. However, those most reluctant to respond, possibly because of the high cost to them of doing so, may have been the ones that postponed their response until after February 1981, at which time firms were no longer required to comply. If so, they would have had no reason to register complaints.

There is currently no requirement that industry respond to the mailing of Form EIA-463. The only relevant question here is whether promulgation of such a mandatory form would be warranted in the future. In response to another threatened or actual world oil crisis, the Reagan administration has said that it will rely on stockpiled oil and on the market mechanism—including rising fuel prices—to induce fuel switching
and other reductions in oil use. However, if a decision is subsequently made that government action is required, issuing of a survey form to determine the characteristics of MFBIs in the inventory would help to keep open the option of mandatory fuel switching. We have found no evidence to suggest that the cost to complying firms would prove especially burdensome. If the benefits of government fuel-switching requirements are found positive, use of such a form would contribute to those benefits. However, the highly conjectural circumstances under which the government might consider mandatory fuel switching are such that no further analysis here seems warranted.

STATE ENERGY CONSERVATION PLANS

Background

DOE's involvement in state energy conservation plans originated with the Energy Policy and Conservation Act of 1975. Federal support was initiated because of Congressional findings that state laws, policies, and procedures could curb energy use, and that the "Federal Government has a responsibility to foster and promote comprehensive energy conservation programs and practices by establishing guidelines for such programs and providing overall coordination, technical assistance, and financial support for specific State initiatives in energy conservation."[21]

Administered by the Office of Conservation and Renewable Resources, the program operates through two mechanisms. First, DOE specified energy conservation goals for each state for 1980.[22] Second, the

Federal Government provides financial and technical assistance for development, implementation, and modification of state energy conservation plans.[23] A plan's eligibility for financial assistance, depends on the following five mandatory elements, and may include other elements deemed "appropriate."[24]

- Mandatory lighting efficiency standards for public buildings.
- Programs promoting car pools, van pools, and public transportation.
- Mandatory standards and policies relating to energy efficiency to govern state and local procurement practices.
- Right-turn-on-red traffic regulations.
- Mandatory thermal efficiency standards for new and renovated buildings.[25]

Congress amended the statute in 1976 to provide the same kind of financial assistance to "supplemental state energy conservation plans."[26] The mandatory elements of supplemental plans are:

- Procedures for continuing public education about conservation and related matters.
- Procedures for coordination among federal, state, and local energy conservation programs.

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- Procedures for "encouraging and carrying out energy audits with respect to buildings and industrial plants."
- Certain other elements DOE may require. [27]

The responsible program office has informed us that in FY 1981, 57 government entities applied for assistance for both the basic and supplemental plans and that the figure has been roughly constant since the beginning of the program. In FY 1981, grants to the states and costs of program support ran to $44.6 million and $3.2 million, respectively. The FY 1982 budget was cut severely for the basic program and provided no funds for the supplemental program.

Analysis and Conclusions

One can assess this program's effect on industrial energy conservation in two fundamentally different ways. The first focuses on the energy conservation plans themselves. The second focuses on the federal role and, primarily, on federal financial assistance. The reason for the distinction is obvious: The program does not require states to produce plans (although states are required to do so if they seek federal assistance), and states are free to produce plans regardless of federal financial assistance. (We ignore here the essentially unanswerable question of whether the state plans would exist without the federal program.)

With respect to the state conservation plans themselves, it is clear that most of their mandatory elements do not directly affect industrial energy conservation. [28] The one exception is an element of

[28] This point may be slightly overstated. The regulations provide that the plan element dealing with car pools and the like may be satisfied by taking one action from a long list in one urbanized area in
the plan dealing with mandatory thermal efficiency standards for new and renovated buildings.[29] Such standards could directly affect industrial energy use in heating and cooling plants. However, it is not clear that the standards would do so, because they would be minimum standards that firms might choose to meet or exceed even without mandatory standards. A first step in analyzing this problem would be to determine what the states' standards actually provide. The second and much more difficult step would be to determine the effects of those standards on energy use in the industrial sector.

The mandatory elements of the supplemental plans are also unrelated to industrial energy use, with the possible exception of the program element dealing with energy audits. Even here, firms are not required to adopt the audit recommendations.[30] Moreover, apparently no provision exists to make the audits mandatory. Thus, the audit programs are a way of providing a service to firms—a service they may or may not take advantage of. An extensive research project could develop modestly reliable information on whether firms adopt conservation measures developed as a result of the program's findings on energy audits. However, because of the tangential relationship between the mandatory elements of state programs and industrial energy conservation, it is not likely that analysis of these program elements will be fruitful with respect to industrial behavior.

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the state. One of the actions on the list is "variable working schedules." 10 C.F.R. Sec. 420.7(b)(1)(v) (1981). If a state actually mandated variable working schedules, industrial energy use might be affected.
If the mandatory program elements themselves have little relation to industrial energy conservation, federal financial assistance for those program elements also has little effect on industrial energy conservation. Nevertheless, interesting issues arise about the federal role: (a) the rationale for this program of federal financial assistance in the first place, and (b) the rationale for continuing federal assistance years after the original programs were developed.

The first rationale derives from (a) the potential efficiencies of a centralized coordinating body for development of decentralized programs, and (b) the potential benefits of energy conservation within a state to other states. With respect to the first rationale, most of the benefits of a centralized coordinating mechanism would likely diminish as states become familiar with these programs. Further, the costs of maintaining programs are surely less than the costs of instituting them. Thus, federal support for program start-up is more important than continuing federal support, despite the benefits that other states might enjoy. This second rationale raises questions about the oil import premium and distortions in natural gas discussed in Sec. II.

In conclusion, potential questions about federal support of state conservation activities are worth further study, but determining the effects of state actions on energy use would be difficult to assess. With only a tangential relationship between the mandated elements of state plans and the response of the industrial sector, such study would probably not demonstrate how the benefits of federal funding would reduce oil and gas use by industry.
GUIDELINES ON THE USE OF ALTERNATE FUELS AND TECHNOLOGIES

Background

As discussed in Sec. II, many temporary and permanent exemptions from the prohibition against using oil and natural gas in new powerplants and in new major fuel-burning installations are possible. Originally, petitioners for certain exemptions would be required to analyze the feasibility of using alternative fuels and in some cases, alternative technologies as well. However, at the time, petitioners did not know what the alternatives were. To be sure, guidance on the information required could be obtained in a "prepetition conference" that the petitioner was free to seek. However, guidelines issued in advance would presumably help the petitioner prepare for the conference and might even obviate the need for it. DOE has not yet developed those guidelines; it has prepared only an outline for producing them. In a 1980 Notice of Inquiry, DOE described the following purposes of the guidelines:

The guidelines and the process of developing them will provide a structured means of communication between the industrial and utility sectors and DOE concerning the technical and economic viability of the various alternative fuels, innovative technologies, mixtures and conservation measures. Second, the guidelines will reduce the uncertainty faced by firms subject to FUA. Firms--particularly smaller firms--will have a better understanding of the alternative fuels and technologies that should be considered in exemption petitions. Third, the guidelines can be an important mechanism for expediting the commercial use of those fuel technologies that merit consideration on technical grounds by providing vendors and other interested parties better access to industrial and utility markets for alternative fuels and technologies.[31]

As originally conceived, the guidelines might have proved quite useful, since the petitioning and approval process promised to be costly and time consuming. The petitioner would have to file a petition on exemption criteria for the specific exemption sought. After the petition was filed, it was to be scrutinized to see if it "appears to contain the information required by ERA to make subsequent analyses and determinations as to the merits of that petition."[32] If ERA accepted the petition, it was to publish a notice of commencement of an administrative proceeding and provide a period for public comment.[33] The implication was that DOE planned to analyze the merits of each petition.

A central element of most exemption petitions was to be the "Fuels Decision Report,"[34] a complex and burdensome document for the petitioner. The contents of the Fuels Decision Report depended on the exemption sought. Some of the exemptions, notably the permanent exemption for "lack of alternative fuel at a cost which does not substantially exceed" the cost of using otherwise prohibited fuels, required that the Fuels Decision Report include documentation of a "fuel search." The rules did not specify exactly what the fuel search should cover, but they specified that fuels the petitioner should consider could range from coal to any fuel (or mixture, if appropriate) that is not petroleum or natural gas. We do require that you describe not only the fuels you analyzed in-depth, but those you rejected, and the reasons you chose not to consider them further. Your Fuels Decision Report reflects a decision tree,
in which a variety of alternatives are examined, but only a few are analyzed in depth.\[35\]

The requirement for a Fuels Decision Report was, to put it mildly, unpopular. Final rules, published in 1980,\[36\] eliminated the Fuels Decision Report and the entire portion of C.F.R. dealing with it (10 C.F.R. Part 502). However, the evidentiary requirements were retained and incorporated in the evidentiary requirements for the exemptions themselves. Thus, in order to obtain a "lack of alternative fuel" exemption, the petitioner must show evidence of a fuel search as follows:

A petitioner must perform a fuel search by examining the use of alternative fuels as a primary energy source at the site under consideration, and for powerplants reasonable alternative sites. In submitting a petition, a petitioner must demonstrate for each of the fuels examined that he would qualify for an exemption. The minimum number of alternative fuels which petitioner will be required to examine in this fuel search can be ascertained prior to submission of a petition provided that a prepetition conference is held in accordance with Part 501.\[37\]

The notable point here is that the petitioner was left uncertain about which fuels to consider.

In June 1981, DOE published a Notice of Proposed Rulemaking, designed to respond to the President's Task Force on Regulatory Relief. It was intended to "simplify the administrative procedures and exemption criteria" by allowing that for most exemptions, petitioners need only "certify" (with backup documentation) that they satisfied the criteria. Although it is unclear how much DOE analysis would be required, we

\[35\] 10 C.F.R. Sec. 502.1(b)-(d) (1980).
\[36\] 45 Fed. Reg. 38276 (June 6, 1980).
\[37\] 45 Fed. Reg. 38276 (June 6, 1980).
assume that in an uncontested case DOE would accept the certifications as correct.

Especially important, DOE narrowed substantially the range of alternative fuels to be considered. For all practical purposes, it reduced the range to one: solid coal. This was accomplished by redefining the required fuels search. According to the new regulatory language:

... a petitioner must perform a fuels search by examining the use of conventional solid coal as a primary energy source at the site under consideration, and for powerplants at reasonable alternative sites. Where a petitioner believes that its use of such coal would be infeasible, however, and where ERA and the petitioner can reach accord, it may evaluate use of a different alternate fuel in lieu of solid coal. A petitioner for these exemptions must demonstrate for any fuel examined that he would qualify for an exemption.[38]

The first sentence of this provision says that for most exemptions of interest, the only alternative fuel that need be considered is "conventional solid coal." The second sentence in effect says that a petitioner may analyze some alternative other than solid coal if the petitioner wants to do so, if the use of coal is infeasible, and if ERA agrees.

Analysis and Conclusions

The progressive easing of the exemption rule since 1980 reflects the interest of DOE and others in reducing the administrative burden to obtain exemptions from FUA's prohibitions. This interest, in turn, indicates a less urgent position on the reduction of oil and gas use through prohibitions. With the most recent rule changes under FUA, the

guidelines have lost their primary function: The need to provide extensive guidance on fuel alternatives does not exist when the rules require consideration of only a single clearly specified alternative.

If one attached high quantitative estimates to the import premium and expressed concern that continued price control of natural gas seriously distorts fuel choices, a logical consequence would be to insist on extensive documentation to support an exemption—including a thorough search for viable alternative fuels and technologies, as DOE originally planned. In this case, guidelines could be quite important in easing the administrative burden on petitioners, and at the same time, in helping to ensure thorough exploration of alternatives. But this view of the import premium and of distortions in natural gas prices is not widely held today within DOE. As with other regulations discussed in Sec. IV, the benefits of the guidelines today are small and relate only tangentially to industrial energy consumption.

OTHER REGULATIONS

In addition to the preceding five regulatory activities that OPPA singled out for our attention, we have examined Title 10 of the Code of Federal Regulations to identify other regulatory activities that concern industrial energy use. We chose Title 10 because (a) it contains all DOE regulations found in the Code of Federal Regulations (CFR), and (b) it is called "energy." We found very little. Some regulatory activities have nothing to do with industrial energy use; others involve no regulatory requirements but federal funding for a variety of activities.

For example, one program is the "Energy Sources and Renewable Resource Obligation Guaranty Program." This program provides for
federal guarantees of obligations issued by various entities (including industrial concerns) to finance energy measures recommended by energy audits. To the extent that these measures are taken in industrial plants, they could affect industrial energy use. The CFR's energy measures that pertain to industrial plants include

- Insulation
- Efficient lighting
- Improved hot water systems
- Improved oil burners
- New boiler controls
- New lighting controls

Presumably, the availability of federal financial support makes it more likely that these measures will be taken by industrial firms, so that their energy use would be affected. Moreover, the list of eligible measures, and implicit exclusion of other measures, presumably influences industrial choice among them.

Title 10 places greater emphasis on residential conservation and on advancing automotive technology than on industrial conservation. For example, Part 430 of the CFR deals with "energy conservation program for consumer products," involving the setting of targets for improvements in the energy efficiency of products other than automobiles. Part 456 covers the Residential Energy Conservation Program, which mandates that utilities offer audits at no more than nominal charge to their residential customers. Parts 474 and 475 cover a research development and demonstration program for electric and hybrid vehicles.
V. CONCLUDING REMARKS

RATIONALES FOR GOVERNMENT ACTION

We have identified three rationales for government intervention in private markets.

- Tendency of funders to underinvest because they cannot capture the full benefits of their investment. Federal funding of municipal waste reprocessing demonstrations falls into this category.

- Removal of institutional and legal barriers to promote economic efficiency. PURPA's cogeneration provisions fall into this category.

- Disparities between private and social costs arising from market imperfections, such as the import premium and continuing gas price controls. All other regulatory activities we have surveyed fall into this category.

This categorization of rationales is not meant to imply, however, that federal support of these programs is warranted. Such rationales provide a supposedly valid reason for federal support, not necessarily a sufficient one. The merits of the specific activities in question must be examined, taking into account imperfections in government actions as well.

COSTS AND BENEFITS

We have uncovered no egregious cases in which the industrial sector has encountered cumbersome regulations with no demonstrable benefits. For the five regulatory activities surveyed in Sec. IV, we have seen no demonstration of significant benefits to society; nor have we found evidence that the burden imposed on complying firms is high.
Three of those five activities focus on mandatory reporting of information. The burden of complying with the reporting requirements (with the possible exception of those relating to municipal waste reprocessing) seems insignificant, as do the benefits in oil and gas savings. Only in the case of municipal waste demonstrations can a strong case be made for systematic collection of information--in this instance to help potential users of the technology make sound decisions. Of course, the case for mandatory reporting can be made only if the demonstrations themselves receive federal support.

Compliance with requirements of the State Energy Conservation Plans imposes a burden on states and their residents, but the benefits only tangentially relate to industrial energy use, since the requirements mostly involve transportation and fuel use in buildings.

With FUA's recently developed certification procedures, guidelines for alternate fuels and technologies are less important now in facilitating exemptions. Since applicants need consider only one alternative fuel--solid coal--the future value of guidelines is questionable.

It seems fair to say that whether any or all of the five regulatory activities are retained or abolished, they will have little effect on the industrial use of energy in general or of oil and gas in particular.

FUA constitutes a potentially far greater intervention in the private sector. But the easing of concerns about availability of gas and the growing worldwide oil surplus since FUA was enacted have led to revisions in the statute and in DOE's rules to reduce that burden. Owners of existing powerplants and MFBI's no longer face fuel-use
prohibitions; and the cogeneration exemption can be obtained through simplified self-certification procedures. Of course, liberalization of FUA's rules will likely lead to smaller gas and oil savings. The magnitude of this loss in benefits depends on one's quantitative assessment of the import premium and on the estimated size of future price distortions in gas markets.

The requirements of PURPA (administered by FERC rather than by DOE) impose burdens on utilities in return for the accelerated development of cogeneration, which may provide a lower cost alternative to centrally generated power. Although FERC's adoption of the full-avoided cost criterion encourages economically efficient outcomes, controversy will persist about the distribution of benefits among cogenerators, utilities, and their customers.

DOE REGULATIONS AND THE INDUSTRIAL SECTOR

Much of the regulatory activity we have surveyed only indirectly relates to industrial energy use, which suggests that DOE's attention has been directed to the residential and transportation sectors. DOE's Residential Conservation Service, for example, requires utilities to offer audits at below cost to their customers. Mandatory elements of state conservation plans reflect concern with transportation and energy use in buildings. Mandatory elements of state supplemental plans focus on public information programs and energy audits. Moreover, as an alternative to direct regulation, DOE has sponsored a variety of information and research and development programs in these other sectors.

This emphasis may reflect yet another rationale for government intervention: the lack of consumer information. When consumers are
uninformed about trade-offs between energy and other resources, the argument is commonly made that government can serve a useful role.[1] In the industrial sector, however, one would normally expect users to be better able to assess trade-offs between energy and other resources. With relatively well-informed participants, a less strong case can be made for government intervention.

At the same time, some federal regulations outside of DOE's purview, and outside the scope of this study, have much to do with industrial energy use. Regulations imposed by the Environmental Protection Agency and by the Internal Revenue Service surely affect firms' decisions about current fuel-use and about new plant and equipment. Thus, those concerned about the more general effect of government regulation on industrial energy use must search far beyond DOE's regulatory requirements.

APPENDIX: THE OIL IMPORT PREMIUM

The import premium has four components: a direct and indirect demand component, and a direct and indirect disruption component. Although a number of studies have addressed the subject, no satisfactory measurement of the premium has resulted.[1] One difficulty is that the value attached to each of the premium's components is sensitive to certain assumptions about market conditions, about which little is known; and the values for each of the components, even if correctly estimated, are not additive. Because the import premium provides a rationale for FUA's curbs on oil and gas use, we will discuss its concept and measurement in some detail.

Direct Demand Component. With world price as a given, private traders do not take into account the effect of their own demand on the world price. An increase in their demand raises world price, to the disadvantage of the U.S. and other importers. To illustrate, suppose that with the imposition of FUA (and whatever other market interventions may be taking place), U.S. oil imports run to 6.5 mmb/d at a world price of $33. If FUA were removed, oil imports would rise by 0.2 mmb/d to 6.7

mmb/d. If the price elasticity of oil supply to the U.S. is 6 (i.e., the percentage increase in quantity is six times the percentage increase in price), the world price would rise to $33.17 per barrel. The total import bill would rise from $214.5 million per day (6.5 x 33) to $222.24 million per day for an increase of $7.74 million per day. Thus, the social cost of importing an additional 200,000 barrels would run to $38.70 per barrel. However, the private cost, equal to the new world price, would be only $32.17. The difference of $6.53 would be the direct demand component of the import premium.[2] In this simple example, FUA would generate gross benefits approximating $1.3 million per day (6.53 x 200,000) or to $475 million per year.[3] From those benefits must be subtracted the costs imposed on firms (subject to prohibitions, forced to use alternative fuels and technologies) and the costs to the government of administering FUA.

Of course, estimates of this component vary greatly. If we take a lower supply elasticity of 2 rather than 6, FUA's daily gross benefits would approach $4 million. Unfortunately, the price elasticity of supply itself is difficult or impossible to estimate because it depends on changing market conditions, and on the reaction of oil exporters, who individually, or working through OPEC, are able to affect world prices through their actions. The more reluctant exporters are to reduce

[2] Other importers are also paying the higher price of $33.17 per barrel because of the increase in U.S. imports. If we regard any portion of the increased cost burden on other importers (especially our allies) also as a social cost to the U.S., the U.S. direct demand component of the premium would be commensurately higher.

[3] Because the direct demand component rises as U.S. imports rise, the first barrel increase in imports of the hypothetical 200,000 barrel increment carried a smaller direct demand component than the last. The calculations of benefits from FUA assume an average per-barrel demand component for the 200,000 barrel increment.
production in the face of declining demand, the smaller is the price
elasticity of supply and the greater is the direct demand component of
the premium. Conversely, greater production cuts mean smaller direct
demand components. Production cuts that would keep world prices
constant would also drive the component to zero. The price elasticity
of demand for oil also affects the size of the demand component, but to
a lesser extent than the price elasticity of supply.[4]

Sensitive to such probable results of the demand component,
previous empirical studies of the direct demand component show estimates
ranging from as little as $1 to as high as $19.[5]

Of course, this direct demand component exists not only for
imported oil but also for any imported commodity whose price is affected
by the level of imports, including bananas, coffee, and a host of
others. Why single out oil? Four arguments are usually advanced:

(a) that oil exporters already exercise some degree of control
over price, (b) that reducing the world oil price . . . is
beneficial to the rest of the industrial world . . . (c) that
oil is of pervasive importance in industrial economy and its
price affects general economic performance, (d) that the
supply of oil is subject to sudden interruptions.[6]

In conclusion, this analysis suggests that the nation would be
better off reducing oil imports by enforcing FUA and other guidelines,
but it can offer little guidance about how that reduction should be
valued in deciding whether FUA benefits or those of other interventions
outweigh the cost. Moreover, some policymakers will be troubled by
singling out oil from other commodities whose prices are also affected
by import levels.

[4] For a tabulation showing the sensitivity of the direct demand
component to assumptions about the price elasticities of both supply and
demand, see Bohi and Montgomery, op. cit., p. 6.
Demand Component: Indirect Cost. Indirect costs, which are harder to identify, come from the possible adverse effects of rising real oil prices on the U.S. economy.

- An increase in the cost of oil contributes to unemployment and inflation if wages and prices are not fully flexible at the time the economy is adjusting production to higher oil prices.

- Economic growth may be reduced, depending on how easily other resources can be substituted for oil; the importance of oil in production processes; and the degree to which offsetting energy-saving technology change occurs.

- Rising prices of oil, by reducing real domestic income, will tend to reduce the savings rate in the economy, which in turn may adversely affect the rate of capital formation and the potential for economic growth.

- For imported oil, rising prices may cause deteriorating U.S. terms of trade.

Unlike the direct demand component, the indirect component demonstrates the effects on the economy of overall consumption of oil rather than of just imports. The macroeconomic effects noted above would come about even if the U.S. imported no oil. A rise in the world price would cause a rise in the price of domestically produced oil (in the absence of trade barriers) and the effect on productivity, inflation, and other factors would remain. Thus, the effects of FUA, as measured by the indirect component, indicate its effect on overall oil consumption and not on imports alone.[7]

It may seem odd to consider indirect adverse effects of rising oil prices with increasing talk of an oil glut and declining oil prices.

[7] This argument implies that any domestically consumed good or service whose relative price is rising generates unfavorable macroeconomic consequences, which come about because of the inflexibility of wages and prices and through possible adverse effects on the savings rate, as noted above.
The issue, however, is the probability and magnitude of long-term real increases in oil prices. Since oil resources are exhaustible, most analysts agree that over the long term, real oil prices will rise as oil becomes increasingly scarce. Market observers disagree about the likelihood of discovering new oil and the costs of extracting oil from known reserves with the help of long-term, cost-cutting technological advances. Projecting long-term oil price paths is only one of many problems encountered in estimating the indirect demand component.

Consequently, it is hardly surprising that past quantitative estimates for the indirect demand component vary widely. Ranging from zero to $100, they show even greater variation than those of the direct demand component.

The Supply Disruption Component: Direct Costs. U.S. vulnerability to disruptions in world oil supplies, exacerbated by the politically unstable, but oil-rich regions around the Persian Gulf, is the main reason for reducing U.S. dependence on foreign supplies. Potential direct and indirect costs imposed on the U.S. because of possible future disruptions are reflected in two additional components of the import premium. The first, direct cost, includes (a) an increase in the transfer of wealth to exporters because of sharply higher oil prices, and (b) a reduction in domestic production of goods and services because of reduced oil consumption.

The transfer of wealth to exporters is comparable to the transfer in the direct demand component, discussed earlier. During a disruption, the cost to the nation of importing an additional barrel of oil would exceed by an even greater amount the private cost, since the price elasticity of supply would likely decrease relative to predisruption
levels. Thus, the net social gain from reducing imports during a
disruption should be included in the import premium.

However, the extent to which the cost of reduced oil production
reflects a disparity between the social and private costs of importing
oil depends on whether private parties have previously anticipated the
effects of the disruption.

For example, industrial firms anticipating future disruption may
invest in more fuel-efficient equipment and stockpile more oil than they
would otherwise. Similarly, consumers may purchase more fuel-efficient
automobiles and appliances.

Even if all users anticipate the costs of disruption and take
appropriate action, the disruption may cause economic loss. Users would
have judged that additional disruption costs are preferable to bearing
additional costs during normal times that would be required to fully
offset the effects of the disruption. Since the cost of disruption
would be fully absorbed by users, no disparity would arise between
private and social costs. Therefore, the cost of reduced oil
production, brought about by the disruption, would not enter into import
premium estimates.

Of course, private agents may not fully anticipate future
disruptions. For example, refineries and distributors might stockpile
less oil during predisruption periods because they fear that if supplies
were disrupted they would not be free to sell or use their stockpiles,
but would be subject to governmentally imposed price and allocation
controls. Moreover, even if the government assured private agents that
it would not take such action in the event of a disruption, the long-
term credibility of those assurances, given shifts in administrations,
for instance, would be questionable.
But anticipating market disruptions is even more complicated. Not only is the "gross" disruption cost difficult to assess; the portion that reflects the private sector's inability to anticipate the costs of the disruption is even more so.

Problems of assigning probabilities to the timing, magnitude, and length of future disruptions have caused estimates from past empirical analyses to vary widely—ranging from $1 to over $13 per barrel.

Supply Disruption Component: Indirect Costs. During a disruption additional costs accumulate because of difficulties in responding to price shocks. The sudden price increase, inducing an enlarged wealth transfer to exporters as well as to domestic oil producers, tends to depress aggregate demand because of time lags in spending these revenues, and time lags in designing and implementing monetary and fiscal policies that will compensate for them. Market inefficiencies resulting from downward inflexibility in wages and prices will unfavorably affect production, unemployment, and inflation. Since these costs are not factored into private parties' decisions on mitigating the effects of disruptions, those costs reflect a disparity between private and social costs and therefore qualify as a component of the oil import premium. The few studies that have taken these indirect costs into account show a range of zero to $14 per barrel.

The Overall Premium and Its Policy Implications. Because of interdependencies among components, the estimates noted above for individual components cannot simply be added together to estimate the overall premium. For example, if measures are taken to reduce the direct demand component, say by imposing a tariff on imported oil or by
discouraging use of oil through FUA and other mechanisms, predisruption oil imports will fall and the direct disruption component will also fall. As Broadman notes, "The total benefits for reducing imports should be determined simultaneously in calculation of the individual components."[8] How one should go about doing this, however, is not clear.
