SYNTHETIC FUELS

Should the government subsidize nonconventional energy supplies?

Paul L. Joskow and Robert S. Pindyck

THE CENTERPIECE of President Carter's energy policy is a program of massive subsidies to hasten the commercial development of synthetic fuels and other "nonconventional" energy supplies. While the ultimate size of the effort will be determined by the Congress, the administration has proposed spending over $100 billion in the next decade, and views this program as its major instrument for bridging the growing gap between our consumption and production of energy.

The particular sources of energy likely to be most heavily subsidized by this program include oil from shale rock and gas and liquid fuel from coal, but subsidies will also be allocated to solar energy, biomass, wind power, and other technologies. Producing energy from these sources does not require fundamental new scientific or technological advances. Shale oil was first produced in Britain in the 1850s, and gaseous and liquid hydrocarbons were produced from coal in Germany during World War II and are being produced today in South Africa. But energy from these sources is often called nonconventional because it is not at present being produced or consumed in significant quantities in the United States or, for that matter, almost anywhere else. The reason is quite simple—these sources of energy are extremely expensive. It is difficult to say just how much more expensive they are than conventional energy supplies, but estimates we have examined put them at twice the cost, on a thermal-equivalent basis.

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Of course, as conventional energy supplies become increasingly scarce and their prices rise, shale oil, gasified coal, solar energy, and a variety of other nonconventional sources may become commercially viable, and in fact may eventually displace conventional oil and natural gas as major fuels. When that day will dawn is difficult to predict. But if, as the Carter administration argues, it will be in the next decade, why is it that we do not already observe the private sector gearing up to produce these sources of energy in the absence of federal subsidies? More important, is it desirable to spend billions of tax dollars to subsidize these sources of energy sufficiently to make them economically attractive to producers and consumers? At a time when there is growing pressure to limit government spending in areas like health, education, and the environment, are these subsidies to specific energy supply technologies really in the public interest?

The Plan for Government Involvement

In the President's proposal for an Energy Security Corporation to support the commercial development of nonconventional energy, as in alternative plans, government subsidies take a variety of forms. First among these are direct subsidies to reduce the cost and increase the profitability of new energy technologies. The most common form of direct subsidy is the use of government revenues to finance part or even all of the construction of "demonstration plants" for nonconventional energy—a demonstration plant being a production facility at (or close to) commercial scale whose construc-

tion provides a way of finding out the actual cost and operating characteristics of each technology. This information is useful more for evaluating the "commercial" possibilities of a specific technology than for obtaining basic or applied scientific knowledge.

Outside of the military and space programs (where commercial viability is not an issue), the government has traditionally focused its R&D expenditures on financing basic and applied scientific research, leaving industrial development and commercialization to the private sector where both the benefits and costs of expenditures can be most effectively balanced. But it is now argued that, without direct government subsidies to finance the construction of demonstration plants, private firms will face too much uncertainty to allow them to make the "correct" investments.

Of course any new technology involves uncertainty and requires an investment in learning—problems long recognized in our patent system. Private investors are normally willing to undertake such projects when the expected rewards from success are greater than the expected losses from failure. Yet we are now being told that, for nonconventional energy, the government should bear much of the cost and the risk because the private sector is unwilling to do so. We have not, however, been told why it should be necessary for the taxpayer to bear these costs if these technologies are in fact "good bets."

Tax credits are another form of proposed subsidy, though one that is somewhat less direct. If the production of a particular form of energy is at all profitable in the long run, tax credits will obviously increase the aftertax profitability. And even if a particular project is *never* profitable, tax credits may have the effect of reducing the overall tax burden to the companies, and thus making the new technology more attractive. The energy tax credits specified in the President's plan are substantially those contained in last year's unsuccessful energy tax bill. They include a $3 per barrel credit for oil from shale and tar sands, a 50¢ per mcf credit for geopressurized methane and for any gas from a nonconventional source, and residential credits for home insulation and expenditures on solar and wind energy.

Loan guarantees, likewise an indirect form of subsidy, are also part of the President's plan. Because shale oil and coal gasification and liquefaction projects have large capital requirements, debt-financing costs are a major component of total cost. By reducing the riskiness of loans, loan guarantees reduce financing costs. What this form of subsidy costs the public is difficult to measure, since that depends on the number and sizes of loans that default. An extensive program combined with a high default rate could be very costly.

We have gathered and evaluated cost data for several nonconventional energy sources and have found only limited prospects for profitability. To put it simply, at least for the next several years, conventional sources are likely to be cheaper than nonconventional sources (for specific data, see Saman Majd, "Financial Analysis of Non-Conventional Energy Technologies," MIT Energy Laboratory). It is therefore not surprising that the private sector has not been particularly interested in developing these sources without the government subsidies; indeed their development is probably not an efficient use of society's scarce resources. It does not make sense to invest large sums of money in projects that do not appear to be economical, unless it can be shown that there are good reasons why the decisions made by the private sector are inconsistent with the public interest.

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We must always remember to ask the question: if energy producers and consumers, who are in the best position to assess the commercial value of alternative energy supplies, are not interested in attempting commercial development, why should the taxpayer overrule their decisions and—what is worse—pay for doing so?

The Rationale for Subsidies

Two basic arguments are made in favor of government participation in the development of nonconventional energy supplies. The first says

that the United States is becoming more and more dependent on imported energy from sources that are increasingly insecure and that we can reduce this dependence by accelerating the production of new domestic energy supplies. There is no question that U.S. dependence on imported energy is increasing as the gap between our energy consumption and our domestic energy production continues to grow. The issue, however, is whether there are more efficient means of bridging the consumption-production gap that would end up costing the American public less.

The second argument says that projects to produce these energy sources are of a special nature that makes it difficult or impossible for them to be undertaken by the private sector without government assistance. Moreover, the administration claims that the special nature of these technologies is such that government participation in their commercialization will be needed even when energy prices are higher. Proponents of this view usually point to the fact that commercialization of these technologies typically involves large capital expenditures and, in some cases, considerable risk, so that private firms would be unwilling or unable to raise the necessary capital and make the necessary investments. In effect, it is argued that there are significant market imperfections which make nonconventional technology *look* unprofitable to private firms, even though its social value is considerable, and that it is these imperfections which justify intervention.

Here we examine these two arguments in some detail to determine whether they do indeed justify the kinds of programs the Carter administration is now proposing. We also present what we think is the proper role of the government in the commercialization of nonconventional energy supplies—first in the context of an ideal, or "first-best," energy policy, and then in the context of a "second-best" energy policy operating under the kinds of political constraints that are likely to exist in the near future.

New Energy Technologies as a Substitute for Imports

Before we consider whether the subsidization of nonconventional energy supplies is a desirable way of reducing the gap between domestic energy consumption and production, we should be clear on just why that gap exists. For the last several years, U.S. energy policy has kept the domestic price of energy well below the world level. Maintaining an artificially low price for consumers—and domestic producers—has stimulated energy demand and, at the same time, reduced domestic production. Some 4 to 6 million barrels per day of our current 8 or 9 million barrels per day of oil imports can be traced directly to recent policies that have kept domestic energy prices far below world market levels. (See article by R. Hall and R. Pindyck in *The Public Interest*, Spring 1977.)

Two principal policies have been used to maintain a low domestic price of energy. One is the crude oil price controls entitlement program, which taxes the domestic production of oil (by holding its price below the refiner's price) and uses the proceeds of the tax to subsidize imports (thereby reducing the cost of high-priced imported oil to the refiner). This has had the effect of keeping the average price of crude oil to U.S. producers about 50 percent below the world price—and has had the interesting side effect of putting the U.S. government in the business of subsidizing oil imports from OPEC.

The second policy is the regulation of the wellhead price of natural gas, which has held natural gas prices far below the world market level for many years, producing domestic shortages even before the 1973 oil embargo. The Natural Gas Act of 1978 represents a major step in correcting this policy, although gas prices will not reach free market levels for several years.

Now the administration, in its synfuel proposals, is asking taxpayers to finance the difference between the high cost of producing nonconventional energy in the United States and the low price consumers will be asked to pay. But Americans will be much worse off with higher taxes than with higher energy prices. Individuals can choose to avoid paying higher energy prices by limiting their consumption, but they have no choice about the taxes they must pay. The proposed "commercialization" program will force consumers to pay a good portion of the high cost of energy indirectly, through their taxes. As a result, there will be little incentive to conserve, so consumption will rise while production falls. A growing tax

burden will then be required to finance a growing amount of subsidized production.

Rather than subsidize nonconventional energy, it would be better to purchase oil and natural gas at home and from abroad at world market prices. Offering government subsidies of one kind or another to developers of new energy forms means requiring the nation to pay much more for energy than is necessary—which is exactly what government policy should avoid.

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A counter argument sometimes raised is that the development of more expensive nonconventional energy should be accelerated today so that lower-cost conventional energy can be saved for future generations. But this argument ignores the time value of money—which makes it cheaper for us to consume low-cost supplies now, in 1979/80, and higher-cost supplies then, in the future. As conventional oil and natural gas reserves are gradually depleted, the market prices of these resources will rise, so that eventually we will shift to higher-cost resources such as shale oil, gasified coal, and solar energy. To reverse this order of use by accelerating the commercialization of nonconventional supplies would only impose an unnecessary cost on the American public.

New Energy Sources and Market Imperfections

We have argued that if a new energy technology does not appear profitable to the private sector, its development may well not be an efficient use of society's scarce resources. But in some cases there may be significant market imperfections that make the technology *appear* unprofitable to private firms, even though its true social value is quite high. It is only in such a case that some type of government intervention might be desirable.

Those who advocate government intervention often point directly or indirectly to one or more alleged failures of the market. Here we examine those alleged failures that have attracted the most attention.

Energy Price Imperfections. As we have pointed out, government regulation has kept most energy prices below their true marginal social cost. But it is prevailing or expected market prices on which private firms base their decisions about the profitability of new energy technologies.

Government price regulation has therefore created an important disincentive to investments in new energy technologies. It may be that such investments are "justified" by a complete analysis of the costs and benefits to the U.S. economy, even though private firms do not find them attractive in the face of regulated energy prices that do not reflect the true social costs of additional consumption to the U.S. economy. Since energy prices are "too low," we cannot expect the private market to provide the proper signals on new sources of supply.

While price regulation clearly leads to an important market imperfection, it is an artificial one created by the government's own actions. To set things right the government can either eliminate the source of the problem by allowing energy prices to rise to replacement cost, or it can try to "balance" the disincentives created by regulation with additional incentives in the form of subsidies to new technologies. We will explore this matter later on.

Discount Rates. It is sometimes contended that private firms, when making investment and planning decisions, use discount rates that are "too high" and that therefore bias their decisions away from capital-intensive projects like the commercialization of nonconventional energy supplies. There are essentially four reasons cited to explain why private discount rates tend to be higher than the "social" discount rates that should be used to properly evaluate the benefit of a project to society.

First, it is argued that social discount rates are lower than private discount rates because private agents do not value the well-being of future generations sufficiently. Using a lower social discount rate would lead us to shift expenditures towards more investment (and less consumption) today and more consumption tomorrow. (Alternatively, some have argued

that we should impute a lower social discount rate in cost-benefit calculations so as to account for external economies or public goods characteristics that are not properly accounted for by private decision-makers.*

Second, it is argued that market interest rates ordinarily include some premium for the risk (or uncertainty) associated with the investment. This risk is reflected in (real and nominal) differences in the interest rates of risky and safe assets. Proponents of subsidies argue that such risk premiums would be unnecessary with government investment projects, since the government is so large and has so many projects over which it can diversify risk that its investments could be treated as being riskless. Government investments would therefore be evaluated at lower interest rates than those private firms use, reducing their apparent costs and making the investments more profitable from a "social" point of view.

Third, it is argued that corporate taxes distort discount rates, since the rate of return on private projects must include a provision for the payment of income and other taxes. According to this argument, because the government does not have to pay taxes to itself, the social rate of discount would be lower than the private discount rate, making projects "socially profitable" even though they are unprofitable in the private market.

Finally, it is argued that the *social* returns from domestic energy projection are higher than the private returns. A reason given for this is that an increase in domestic production will lead to a reduction in imports, which in turn will lead to a reduction in the OPEC price.

For alternative energy sources, all four arguments are largely specious. Most of the historical discussion of social discounting has been conducted in the context of very large capital-intensive projects (such as dams), which have very long lifetimes as well as public goods characteristics and external economies, and which will be owned and operated by the government. But new energy technologies do not fit this bill.

There is also little evidence that private firms "overdiscount" the future, though this is a question not really subject to objective analysis. In any case, there is no reason to believe that such an effect would appear only in energy supply and demand decisions.

While it is true that government bonds will carry a lower interest rate than other bonds because bondholders always expect the government to pay up, this is risk reduction from the viewpoint of investors rather than from the viewpoint of society. If new energy technologies are inherently risky, there is little reason to believe that the government can make them any less so. Government only shifts risk from investors to taxpayers: it does not eliminate it.

It is true that the government might be in a better position to diversify risks than the private capital market when such extremely large amounts of capital are involved that the risks of default cannot be adequately absorbed by a single firm or a consortium of firms. But such situations are rare. The investments contemplated for most new energy technologies are not significantly larger than the amounts the energy industry has been able to raise in the past. Private firms have had little or no trouble in raising capital for projects like the Alaskan pipeline, liquefied-natural-gas tankers, oil refineries, and large chemical plants—projects whose capital requirements were of roughly the same magnitude as a shale-oil or coal-gasification plant. If there is a problem here it is not in the size of plant investments required.

The argument that taxes distort discount rates is likewise specious. The capital that might be used by the government to finance a project has an opportunity cost—that is, it is withdrawn from the private sector, thereby losing returns from private investments that would otherwise have been made and losing tax revenues that such investments might have generated. In short, the cost of obtaining funds for public investment projects is equal to the gross rate of return, including taxes, forgone by diverting this capital from the private sector to the public sector.

Finally, it is unlikely that a reduction of 2 or 3 million barrels per day of imports (in 1990) will significantly affect the OPEC price, since the United States simply does not have enough effective monopsony power as a buyer of OPEC oil. But even if it did, subsidizing particular synthetic fuels is surely not the most cost-effective way of reducing imports.

*By "public goods characteristics" we refer in particular to the fact that once a "public good" exists (a highway, a dam, or a navy), it costs little or nothing for each additional user to gain its benefits—which, of course, makes cost allocation difficult.

It is thus hard to be impressed by arguments that private decision-makers use a discount rate that is "too high." Let us therefore turn to the other arguments about market imperfections.

Capturing the Benefits of Technological Information. Considerable technological information might of course be forthcoming from greater R&D efforts. But—it is argued—because this information is difficult to keep private, the benefits will not all accrue to private investors, and thus private firms will tend to underinvest in R&D. Alternatively, greater patent protection might solve this problem but would be undesirable because of the distortion caused by the resulting monopoly power.

While this argument is generally true for R&D activities that produce basic scientific and technical knowledge, it is not applicable to the commercialization of new energy technologies. Commercialization is not basic research. Most new energy technologies that are candidates for huge subsidies are well understood. While there may be some uncertainty about their ultimate cost, the uncertainty is no greater than what is involved in many other ventures commonly undertaken by private firms. Thus, while a good case can be made for government funding of basic energy research activities, the argument does not apply to government funding for the industrial development and commercialization of alternative energy technologies.

Regulatory Uncertainty. The technological and economic risks of new energy technologies are likely to be overshadowed by uncertainties about environmental regulations. Environmental (and other public policy) controversies surrounding the Clinch River Breeder Reactor and the Barnwell Reprocessing Plant are examples of the kinds of problems potential investors fear.

Uncertainties over the ability to meet current and future environmental standards are present in many industrial investments, but are probably greater for such energy technologies as shale oil and coal gasification. These technologies raise new and different environmental questions, and to the extent that environmental standards may not be promulgated until the plants are operational, there may indeed be significantly greater regulatory uncertainty.

The environmental problems fall into three main areas: air quality, land, and water. Plant emissions and fugitive dust can cause air quality problems. Second, both the plants and mines needed for these coal technologies and the disposal of the spent shale may seriously scar the landscape. Indeed the use of the land for these plants may permanently destroy vegetation and wildlife and, as with Appalachian coal-based synfuels, render agricultural and forest lands unsuitable for their original use, even with reclamation. Reclamation and revegetation would be even more difficult in areas of low precipitation. Finally, the development of these technologies raises concern over the adequacy of water supplies and the pollution of existing sources, since synthetic fuels production requires large quantities of water. In some regions this would mean a shortage of water for other uses (for example, agriculture). Discharge of pollutants into surface streams and leaching into underground sources are dealt with at the planning stage by designing the plants for "zero-discharge," involving recycling of spent water for use at the plant site. But whether the discharge will be quite "zero" at full-scale operation remains to be seen.

It has been argued that understanding and solving the environmental problems presented by new energy technologies may require the technology to operate for some period of time. While this would provide the information needed to draw up regulations, the technology may not be developed without clearly defined regulations because of the associated uncertainties. To the extent that this dilemma exists, the construction and operation of first-of-a-kind facilities may have "public goods" characteristics that would justify some form of government intervention. On the other hand, regulatory reform, leading to the removal of unnecessary, even counterproductive, regulations and to a clarification of the kinds of environmental standards likely to be enforced in the future, seems a better way of dealing with this kind of market imperfection.

The Proper Role for Government

If the President's proposals are adopted, subsidized nonconventional energy supplies will soon be relied upon to help close the growing gap between the consumption and production

of energy in the United States. This would indeed be unfortunate. Most of the gap comes from price controls on crude oil, natural gas, and electricity, and it would be much more effective and much less costly to eliminate the regulation that produces the gap than to subsidize expensive energy substitutes for low-priced but nonavailable energy. Eliminating price controls would enable us to begin using nonconventional energy supplies as they become economically viable.

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Of the various forms of market imperfections that are put forth as reasons for government intervention, the most real and most serious is uncertainty over future regulation. We have noted the existing uncertainty about future environmental constraints and regulations, but of even greater concern to the potential producer of new energy technology is uncertainty over future government *price* regulation.

The commercialization of shale oil, for example, is a risky venture. Indeed, if private firms do undertake it, they will do so only because they see a profit potential large enough to warrant the considerable risk. The fear of private firms, however, is that while they will be permitted to lose almost any amount of money, they will not be permitted to make almost any amount of money. Firms considering shale oil projects rightly worry that, if the world price of conventional oil rises considerably over the next decade so that a shale oil facility turns out to be an economic success, the government will then regulate the price of the shale oil, thereby reducing the profits that can be earned.

Private firms usually have no problem with downside risk as long as there is a commensurate potential for profit on the upside. The problem with nonconventional energy supplies is that firms are unwilling to take downside risk when they perceive a probable government ceiling on upside potential. It is therefore not surprising that these firms are asking for various forms of government subsidies to limit their downside risk. Once again, government subsidies are a costly and unnecessary alternative to dealing with the problem directly. The removal of price controls—and the guarantee that controls will not be imposed on the prices of nonconventional energy supplies produced by the private sector in the future—would eliminate the one form of market imperfection that is indeed significant and serious.

Decontrol of the current and future prices of energy supplies is the most important part of a "first-best" energy policy. This, together with a revision of those environmental regulations that are unnecessary and unreasonable and a clarification of environmental standards and regulations that would apply in the future, would permit private firms to develop new energy technologies at a socially optimal rate. There would then be little or no need for the government to subsidize the commercialization of these technologies. While we would hope to see continued government support for basic energy research, subsidies for the production of nonconventional energy supplies are no more warranted than subsidies for the production of sugar, tobacco, or peanuts.

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It has been argued that the deregulation of domestic energy prices is politically impossible, at least over the next several years. Would this make government subsidies for new energy technologies desirable? That is, if we cannot have the "first-best," what role should the government play in the commercialization of these technologies as part of a "second-best" policy?

In this case, the government should use its limited resources to reduce the cost (or the risk) of producing nonconventional energy supplies, but should avoid determining the specific technologies to be developed. An especially attractive way to do this would be for the government to provide price guarantees or purchase agreements for broad categories of nonconventional energy supplies, rather than subsidizing specific demonstration plants or tech-

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