Background Information on Debt

Debt issues, primarily in the form of bonds, play a critical role in energy markets. Capital intensive industries such as electrical generating and transmission facilities have traditionally relied on bonds to finance much of their growth. Since the industry was regulated, default risks for utilities were perceived as very low, facilitating a financial structure with more debt than was possible for many other industries. In addition, the construction of municipal infrastructure such as public power facilities, gas pipeline distribution systems, ports and harbors, waste-to-energy facilities, and highways, have all relied heavily on low-cost tax-exempt bond issues.

Debt also plays an important role in the accrual of funds needed to decommission nuclear plants and federal uranium enrichment facilities, and to build a nuclear waste repository. In all of these cases, funds are collected currently and invested (primarily in debt) to accrue the necessary financial resources to pay for these activities at the appointed time. The real, inflation adjusted yield on these investments has much to do with whether there will be adequate resources 10-50 years into the future.

Federal appropriations, through Congress, are another method by which much of the existing energy infrastructure was built. The Power Marketing Administrations and the Tennessee Valley Authority are the best examples of the use of direct government funding to build hydroelectric and thermal-electric power capacity. Most of these federal appropriations for facilities that now generate revenues through power sales have been converted into debt-type arrangements between the energy producing administration and the federal government.

Understanding debt arrangements is a very important component in assessing government support for energy. Government provision of capital at rates, durations, or terms not available in the private market exposes the government to refinancing risks and provides tangible economic benefits to the borrower. Assessing the terms of government debt arrangements is quite difficult since much of the federal debt to build the existing public energy infrastructure was issued in the 1930s and 1940s, periods which precede comprehensive collection of debt statistics.

Characteristics of Debt Arrangements

Whether public or private, all debt has a number of characteristics in common governing how much is lent, for how long, with what repayment schedule, at what interest rate, for what purpose, and with what collateral. Each of these areas offer opportunities for government absorption of financial and operating risk to a degree greater than that available in the private capital markets at the time. These are presented in more detail below.

Duration and Repayment Schedule. A specified repayment period and repayment schedule is set out. Borrowers who do not repay according to this schedule go into default, and are subject to action by the lender to recover the lent funds in another way. Bond duration arrangements may also include the use of "call" provisions which allow the borrower to repay the bond early. Calls protect the borrower against large shifts of interest rates. Repayment schedules may also vary significantly. Three common types include sinking funds, where part of the principal is repaid every year; balloon payments, where interest only is repaid, with large chunks of the debt coming due at longer intervals; and zero-coupon, where all principal and accrued interest come due at the end of the bond life.

The duration of bonds has not been well tracked historically. In addition, the appropriate measure of duration has also changed over time. Prior to the 1970s, the general measure of bond life was until maturity, or the date all the funds had to be repaid. More recent bond tracking pays more attention to the time until the first call. Even here, data are not as systematic as for the volume of total issues. We

assume somewhat arbitrarily that bonds turn over about every 10 years, and use bond issues between 1980 and 1989 to estimate tax subsidies through tax-exempt debt issues. More detailed data on time until redemption would be useful in improving this estimate.

To the extent that the government lent money for periods longer than that available on the private market (and longer than the period for which the government itself could borrow), the bonds had to be "rolled-over" or refinanced. This refinancing meant that the federal government had to accept new conditions regarding interest and terms, which reflected the capital market at a later point of time, given new expectations on the future and inflation, even though the terms on the money it had lent retained their old conditions. This is known as refinancing risk, and can create a situation, for example, where the Treasury must pay 7% on new bonds because its prior loans, out at 3%, are not yet repayable. The actual historic context of debt duration is discussed later in this chapter.

Furthermore, for the both the Power Marketing Administrations and the Tennessee Valley Authority, repayments of interest on the debt could be suspended for 1 or two years with no penalty (interest would simply accrue on the unpaid balance). This type of arrangement approaches more that of a preferred stockholder than a debt holder, and in the private market would probably require an incremental return.

Interest Rates. The funds are lent at an agreed upon interest rate. These rates will vary based on the expected risk of the bond. Broadly, interest rates are set in the marketplace based on the supply and demand for money. However, at any given point in time, debt will be available at a wide range of interest rates. The rates charged for a particular project will vary by the perceived riskiness of the activity. For example, federal government securities carry what is known as the "risk-free" rate since they are widely perceived as having no risk of default. This is the lowest rate available for a taxable bond issue.

From this risk-free level, various risks will add to the required interest rate. For example, longer-term issues usually carry a higher interest rate than shorter term interest rates.[1] This is because a longer time horizon carries more inflation risks, uncertainty of default, or of alternative investments arising which offer a better yield. Thus, 5-year Treasury bonds usually have a lower interest rate than 30-year Treasury bonds even though both have no risk of default. When the economy enters a recession, long-term issues will carry a lower interest rate than short-term issues since borrowers expect rates to fall still further. This situation, called a "reverse yield curve," usually lasts only a year or two. Historically, longer-term rates have exceeded short-term rates most of the time since 1930. The amount the long-term rates exceed short-term rates varies more between short and long issues (e.g., 1 year versus 10 years) than between long and longer issues (e.g., 20 versus 30 years). In addition, expectations about the future will influence the magnitude of the spread. Generally, interest spreads tend to widen during recessions, and narrow during recoveries. (Citicorp, 4).

Interest rates will also increase as the expected probability of default increases. Thus, bond issues for even the best private corporations will carry a higher interest rate than for the federal government, since corporations don't have the power to tax behind meeting their obligations. In addition, borrowing large sums at once will generally be less expensive per dollar borrowed since fixed costs of obtaining debt will be spread over a larger base.

For any level of perceived risk, the interest rates will also be influenced by whether the interest on the bonds is taxable or not. Even purchasers of risk-free Treasury bonds must pay taxes on the interest

[1] The relationship between the yield and the duration of an issue called the "term structure" of interest rates.

income that the bonds provide. Thus, an investor in the top individual tax bracket of 31% will get to keep only 69 cents out of every dollar of interest income, reducing the investor's effective after-tax yield - the real driver of the attractiveness of an investment. This simple illustration demonstrates that lenders will provide debt at lower interest rates if their interest payments are tax-exempt. In fact, bonds for municipal buyers with a higher default risk than the federal government may well be able to borrow at a lower cost than the U.S. Treasury due to special tax provisions which allow them to issue tax-exempt debt.

To the extent that the government lent funds at below-market rates, or provided loans at the government's cost of borrowing, the loan recipient benefitted.

The Value of Government Intermediation

Due to both its minimal default risk and its ability to borrow huge chunks of money at once, the federal government is able to borrow at lower rates than private parties. Providing government access to debt markets to various administrations (such as TVA or the Export Import Bank) reduces the cost of debt to these parties. Funds are generally channeled through the Treasury or the Federal Financing Bank, and lent at rates which are, at most, slightly above the government's cost of funds.

The difference between the rate the government charges the borrowing administration, and the prevailing rate on the highest grade corporate debt estimates the value of using the government as a borrowing agent. However, we calculate the value of federal intermediation in financial markets differently, depending on whether the funds are used by the borrowing entity directly or whether they are re-lent to other borrowers.

Where the funds are used by the government enterprise directly, such as with TVA, the Power Marketing Administrations, and the Strategic Petroleum Reserves, we use the weighted average cost of new power, light, and gas bonds in our high estimate as a proxy for the cost of borrowing funds as a private entity. The difference between the interest charged the power, light, and gas borrower and that paid on Treasury borrowing is a good measure of the value of federal intermediation for utility borrowers, and includes both economies of scale in borrowing and default risk.

The value of intermediation for funds borrowed and then re-lent (such as is done by the Rural Electrification Administration) is measured in a different way in order to eliminate double-counting of default risk. Specifically, the interest rate on power, light, and gas (from above) includes some default risk. Since our subsidy estimate for REA includes a portion of the actual defaults experienced, it is inappropriate to count the default component of interest rates to REA also.

To eliminate most of this default risk component in the difference between Treasury and private borrowing rates, we use the highest grade corporate debt as a proxy. Our high estimate for REA interest rate subsidies, for example, is calculated using the difference between the rates charged to borrowers, and the Corporate Aaa rate. Corporate Aaa borrowers are perceived to have a very low default risk. Therefore, the difference between corporate Aaa rates and Treasury borrowing rates may be assumed to be primarily due to economies of scale in government borrowing. Since Aaa bonds do have a small default risk, there will be some double counting between actual defaults and interest rate subsidies in our high estimate for REA; however the amount should be extremely small.

For both of these examples, the difference between the Treasury rates and the proxy is not a direct cash cost to the Treasury, but it does have financial value to the recipient and it does reduce the amount the recipient must charge for the power it produces. As such, government intermediation in debt markets

serves as a barrier to entry for substitute forms of energy, and is included in our high estimate. Subsidies through intermediation exist for both short- and long-term debt.

The Availability of Debt at Conditions Matching Government Provisions

We have tried to make reasonable assumptions in assessing the value of refinancing risk borne by the federal government in programs such as the 50-year payback of government debt by Power Marketing Administrations. Information on capital markets in the early part of this century is not easy to come by, and is rarely in the form needed for this study. We tried to find the yields on the longest-duration Treasury and private debt available.

However, yield data for periods prior to 1950 is aggregated in a category called "long-term" which includes bonds with lives more than 8-15 years (the makeup of the mix changed over time). We were unable to obtain yield information disaggregated by duration from the Federal Reserve, Moody's, Standard & Poor's, and several bond-rating agencies and investment banks. We were, however, able to confirm that federal debt issues for 30 years existed as early as 1925.[2] Therefore, we use a 30 year refinancing period in assessing subsidies to hydroelectric facilities that have a 50-year payback period.

But was there private market debt available for 40 or 50 years in the 1930s and 1940s when the bulk of construction of the Power Marketing Administration Dams went on? There were clearly bonds for 100 years, and even perpetual issues (where the borrower had no required repayment time so long as interest payments were met) in the 1800s. However, according to Sidney Homer, a historian of capital markets, during this century

> the undated perpetual bonds of the early nineteenth century and the noncallable 100-year corporate bonds so popular in 1900 all but vanished. Investors became maturity-conscious; the early concept of a permanent annuity lost its appeal...Up to the 1960's, most new corporate bond issues matured in twenty to forty years. However, in the 1970's, following a major decline in bond prices and a rise in yields to new highs, many investors began to insist on shorter maturities of five or ten years. (Homer, 332).

This implies that there were some 40 year issues available. For example, testimony by Daniel Ogden, Manager of the Public Power Council, a trade association of public utilities in the Pacific Northwest, points to three examples of hydroelectric bonds floated for 55 years in the 1950s by the Grant, Douglas, and Chelan County Public Utility Districts. Such debt issues, if commonly available to the Public Marketing Administrations, would eliminate the refinancing risk to the federal government which we imputed in our subsidy estimates.

This issue is worthy of further research. However, it is by no means clear that such long-term issues were commonly available in the 1930s, or in the 1950s. Furthermore, issuance of such long-term debt may have been enhanced by the structure of the contracts. For example, the Public Utility Districts in the above example may have been able to guarantee repayment by the full faith and credit of the relevant state governments, significantly reducing default concerns. Similarly, default risks on very long-term issues such as railroad bonds with maturities of 100 years may have been successfully mitigated via the bank cross-ownership of part of the enterprise and membership on the railroad board of directors that many of the railroad financiers had at the time. Such arrangements would have given the lender more

[2]From the Center for Research on Securities Pricing at the University of Chicago Business School.

control over management decisions and provided a return on the investment through equity holdings as well as debt.

In summary, we could find no yield information on extremely long-term issues (such as 40 or 50 years). According to Homer

> Most averages used to contain a variety of maturities and discarded only truly short bonds. In the early part of this century and in the mid-1920's when there was little or no yield difference between, say, fifteen-year and forty-year bonds, this was not a handicap. However, in 1920, when medium-term bonds sold to yield much more than longs, the presence of a few ten- to twenty-year maturities in an average would raise its yield above the going yields of the truly long-term bonds. Conversely, when in the 1930's the yield curve became sharply positive, the presence of shorter maturities depressed the average yield. The same problem persisted through the 1950s. (Homer, 405).

This lack of data introduces two errors into our estimates. First, the imputed refinancing period is not as precise as it should be to accurately measure the subsidies provided to power producers via long-term debt arrangements. This may overstate the subsidies. Second, data between 1930 and 1950 will understate the government's actual cost of borrowing long-term, and will therefore understate the subsidies. We do not know the relative magnitude of these two sources of error.

Estimating Returns on Invested Assets

As mentioned in the introduction to this chapter, critical aspects of energy markets such as decommissioning nuclear plants and building a nuclear waste site use funds collected over many years to finance a very expensive future activity. These funds are invested either explicitly (as with nuclear decommissioning trust funds) or implicitly (as with surplus collections for the Nuclear Waste Fund, on which the Treasury pays interest). The higher the yield on the invested funds, the less the annual collections will need to be to finance any given level of expected future need.

Some of our subsidy estimates required us to estimate the yield on surplus funds and current collections in order to assess the likelihood that current fees or accruals are sufficient to finance the projects for which the funds were created. This assessment is critical, because shortfalls are very likely to fall on the taxpayer, rather than on the industry (or consumers) benefitting from the energy service.[3] For example, current users of nuclear power may be receiving large subsidies because they are not adequately paying for nuclear waste disposal and reactor decommissioning, liabilities which will have to be paid whether or not the utilities have adequately accrued for the final costs.

Choosing the appropriate yield required judgment, and we used some guides to aid in this process. First of all, we used historical real rates of return, rather than nominal rates of return, whenever estimates of future need were in current dollars. Using a real return enabled us to estimate the annual subsidy, net of inflation.

Second, we used historic real yields for financial instruments that matched those currently held as closely as possible, both in terms of type and duration. For example, a number of financial analysts stated that nuclear decommissioning trusts should hold shorter term, low risk securities. We used this

[3] In the case of many nuclear-related expenditures, for example, by the time the deficits are discovered, many of the reactors will no longer be operating and will therefore be unable to charge customers for the shortfall.

information in the choice of the appropriate real yields to use in imputing the future value of current collections for decommissioning.

Finally, we generally used the historic average real yield since 1926. This is a fair proxy for imputing yields on extremely long-term projects, such as the nuclear waste repository, which will operate for the next 100 years. Is it appropriate for the other enterprises? We think it is, since although the time frame shown includes the Great Depression, real yields since the end of World War II were even lower. Therefore, using the 1926-present time period is a conservative assumption.

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Federal Energy Subsidies:

Energy, Environmental, and Fiscal Impacts

Technical Appendix
(Appendix B)

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The Alliance to Save Energy
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