THE DISCOUNT RATE IN THE FIFTH POWER PLAN
DRAFT FOR DISCUSSION

When Albert Einstein died, he met three people in the queue outside the Pearly Gates. To pass the time, he asked them their IQs. The first replied "190." "Wonderful," exclaimed Einstein. "We can discuss the contribution made by Ernest Rutherford to atomic physics and my theory of general relativity". The second answered "150." "Good," said Einstein. "I look forward to discussing the issues of nuclear non-proliferation in the quest for world peace". The third one mumbled "50." Einstein paused, and then asked, "So, what's your forecast for interest rates next year?"[1]

INTRODUCTION AND SUMMARY

This paper recommends that the Council use a real discount rate of 4 percent for its analysis for the upcoming power plan. This is based on near term forecasts of the cost of capital to the entities or sectors examined. The sections below briefly review the need for a discount rate, the various approaches that have been taken in the literature and relied upon by the Council in the past, and the development of the specific values that are suggested to be used. The paper also notes that, unlike other data in the power plan, which can be used directly by the various regional entities responsible for meeting loads, the discount rate used in the Council's analysis is a composite rate that will not be directly applicable to most of these entities. The approach to calculation of a discount rate can be applicable, however.

BACKGROUND

Investment analysis, such as that for the Council's plan, typically has to compare projects with different time patterns of costs. A conservation project or a wind turbine installation, for example, is characterized by high fixed investment costs and low operating expenses. In the presence of any inflation, the impact of this fixed cost, even if it is financed over a number of years, typically declines in real terms. Contrast this with, for example, a combustion turbine investment, where the bulk of the cost is in the fuel rather than the fixed cost. With any escalation in real terms – above the general level of inflation – the biggest part of the lifetime cost will come in future years.

The discount rate is a fundamental piece of the Council's resource analysis for the power plan. The discount rate is the piece that tells us the rate of time preference we are applying to the analysis, that is, how much relative importance we give to costs and benefits in different years in the future. The discount rate is used to convert future costs or benefits to their present value. A higher discount rate reduces the importance of future effects. All else equal, it would tend to value a combustion turbine over a wind project, for example, by disproportionately reducing the higher fuel costs in future years. On the other hand, a low discount rate, would not reduce the effects of those future costs so much. A discount rate of 0 percent for example, would treat

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[1] Adapted from JokeEc, the economist joke web site.

effects in all years, whether next year or 30 years from now, the same in terms of their impact on the investment decision.

This notion of time preference is not, however, an abstract preference for the short term versus the long term. Time preference is directly tied to the concept of a market interest rate. Putting aside questions of risk temporarily, a dollar to be paid next year is less of a burden than a dollar this year. That is because one could invest less than a dollar today and, assuming sufficient return on that investment, use the proceeds to pay the dollar cost next year.

From the other side, a dollar benefit this year is more valuable than the same dollar benefit next year, because it can be turned into more than a dollar next year by investing it. The important point here is that dollars at different times in the future are not directly comparable values; they are apples and oranges. Applying discount rates turns costs and benefits in different years into comparable values. Because the Council's analysis looks at annual cost streams of various resource types, discounting is required in order to calculate and fairly compare total costs of alternative policies.

Market interest rates embody the effect of everybody's rates of time preference. Individuals and businesses that value current consumption more than future consumption will tend to borrow, and those that value future consumption more will save. The net effect of this supply and demand for money is a major factor in setting the level of interest rates, as are the actions of the Federal Reserve in setting the discount rate and influencing inflation expectations through its actions on the aggregate money supply. Market interest rates also embody considerations of uncertainty of repayment, inflation uncertainty, tax status, and liquidity, which together account for most of the variations among observed interest rates.

Because of this overall relationship between rates of time preference and interest rates, the level of the discount rate should be related to the level of interest rates. The difficulty is in determining which interest rate is the appropriate one for the choices being made. There are three general approaches that can be used for this choice, the regional consumer's perspective, the corporate perspective and the national perspective.

In addition, risk and uncertainty in capital project evaluation is sometimes treated by modifying the discount rate and sometimes by directly modifying the treatment of costs and benefits in the analysis. There are theoretical arguments in the economic literature on all sides of these issues.

Regional Consumer's Perspective: The regional consumer's perspective looks at the after-income tax returns available to regional consumers to determine their rate of time preference. The Council has taken this perspective in the past and has examined a number of different kinds of interest rates that individuals earn or have to pay, ranging from savings accounts with negative real after-tax returns, through mortgages and stock and bond market returns, to the cost of credit card interest, which is quite high in real, after-tax terms. Generally, the Council had concluded that mortgages and stock and bond investments best represented the household consumer's rate of time preference. The analysis done by the Council in previous plans also considered the effects of utility bills on business consumers of electricity as well as on household consumers. The number used by the Council incorporated that effect for use in the plan.

Corporate Perspective: The corporate perspective looks at a company's weighted cost of capital, adjusted for the deductibility of bond interest to the company, as the starting point for choosing a discount rate to evaluate investment decisions. With this approach, we would use a cost of capital roughly weighted by the types of financial entities represented by the utilities in the region (municipally financed, treasury financed, taxable-market financed and equity financed).

The literature on corporate investment decisions almost uniformly holds that the correct discount rate is the firm's tax-adjusted cost of capital. Broadly considered, this perspective uses the cost of capital to the entity making the investment decision. While most of the literature focuses on private corporate entities, this perspective is also applicable to entities with other forms of ownership, as long as they are externally financed. Using the corporate cost of capital as the discount rate will ensure that the decisions that are made maximize the value to the owners of the firm.

There is a second argument in favor of this perspective that would apply even for those entities without stockholders or for those which have a focus on something other than owner wealth maximization. This argument holds that the majority of the investment decisions in the U.S. are made by private corporations that use this investment rule. To use another rule for a limited sector of the economy would distort investment patterns in the overall economy, either over-investing or under-investing, depending on whether the discount rate is lower or higher than appropriate.

This is the perspective that has been adopted (implicitly or explicitly) by the region's IOUs and the utility commissions who regulate them. With this perspective, Bonneville would use its cost of capital – treasury borrowing plus a small markup – and the region's publicly owned utilities would use theirs – tax-exempt municipal bond borrowing. The Council uses the corporate perspective in preparing forecasts of future generating resource development and power prices, under the assumption that "real world" resource development decisions will be based on corporate discount rates.

National or Social Perspective: There is a third perspective, which might be called the "national consumer's" or the "social" perspective. This is similar to the regional consumer's perspective except that it looks at pre-tax returns/costs rather than after-tax returns/costs. From an overall social perspective, income taxes are a deliberately incurred device that, among other things, raises the cost of capital to individuals and most corporate entities. This is sometimes combined with the corporate perspective in arguments that national government investments should adopt some form of the private sector's cost of capital as the discount rate, using, however, the pre-tax rather than the tax-adjusted cost (as the firm itself would use).

Risk and Uncertainty Issues: As was mentioned earlier, variations in risk and uncertainty account for a major part of the differences among returns to various potential investments. It is important to try to capture these elements of potential investments in the analysis in some manner, and at the same time, not double count them by embodying them in both the discount rate and the rest of the analysis. The Council's resource analysis explicitly accounts for major risks, such as water conditions, load growth uncertainty and fuel prices. In the past this has lead

us to equate the residual risk embodied in the discount rate to that embodied in the returns/costs of stocks, long-term bonds and mortgages. This is, however, an area where it is difficult to draw clear lines.

RECOMMENDED APPROACH

In earlier plans the Council used the regional consumer's perspective. In the last plan, the staff suggested that the corporate perspective be relied upon as well, noting that it tended to raise the proposed discount rate somewhat, but not dramatically; the values calculated using the two approaches were reasonably similar. In the last plan, the Council did not formally adopt a perspective, but did adopt a number that was closer that that given by the corporate perspective.

This paper is recommending that the Council use the standard corporate perspective in adopting a discount rate for use in the Fifth Power Plan. This approach is most frequently recommended in the economic literature and is widely used in the electric industry, as well as in other industries. It leads to a discount rate that aligns the decision about investing capital with the cost of that capital to the entity making the investment decision.

It should be noted that, unlike much of the analysis and data provided by the Council in its plans, which are directly useable by the entities acquiring resources, costs of capital and discount rates derived from them are specific to the entity. A composite rate, such as is used by the Council, will not necessarily be appropriate for use by any particular utility, though the Council's approach to choosing a value should be useful.

CONSIDERATIONS IN CHOOSING A SPECIFIC VALUE[2]

This paper assumes that the plan will be completed in late 2003, and that the period over which it will be most relevant will be the succeeding several years, starting in 2004. The reference value for the discussion below will be a forecast of the nominal rate for a 10 year Treasury note taken from the Philadelphia Federal Reserve Bank's Survey of Professional Forecasters, updated quarterly. The first quarter 2003 mean long-term (2003-2012) forecast for the 10 year Treasury note was 5.4 percent; this value is only forecasted in the first quarter's survey. The second quarter's survey in 2003 reduced the forecasted 2003 return on the 10 year Treasury note from 4.3 percent to 4.1 percent and the 2004 forecast from 5.1 percent to 4.7 percent. Given the adjustments to the near term end of the forecast, this paper will use 5.2 percent as the reference forecast for the 10 year Treasury note.

Much of the Council's analysis is done in real inflation-adjusted terms. This means that the discount rate should be a real rate as well, which in turn means that some value of future inflation should be used to adjust the nominal interest rates that are what we see, with one exception, today and what are typically forecasted. (The exception is US Treasury Inflation Protected Securities, TIPS, in which the principal that is to be repaid is adjusted annually by the CPI, so that the interest rate itself is an inflation-free rate.)

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[2] Specific values and sources referred to in this section are identified more specifically in the Appendix, unless otherwise noted.

The Philadelphia Fed's survey of forecasters produced a mean forecast of inflation, measured by the CPI, of 2.5 percent in both the first and second quarter's surveys, which is consistent with the value assumed in at least three of the region's IOU integrated resource plans produced recently (and where the value was explicitly noted in the reports). This rate of inflation is also that assumed for the Council's work since the Fourth Power Plan. The evidence from the bond market, however, is for a lower expectation of inflation. The implied market forecasts for inflation, calculated as the difference between the current yields on regular and inflation protected 10 year Treasury notes and 30 year Treasury bonds are 1.6 percent and 2.1 percent respectively.

It is not clear what the discrepancy is due to. One potential explanation is that the spread between the two sets of Treasury instruments has more to do with the central role of the 10 year Treasury note in US financial transactions, and the current high demand for the note, which has driven its yield to approximately 45 year lows, than to any consistent buying and selling of the two instruments to arbitrage against interest rate forecasts. That is, the Treasury markets and the forecasts might be considered two separate markets for information, with the Treasury market having a number of other functions besides the provision of inflation forecasts. This paper will use the value from the forecasters rather than that from the Treasury market.

Using 2.5 percent for the inflation forecast along with 5.2 percent for the 10 year Treasury note gives an implied real return on the 10 year Treasury note of 2.6 percent, roughly consistent with the long term (1926-02) real returns on 5 year bills (2.6 percent) and 20 year bonds (2.9 percent)[3].

The discount rates that are used for the three major categories of retail load-serving entities (municipals/PUDs, coops and IOUs) are distinguished by their financing costs. High grade municipal bond rates, over the period 1993-2003 have had interest rates that averaged 33 basis points (0.33 percent) below 10 year Treasury notes. Using this approximate relationship, municipal financing would be forecast to be available at 4.9 percent, or 2.3 percent in real terms, assuming 2.5 percent inflation. Coops are able to finance at about 100 basis points above Treasury rates, implying a rate of 6.2 percent or 3.6 percent in real terms.

Bonneville financing is about 30-40 basis points about Treasury rates, implying a rate of 5.5-5.6 percent or 2.9-3.0 percent in real terms. Note that use of such a rate for Bonneville implies relatively unlimited access to capital, which is not the case for Bonneville, which has a statutory cap on its borrowing authority and is dependent on Congress to change it. One approach to capital budgeting in the presence of limited capital is to simply rank projects by net present values; another is to deliberately raise the discount rate to ensure that only the projects that have the most immediate payoffs are pursued. Bonneville has apparently used the latter approach in some of its recent analysis. The November 2002 study of non-wires alternatives to the Kangley-Echo Lake transmission project done for Bonneville by a consortium of consultants used 9 percent as a nominal utility discount rate (6.1 percent in real terms, given the 2.7 percent

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[3] These historic averages are strongly influenced by the last five years' high bond returns; the 1926-1997 averages were 2.3 and 2.6 percent respectively. Data from Ibbotson Associates, <u>Stocks, Bonds, Bills and Inflation</u>, Annual Yearbooks, 1998 and 2003.

inflation assumption), where the financial assumptions were supplied by Bonneville to the consultants[4].

The discount rates used by regional IOUs in recent integrated resource plans ranged between about 7.5-8.4 percent in nominal terms, or 4.9-5.7 in real terms, using 2.5 percent as the inflation rate. They represent the tax adjusted weighted average cost of capital (WACC) for the utilities and typically employ the allowed rate of return from the most recent rate case. They are substantially higher than the other entities' rates both because of the large equity component in their capital structures and because their credit ratings on debt are relatively weaker. A composite value can be calculated using the current cost of equity, roughly averaged from the data, and a forecast cost of debt based on the 10 year Treasury note forecast and the historic spread between the Treasury note and corporate Baa-rated bonds, adjusted for the latter's tax deductibility. This calculation would give 5.3 percent in real terms, comparable to a rough average of the values currently being used in the integrated resource plans of several of the IOUs.

Home mortgage rates are another financial component that is used in the Council's analysis. Historic data for the past 10 years show an average spread over 10 year Treasury notes of about 140 basis points, giving a rate to use for the Council's analysis of 6.6 percent or 4.0 percent in real terms.

CONCLUSIONS

This paper recommends a real discount rate of 4 percent be used in the Council's analysis. The pieces are shown in the table below. The values for capital costs for the various entities making resource acquisition decisions in the region are suggested in the Appendix. The question of the cost of capital for IPPs, used in parts of the Council's analysis, but not in the calculation of the discount rate, will be discussed with the Council's Generating Resources Advisory Committee.

Real Discount Rate Proposed for Fifth Plan – 4 %

Entity or Item	Real Capital Cost %	Regional Load Share %	Load weighted cost %
Municipal	2.3	35	
Co-op	3.6	10	4.1
IOU/IPP	5.3	55	
Bonneville	2.9	-----	2.9

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[4] Kangley-Echo Lake Economic Screening and Sensitivity Analysis Report, Energy and Environmental Economics, Inc./Awad & Singer/Nexant, Inc/Tom Foley Consulting, November 2002.

APPENDIX - Background Data, Sources, and Calculations

Entity or Item	Debt Cost %	Equity Cost %	Equity Ratio %	Nominal Discount Rate %	Real Value or Discount Rate %[10]
IOU					
- Idaho				7.6[1]	5.0
- Puget		11.0[2]	40[3]		
- PacifiCorp		11.0/10.8/11.0[4]	46-52[5]	7.52[6]	4.9
- PGE		10.5[7]		8.34[8]	5.7
- Avista				8.22[9]	5.6
Forecasts					
10 Yr Treasury	5.2[11]				2.6
Mortgages	6.6[13]				4.0
Bonneville	5.5[14]				2.9
Municipal	4.915				2.3
Co-op	6.2[16]				3.6
IOU	7.3[17]	11.0	50	7.9[18]	5.3
Inflation (CPI) - Forecasters - T bill market - T bond market	2.5% [11] (10 year) 1.6% [12] (10 year) 2.1% [12] (Long term)				
Notes					
1	After-tax WACC (IRP 02), Credit rating A-/A3 (31Dec02 10K)				
2	8.76% WACC with target 40% equity, (20Jun02 rate case 31Dec02 10K), credit rating BBB-/Baa3				
3	Milestone equity ratios 34/36/39 at end of 03/04/05 (31Dec02 10K)				
4	8.9/8.6/8.9% WACC (UT/OR/WY recent rate cases 31Mar03 10K)				
5	Target equity ratio range (31Mar03 10K)				
6	After-tax WACC, 8.87% pre-tax WACC, 2.5% inflation (IRP Mar02)				
7	1Oct01 Rate case, Credit ratings BBB+/Baa2 (31Dec02 10K)				
8	Long run incremental after-tax WACC based on 10% pre-tax WACC (IRP Aug02), 2.5% inflation				
9	After-tax WACC (IRP 03), 2.5% inflation				
10	Assumes inflation at 2.5%				
11	Derived from 10 year forecast, Survey of Professional Forecasters (Federal Reserve Bank of Philadelphia), 1st and 2nd Quarter 2003 Releases				
12	Inflation implied by difference in yield between July 2012 (April 2028) inflation-indexed Treasury note and August 2012 (August 2028) conventional Treasury note, 30May03.				
13	10 year Treasury forecast + average spread 1993-2002 (1.42%) 2003 Economic Report of the President, Council of Economic Advisors				
14	10 year Treasury forecast + 30-40 basis point spread				
15	10 year Treasury forecast + average spread high grade municipals 1993-2002 (- 0.33%) 2003 Economic Report of the President, Council of Economic Advisors				
16	10 year Treasury forecast + 100 basis point spread				
17	10 year Treasury forecast + average spread 1993-2002 for corporate Baa bonds (2.1%), 2003 Economic Report of the President, Council of Economic Advisors				
18	After-tax WACC, calculated assuming 35% corporate tax rate.				