Appendix N: Financial Assumptions and Discount Rate

INTRODUCTION AND SUMMARY

The Council uses a real discount rate of five percent for its analysis for the upcoming power plan. This is based on mid-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 appendix 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 making resource decisions. The approach to calculation of a discount rate is applicable, however.

The underlying financial assumptions were updated in October 2009, based on the most-recent Global Insight long-term forecast.

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. With initial capital costs repaid over time, the time pattern of costs for this type of investment will typically look generally flat over its lifetime. 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 more than a lower discount rate. All else equal, a higher discount rate 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 effects in all years, whether next year or 30 years from now, the same in terms of their impact on the investment decision taken now.

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 a discount rate 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 federal funds 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 in the literature that can be used for this choice, which can be described as the regional consumer's perspective, the corporate perspective and the national perspective.

Finally, 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. The Council's analysis evaluates project risk and uncertainty explicitly and does not incorporate it into the discount rate decision.

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. This perspective bypasses considerations of who, or what kind of entity, is making the investment decision and addresses the question for whom the investment is ultimately being made, regional utility customers in this case. The Council had taken this perspective in earlier plans and had 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.

Corporate Perspective

The corporate perspective addresses the perspective of who, or what kind of entity, is making the investment decision. It typically looks at a company's weighted cost of capital, adjusted for the deductibility of bond interest from corporate income taxes 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. This argument would also apply to publicly owned entities without stockholders.

There is a second argument in favor of this perspective that would also apply 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 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 on-the-ground 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[1]. This is sometimes combined with the corporate

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[1] This effect is partially mitigated by the reduction in income taxes afforded by the deductibility of interest payments mentioned above.

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 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 uncertainties and risks, such as water conditions, load growth uncertainty, fuel prices, power market prices, CO_2 mitigation requirements, and so forth.

APPROACH CHOSEN

In the Fifth Power Plan, the Council adopted the corporate perspective in setting the discount rate. The Council continued to use the corporate perspective in adopting a discount rate for use in the Sixth 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 interest rates and cost of that capital to the entity making the investment decision.

For the Sixth Plan, this approach has been modified to include the effect of other investment decision makers, end-use consumers, as appropriate for the decision in question, rather than implicitly assuming that all decisions on resources are made by utilities. This will be described further below.

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 each entity. A composite rate, such as the Council uses, will not likely be appropriate for use by any particular utility, though the Council's approach to choosing a value should be useful and is recommended.

CONSIDERATIONS IN CHOOSING A SPECIFIC VALUE FOR THE COUNCIL'S PLAN

The plan will be completed in late 2009, and the period over which it will be most relevant for decision making will be the succeeding five years, starting in 2010. Consequently, the analysis looks primarily at forecast data for 2010 - 2014.

The approach in this appendix builds on two sets of assumptions. The first is the relative shares of future investment decisions made by different actors (BPA, publicly owned utilities, IOUs and residential and business customers). The second is a set of forecast data developed by Global Insight, a national economic consulting firm, whose forecasts are used for various purposes by the Council.

The first set of assumptions looks at decision makers. Because the chosen approach looks at investment decision makers, and because a significant fraction of the conservation resource is expected to be paid for directly by consumers, we have made assumptions about the shares of the ultimate portfolio that will be made up of generation and conservation and the shares of the conservation decisions that will be made by consumers.   Generation decisions will be made by utilities; conservation investment decisions will be made both by utilities, through purchase or rebate programs, and by consumers directly. An assumption has also been made about the share of the public agencies' new resource requirements that will be placed on Bonneville under the new contracts. That share will be evaluated at a Bonneville discount rate.

Plausible changes from the reference assumptions would affect the ultimate discount rate somewhat. Because of that both the reference assumptions and a range of assumption values have been examined. The ranges were not intended to try to capture exactly equal weightings on both sides of the reference value, but were simply chosen to show plausible values on both sides. Both the reference value and the ranges are shown in Table N-1 below. Moreover, the final calculated value, described later, has been rounded rather than an attempt being made to capture unrealistic precision.

Table N-1: Share Assumptions

Entity or Item	Reference Share	Range
BPA share of publics' generation needs	.20	.10-.30
Generation share of new resource	.60	.50-.70
Conservation share of new resource	.40	.50-.30
Utility share of conservation cost	.60	.50-.70
Consumer share of conservation cost	.40	.50-.30
Residential share of consumer conservation	.33	.30-.40
Business share of consumer conservation	.67	.70-60

The second set of assumptions consists of cost of capital estimates for the various decision-making entities described above. As noted, they are based on the most recent forecasts of financial variables as of January 2009 by Global Insight (these assumptions will be updated before the analysis for the final Power Plan). There are five basic inputs to the calculation from this forecast, all averaged over the years 2010-14, except the GDP deflator, which is averaged over 2010-2018[2]: GDP deflator, used to convert to real terms, and nominal 30 year Treasury bond rates, 30 year new conventional mortgage rates, long-term AAA rated municipal bond rates and long-term Baa corporate bond rates. These values are shown in Table N-2 below:

Table N-2: Basic Financial Assumptions

Item	2010-14 Average
GDP deflator	1.65%
30 year Treasury	5.03%
30 year new conventional mortgage	6.08%
Long-term AAA municipal bond	5.09%
Long-term Baa corporate bond	7.13%

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[2] The GDP deflator is used to convert nominal interest rates to real rates, and that conversion is properly done for any year's long-term interest rate using a comparison with long-term expectations of inflation, not any individual year's expectations.

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 and estimates can be derived from the above values.

Municipal utilities and public utility districts are assumed to be able to borrow at AAA municipal bond rates, or 3.4 percent in real terms. Coops are able to finance at about 100 basis points above Treasury rates, implying a rate of 6.03 percent or 4.3 percent in real terms. Bonneville financing is about 90 basis points above Treasury rates for long-term borrowing, implying a rate of 4.2 percent in real terms.

The discount rates used by regional IOUs in recent integrated resource plans ranged between about 7.0 - 8.3 percent in nominal terms, or 5.1 - 5.6 in real terms, using the inflation rates assumed in the various IRPs[3]. 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 for the IOUs using the assumptions in this paper can be calculated using the current cost of equity, roughly averaged from the data, and a cost of debt based on the forecast cost of Baa debt, adjusted for its tax deductibility. This is necessary because the effective cost of the debt is lower because it is deductible for corporate income tax purposes, just as home mortgage debt is deductible for personal income tax purposes. This calculation would give 5.5 percent in real terms, similar to the range of values (5.1 - 5.6 percent) being used in the integrated resource plans of several of the IOUs using their own calculations and forecasts of inflation.

The approach for assessing decision making by consumers for the consumer-funded portion of the conservation is similar, though it looks mostly at different data.   DOE has recently conducted a study on consumer discount rates[4] for the purpose of evaluating some proposed national lighting standards. On the residential side, they looked at a range of assets and borrowing sources available to individual consumers[5], weighted by their historic use based on the Federal Reserve Board's Survey of Consumer Finances over a recent 15-year period. Based on this historic data analysis, DOE calculated a real consumer discount rate of 5.6 percent. (More details of this calculation are in Section 8.2.7.1 of the DOE report cited in Footnote 4.)

We can also look at the Global Insight forecast data, which has been used for the previous calculations in this paper, though this forecasts a much more limited range of assets than the DOE data looked at. It has one series that can be taken as one kind of proxy for a consumer

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[3] To the extent they are explicit, the IOU IRPs use various inflation rates that are more or less different from the assumption in this paper. Where the calculation is explicit, the recent IOU discount rates are reported as ranging from 5.1 - 5.6 percent in real terms.

[4]
http://www.eere.energy.gov/buildings/appliance_standards/residential/gs_fluorescent_incandescent_tsd.html

[5] Similarly to the approach used by Council in earlier plans, when it took a region consumer's perspective.

discount rate, the 30-year mortgage rate. That forecast rate, averaged over the period 2010-14 is 6.08 percent. Because mortgages are deductible for income-tax purposes, the net cost to consumers is lower. Assuming a 20 percent tax rate gives an after-tax mortgage cost of 4.86 percent or 3.2 percent in real terms. Because that is significantly less than the average calculated by DOE, primarily because of the tax deductibility effect for this particular asset, the final calculation will again use a range for this variable, along with the ranges for the others.

The last item that needs to be calculated is the discount rate for business consumers. DOE also estimated values for this, based on a different approach than they had used for residential consumers. They used the Capital Asset Pricing Model, a widely used approach in financial economics, to calculate the cost of equity for a large sample of commercial and industrial companies. Using the same data base from which the companies were drawn, they extracted estimates of cost of debt, debt/equity ratios and factors relevant to the calculation. Using an estimate of long-term Treasury rates of 5.5 percent (higher than the Global Insight forecast used here, 5.03 percent) and an inflation forecast of 2.3 percent (higher than that used here, 1.65 percent) they derive real industrial and commercial discount rates of 7.5 and 7.3 percent, respectively. (More details are available in Section 8.2.7.2 of the DOE paper cited in Footnote 4.)

In order to make the result somewhat more comparable to the calculations in this paper, the values can be recalculated using the Global Insight forecast of inflation, which has the effect of implying higher real interest rates.   That calculation would yield industrial and commercial real discount rates of 7.7 and 7.5 percent respectively.

Note that use of such a rate for business decisions implies relatively unlimited access to capital, which is typically not the case. 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. These potential actions can be captured using a higher discount rate for business decisions, in a sensitivity analysis.

In addition to the range of values used for the decision-share assumptions, described earlier in the paper, the recommendation for a discount rate to use in the Council's analysis will be based on a range of real discount rates for business and residential consumer decisions. The final set of assumed values with their ranges is shown below in Table N-3, which partly recapitulates Table N-1. The output of the spreadsheets for the reference and high and low assumption calculations are reproduced in the Attachment. Note that in the calculation of the effect of the individual ranges, the low end is driven by assumptions that drive the result low, which may not necessarily be the low end of any particular range (sometimes the high assumption drives a lower discount rate), and similarly for the high range calculation.

Table N-3: Discount Rate Summary

Item	Value	Range
Inflation	1.65%	NA
Municipal/PUD real discount rate	3.4%	NA
Co-op real discount rate	4.3%	NA
IOU real cost of equity	8.4%	NA
IOU real cost of debt	5.4%	NA
IOU real discount rate (tax-adjusted)	5.5%	NA
BPA real discount rate	4.2%	NA
Residential consumer real discount rate	3.2%	3%-5%
Business consumer real discount rate	7.6%	7%-9%
Real discount rate for plan	4.9%	4.7%-5.5%

CONCLUSIONS

Taking account of the range of assumptions used, the Council has chosen a real discount rate of 5 percent be used in the Sixth Plan analysis. The Council expects that individual entities may well have different values at the point at which they actually make investment decisions.

NORTHWEST
6th
POWER PLAN

Appendix N1: Attachment

Figure N1-1: Reference Assumptions

Weighted Discount Rate Based on Global Insight 3Q09 Forecasts

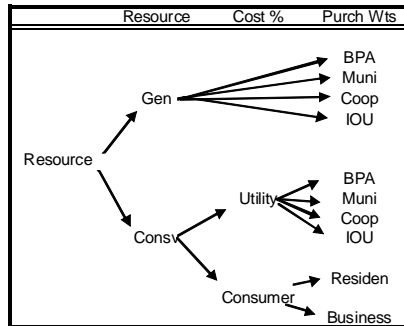| Purchaser	Wtd Disc Rate	Real Disc Rate	Purchaser Weight	Consv Respon Share	Utility Res Respon Share	Regional Load Share
Muni	0.008	0.034	0.235	0.168	0.280	0.350
Co-op	0.003	0.043	0.067	0.048	0.080	0.100
IOU	0.025	0.055	0.462	0.330	0.550	0.550
BPA	0.003	0.042	0.076	0.054	0.090	
Residen Cust	0.002	0.032	0.053	0.132		
Business Cust	0.008	0.076	0.107	0.268		
Wtd avg	0.049		1.000	1.000	1.000	1.000

GI 3Q09 Fcsts 2010-28 avg

GDP Deflator	0.0165

GI 3Q09 Fcsts 2010-14 avgs

30 Yr Treasury	0.0503
30 Yr New Morgages	0.0608
AAA Munis	0.0509
Baa Corporate	0.0713

Other factors

BPA adder on 30 Yr Treasury	0.0090
Co-op adder on 30 Yr Treasury	0.0100
Tax-Adj Baa corp	0.0428

IOU WACC calc

Equity cost	0.102
Tax adj debt cost	0.0428
Debt ratio	0.5
WACC	0.07239
Real WACC	0.055

Assumptions

Corporate tax rate	0.40
Indivdividual tax rate	0.20
BPA share of publics' gen res respon	0.20
Gen share of future res	0.60
Consv share of future res (CALC)	0.40
Consumer share of consv cost	0.40
Residen sector share of consv	0.33
Business sector share of consv (CALC)	0.67
Residential real discount rate	0.032
Business real discount rate	0.076

Figure N1-2: Assumptions that Drive Discount Rate Up

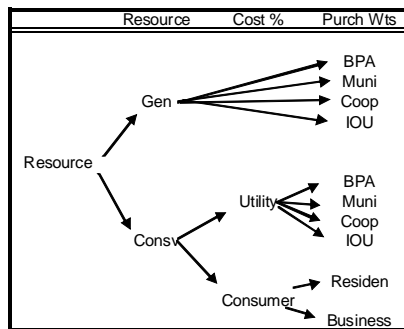**Weighted Discount Rate Based on Global Insight 3Q09 Forecasts**

Purchaser	Wtd Disc Rate	Real Disc Rate	Purchaser Weight	Consv Respon Share	Utility Res Respon Share	Regional Load Share
Muni	0.006	0.034	0.184	0.123	0.245	0.350
Co-op	0.002	0.043	0.053	0.035	0.070	0.100
IOU	0.023	0.055	0.413	0.275	0.550	0.550
BPA	0.004	0.042	0.101	0.068	0.135	
Residen Cust	0.004	0.050	0.075	0.150		
Business Cust	0.016	0.090	0.175	0.350		
Wtd avg	0.055		1.000	1.000	1.000	1.000

GI 3Q09 Fcsts 2010-28 avg

GDP Deflator	0.0165

GI 3Q09 Fcsts 2010-14 avgs

30 Yr Treasury	0.0503
30 Yr New Morgages	0.0608
AAA Munis	0.0509
Baa Corporate	0.0713

Other factors

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Co-op adder on 30 Yr Treasury	0.0100
Tax-Adj Baa corp	0.0428

IOU WACC calc

Equity cost	0.102
Tax adj debt cost	0.0428
Debt ratio	0.5
WACC	0.07239
Real WACC	0.055

Assumptions

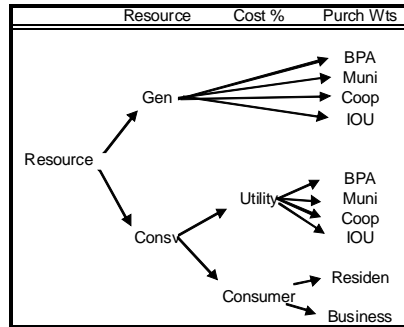|	
Corporate tax rate	0.40
Indivdividual tax rate	0.20
BPA share of publics' gen res respon	0.30
Gen share of future res	0.50
Consv share of future res (CALC)	0.50
Consumer share of consv cost	0.50
Residen sector share of consv	0.30
Business sector share of consv (CALC)	0.70
Residential real discount rate	0.050
Business real discount rate	0.090

Figure N1-3: Assumptions that Drive Discount Rate Down

Weighted Discount Rate Based on Global Insight 3Q09 Forecasts

Purchaser	Wtd Disc Rate	Real Disc Rate	Purchaser Weight	Consv Respon Share	Utility Res Respon Share	Regional Load Share
Muni	0.010	0.034	0.287	0.221	0.315	0.350
Co-op	0.004	0.043	0.082	0.063	0.090	0.100
IOU	0.028	0.055	0.501	0.385	0.550	0.550
BPA	0.002	0.042	0.041	0.032	0.045	
Residen Cust	0.001	0.030	0.036	0.120		
Business Cust	0.004	0.070	0.054	0.180		
Wtd avg	0.047		1.000	1.000	1.000	1.000

GI 3Q09 Fcsts 2010-28 avg

GDP Deflator	0.0165

GI 3Q09 Fcsts 2010-14 avgs

30 Yr Treasury	0.0503
30 Yr New Morgages	0.0608
AAA Munis	0.0509
Baa Corporate	0.0713

Other factors

BPA adder on 30 Yr Treasury	0.0090
Co-op adder on 30 Yr Treasury	0.0100
Tax-Adj Baa corp	0.0428

IOU WACC calc

Equity cost	0.102
Tax adj debt cost	0.0428
Debt ratio	0.5
WACC	0.07239
Real WACC	0.055

Assumptions

Corporate tax rate	0.40
Indivdividual tax rate	0.20
BPA share of publics' gen res respon	0.10
Gen share of future res	0.70
Consv share of future res (CALC)	0.30
Consumer share of consv cost	0.30
Residen sector share of consv	0.40
Business sector share of consv (CALC)	0.60
Residential real discount rate	0.030
Business real discount rate	0.070