NOTES FOR TECHNICAL CONFERENCE
Revenue Requirement and Cost-of-Service Models
Docket No. 11-035-200, June 4, 2012

A. Introduction

This note discusses certain relations used in regulatory reporting and ratemaking. On June 27, 2011, in Docket No. 02-035-04, *In the Matter of: the Application of PacifiCorp for an Investigation of Inter-Jurisdictional Issues*, PacifiCorp filed an ***A****greement Pertaining to PacifiCorp's September 15, 2010 Application for Approval of Amendments to Revised Protocol Allocation Methodology*. Attached to this filing was *Exhibit A to the Agreement, Allocation Factors Used in the Revised Protocol and 2010 Protocol*. On the last page of this exhibit, page 16, is a note stating:

> "Rather than allocated to jurisdictions using the Income Before Tax factors, state income taxes are calculated by applying the blended statutory state and local rate to taxable income by jurisdiction."

This change in the inter-jurisdictional treatment of state income taxes simplifies considerably the modeling of PacifiCorp's results of operations. This note presents the relations between cash working capital, imputed interest expense and state and federal income taxes used by the Company in its models. It also presents both the cost and income approaches to calculating the change in revenues required to achieve an allowed rate of return.

B. The Jurisdictional Allocation Model

1. Specification of Regulatory Relations

Cash working capital (*CWC*) is the product of the net lag days (*nld*) and the average daily balances of operations and maintenance expense (*O&M*), taxes other than income (*TOTI*), state income taxes (*SIT*) and federal income taxes (*FIT*).

$$CWC = nld \cdot (O\&M + TOTI + SIT + FIT) / 365$$ row 993

Cash working capital is a component of rate base, and can be identified separately from all other items in rate base (RB^o).

$$RB = RB^O + CWC$$ row 1117

Interest expense is imputed in the calculation of income taxes. For imputation, the proportion of rate base financed by long-term debt is assumed to be the same as the proportion of long-term debt in the utility's capital structure and is obtained by applying the weight of debt in the capital structure,(ω_D) to the rate base (*RB*). Multiplying this total by the cost of long-term debt (ρ_D) yields imputed interest expense (*INT*).

$$INT = \rho_D \cdot \omega_D \cdot RB$$ row 1890

The expenses included in taxable income, (*E*), are operations and maintenance expense (*O&M*), depreciation (*DEPR*), amortization (*AMORT*), taxes other than income (*TOTI*), and miscellaneous expenses (*MISC*).

$$E = O\&M + DEPR + AMORT + TOTI + MISC$$ rows 1745+1817+1867+1878+1227

State taxable income, or income-before-tax, consists of revenues (*R*), less expenses (*E*), interest and dividends (*I&D*), Schedule M adjustments to taxable income (*SCHM*), and imputed interest expense (*INT*).

$$IBT = R - E - I\&D - SCHM - INT$$ row 2011

State income tax expense (*SIT*) is obtained by applying the blended state income tax rate (t^S) to income-before-tax, to which state renewable energy credits (REC^S) are added.

$$SIT = t^S \cdot IBT + REC^S$$ row 2018

Federal income tax expense (*FIT*) is obtained by applying the federal income tax rate (t^F) to income-before-tax less state income taxes, to which is the federal renewable energy credits (REC^F) are added.

$$FIT = t^F \cdot (IBT - SIT) + REC^F \qquad \text{row 2028}$$

Ratemaking income is defined to be revenues (*R*) less expenses (*E*), income taxes (*IT*), deferred income taxes (*DIT*) and investment tax credits (*ITC*), and is expressed by:

(1.8) $$I = R - E - IT - DIT - ITC \qquad \text{row 2067}$$

The rate of return on rate base (α) is the ratio of ratemaking income (*I*) to rate base (*RB*).

$$\alpha = I / RB \qquad \text{row 2095}$$

Finally, cost-of-service is defined to be the total of costs, i.e., all expenses, taxes and income (the rate of return applied to rate base).

$$COS = E + IT + DIT + ITC + \alpha \cdot RB$$

2. Simplifying Income Taxes

It is useful to consider the total of state and federal income taxes.

$$IT = SIT + FIT$$

for which a composite income tax rate, *t*, is defined by:

$$t = \left(1 - t^{F}\right) \cdot t^{S} + t^{F}$$

and the sum of state and federal renewable energy credits, *REC*, which recognizes state income taxes are deducted from federal income taxable income, is defined by:

$$REC = \left(1 - t^{F}\right) \cdot REC^{S} + REC^{F}$$

When allocating state income taxes on income before taxes, the effective state income tax rate for jurisdiction *j* is:

$$\hat{t}^{S} = \frac{SIT}{IBT} = \frac{\sum_{j} t_{j}^{S} \cdot IBT_{j}}{\sum_{j} IBT_{j}} = \sum_{j} t_{j}^{S} \cdot \left(\frac{IBT_{j}}{\sum_{j} IBT_{j}}\right)$$

The current blended state income tax rate replaces this average of state income tax rates weighted by income-before-tax. It has been 4.54 percent since the 2003 Semi-Annual Report.

3. JAM - Calculating the Earned Rate of Return from Actual Revenues

The Jurisdictional Allocation Model (JAM), apportioning system results to jurisdictions, can be described by the following set of relations:

$$CWC = \frac{nld}{365} \cdot (O\&M + TOTI + IT)$$

$$INT = \rho_D \cdot \varpi_D \cdot \left(RB^o + CWC\right)$$

$$IT = t \cdot (R - E - I\&D - SCHM - INT) + REC$$

$$\alpha = (R - E - IT - DIT - ITC) / \left(RB^o + CWC\right)$$

The first three equations can be solved for income taxes.

$$IT(R) = \left(1 + t \cdot \rho_D \cdot \varpi_D \cdot \frac{nld}{365}\right)^{-1} \Big(t \cdot \Big\{R - E - I\&D - SCHM \cdot$$

$$- \rho_D \cdot \varpi_D \cdot \left[RB^o + \frac{nld}{365} \cdot (O\&M + TOTI)\right]\Big\} + REC\Big)$$

Revenues are identified on the left-hand side of the above equation to distinguish the relation of income taxes to revenues rather than rate of return. A multiplier is applied to the term in parentheses to account for the income taxes removed from cash working capital in the rate base used to impute interest expense. This equation is the solution to the simultaneous treatment of cash working capital, imputed interest expense and income taxes for given revenues.

The rate of return earned from given revenues is:

$$\alpha(R) = \frac{R - E - IT(R) - DIT - ITC}{RB^o + \frac{nld}{365} \cdot (O\&M + TOTI + IT(R))}$$

$$= \frac{I(IT(R))}{RB(CWC(IT(R)))}$$

This is the solution to the earnings problem, the ratio of income to rate base consistent with relations regarding cash working capital, interest expense and income taxes for given revenues.

4. JAM - Calculating Actual Revenues from the Earned Rate of Return

Consider the same relations for cash working capital, interest expense and income taxes as above, but with revenues expressed as a function of the rate of return, i.e., simply rearranging the expression above for the rate of return.

$$R = E + IT + DIT + ITC + \alpha \cdot \left(RB^{o} + CWC \right)$$

Now income taxes are related to the rate of return rather than revenues.

$$IT(\alpha) = \left\{ 1 - t \cdot \left[1 + \left(\alpha - \rho_D \cdot \varpi_D \right) \cdot \frac{nld}{365} \right] \right\}^{-1} \cdot \left\{ \left(\alpha - \rho_D \cdot \varpi_D \right) \cdot \left[RB^{o} + \frac{nld}{365} \left(O\&M + TOTI \right) \right] + DIT + ITC - I\&D - SCHM \right\}$$

The rate of return is identified on the left-hand side of the above equation to distinguish the relation of income taxes to rate of return rather than revenues. A multiplier is applied to the term in parentheses to account for the income taxes removed from cash working capital in the rate base. This equation is the solution to the simultaneous treatment of cash working capital, imputed interest expense and income taxes for a given rate of return.

=> $IT(\alpha(R)) = IT(R)$

For related revenues and rate of return, income taxes calculated based on revenues or rate of return produce the same result and both are consistent with the specified regulatory relations.

Revenues required to recover costs including the income and income taxes associated with a given rate of return are:

$$R(\alpha) = E + IT(\alpha) + DIT + ITC + \alpha \cdot \left[RB^{o} + \frac{nld}{365} \cdot \left(O\&M + TOTI + IT(\alpha) \right) \right]$$

$$= COS(IT(\alpha), \alpha)$$

This is part of the solution to the ratemaking problem, the relation of revenues to costs consistent with relations regarding cash working capital, interest expense and income taxes for a given rate of return.

5. FAM - Calculating the Imputed Revenues from the Earned Rate of Return

The Functional Allocation Model (JAM), apportioning Utah jurisdictional results to functions, can be described by the following set of relations:

$$CWC = \frac{nld}{365} \cdot (O\&M + TOTI + IT)$$

$$IT = t \cdot (R - E - I\&D - SCHM - INT) + REC$$

$$R = E + IT + DIT + ITC + \alpha \cdot \left(RB^{o} + CWC\right)$$

In FAM, the Utah jurisdictional interest expense is allocated to functions based on the relative gross plant of the functions. Since it is independent of the calculation of income taxes and cash working capital, it is treated simply as a fixed input. Interest expense is not imputed as it is in JAM.

Solving this set of expressions provides income taxes as a function of the rate of return,

$$IT(\alpha) = \left[1 - t \cdot \left(1 + \alpha \cdot \frac{nld}{365}\right)\right]^{-1} \cdot t \cdot \left\{\alpha \cdot \left[RB^{o} + \frac{nld}{365} \cdot (O\&M + TOTI)\right] + DIT + ITC - I\&E - SCHM - INT\right\} + REC\}$$

Using the Utah jurisdictional earned rate of return, this expression is used to impute revenues to functions.

6. FAM - Calculating the Earned Rate of Return from Imputed Revenues

Consider the same relations for cash working capital and income taxes as above, with interest expense given, but with the rate of return expressed as a function of the imputed revenues, i.e., simply rearranging the expression above for revenues.

$$\alpha = (R - E - IT - DIT - ITC) / \left(RB^{O} + CWC\right)$$

Now income taxes are simply:

$$IT(R) = t \cdot (R - E - I\&D - SCHM - INT) + REC$$

Using the revenues imputed to functions, this expression is used to determined the rate of return earned by a function, and it will equal that assumed for imputing revenues.

7. SAM - Calculating the Earned Rate of Return from Actual Revenues

$$CWC_{i,f} = \left(O\&M_{i,f} / O\&M_f\right) \cdot CWC_f$$

$$INT_{i,j} = \left(RB_{i,f} / RB_f\right) \cdot INT_j$$

$$IT_{i,f} = \left[\left(1 - t^F\right) \cdot \frac{t^S \cdot IBT_f}{\sum_i IBT_{i,f}} + t^F\right] \cdot \left(R^a_{i,f} + R^c_{i,f} + R^o_{i,f}\right.$$

$$\left. - E_{i,f} - I\&D_{i,f} - SCHM_{i,f} - INT_{i,f}\right) + REC_{i,f}$$

$$R^a_{i,f} + R^c_{i,f} + R^o_{i,f} = E_{i,f} + IT_{i,f} + DIT_{i,f} + ITC_{i,f} + \alpha \cdot \left(RB^o_{i,f} + CWC_{if}\right)$$

$$R^c_{i,f} = \frac{E_{i,f} + IT_{i,f} + DIT_{i,f} + ITC_{i,f} + \alpha_{UT} \cdot \left(RB^o_{i,f} + CWC_{i,f}\right)}{\sum_i \left[E_{i,f} + IT_{i,f} + DIT_{i,f} + ITC_{i,f} + \alpha_{UT} \cdot \left(RB^o_{i,f} + CWC_{i,f}\right)\right]} \cdot R^c_f \quad \text{where}$$

$$R^c_f = \frac{E_f + IT_f + DIT_f + ITC_f + \alpha_{UT} \cdot \left(RB^o_f + CWC_f\right)}{\sum_f \left[E_f + IT_f + DIT_f + ITC_f + \alpha_{UT} \cdot \left(RB^o_f + CWC_f\right)\right]} \cdot R^c$$

$$\alpha_i = \frac{R^a_i + \sum_f \left(R^c_{i,f} + R^o_{i,f} - E_{i,f} - IT_{i,f} - DIT_{i,f} - ITC_{i,f}\right)}{\sum_f \left(RB^o_{i,f} + CWC_{i,f}\right)}$$

C. The Change in Revenues

1. JAM - Income Approach

Revenues must recover not only the costs which are independent of revenues, they must also recover the costs which vary with revenues. Some revenues, although billed, are not collected and become uncollectible expenses. With any change in revenues, the associated change in uncollectible expenses is determined by applying an uncollectible rate, u, to the change in revenues. In the Company's JAM, the uncollectible rate is the ratio between uncollectible expense in the directly-assigned component of account 904 and the sum of revenues in the directly-assigned components of accounts 440, 442, 444 and 445.

Considering the income-before-tax equation for given revenues, above, a change in revenues appears in three places: directly as revenue, as a change in uncollectible expenses, and as a component of the cash working capital calculation. The relation of income taxes with and without the change in revenues is:

$$IT(R, \Delta R) = IT(R) + \left(1 + t \cdot \rho_D \cdot \varpi_D \cdot \frac{nld}{365}\right)^{-1} \cdot t \cdot \left(1 - u \cdot \left(1 + \rho_D \cdot \varpi_D \cdot \frac{nld}{365}\right)\right) \cdot \Delta R$$

For given revenues, the ratemaking problem can be presented as solving the following expression for the change in revenues:

$$R + \Delta R = E + u \cdot \Delta R + IT(R, \Delta R) + DIT + ITC$$

$$+ \alpha \cdot \left[RB^{o} + \frac{nld}{365} \cdot \left(O\&M + u \cdot \Delta R + TOTI + IT(R, \Delta R)\right) \right]$$

$$= COS(IT(R), \alpha) + \left(1 + \alpha \cdot \frac{nld}{365}\right) \cdot \left(1 + t \cdot \rho_D \cdot \varpi_D \cdot \frac{nld}{365}\right)^{-1} (t + (1 - t) \cdot u) \cdot \Delta R$$

The change in revenues must account for associated changes in income taxes, cash working capital and uncollectibles. The solution can be expressed in terms of a multiplier defined by:

$$m_B = [t + (1 - t) \cdot u] \cdot \left(1 + \alpha \cdot \frac{nld}{365}\right) \cdot \left(1 + t \cdot \rho_D \cdot \varpi_D \cdot \frac{nld}{365}\right)^{-1}$$

If the changes in cash working capital associated with the change in revenues are ignored, then the two terms in parentheses on the right-hand side disappear, and only the first term remains. This is the Company's multiplier.

In the income approach, the change in revenues is provided by:

$$\Delta R\left(m_B, \alpha, R\right) = \left(1 - m_B\right)^{-1} \cdot \left[COS\left(IT\left(R\right), \alpha\right) - R\right]$$

$$= \left(1 - m_B\right)^{-1} \cdot \left[I\left(R, IT\left(R\right)\right) - \alpha \cdot RB\left(CWC\left(IT\left(R\right)\right)\right)\right]$$

$$= \left(1 - m_B\right)^{-1} \cdot \left[\alpha\left(R\right) - \alpha\right] \cdot RB\left(CWC\left(IT\left(R\right)\right)\right)$$

In the second line above, the bracketed term is the difference between the income earned from given revenues and the income allowed from a given rate of return and rate base. In the third line, the bracketed term is the difference between the rate of return earned from given revenues and an allowed rate of return.

2. JAM - Cost-of-Service Approach

Considering the income-before-tax equation for given rate of return, above, the change in uncollectible expenses appears in the calculation of cash working capital. The relation of income taxes with and without the change in uncollectibles is:

$$IT(\alpha, u\cdot\Delta R) = IT(\alpha) + \left(1 - t - t\cdot(\alpha - \rho_D\cdot\varpi_D)\cdot\frac{nld}{365}\right)^{-1}\cdot t\cdot(\alpha - \rho_D\cdot\varpi_D)\cdot\frac{nld}{365}\cdot u\cdot\Delta R$$

For of a given rate of return, now the ratemaking problem can be presented as solving the following expression for the change in revenues:

$$R + \Delta R = E + u\cdot\Delta R + IT(\alpha, u\cdot\Delta R) + DIT + ITC$$

$$+\alpha\cdot\left[RB^{o} + \frac{nld}{365}\cdot\left(O\&M + u\cdot\Delta R + TOTI + IT(\alpha, u\cdot\Delta R)\right)\right]$$

$$= COS(IT(\alpha), \alpha) + \left(1 + \alpha\cdot\frac{nld}{365}\right)\cdot\left(1 - t - t\cdot(\alpha - \rho_D\cdot\varpi_D)\cdot\frac{nld}{365}\right)^{-1}\cdot(1-t)\cdot u\cdot\Delta R$$

The change in revenues can be expressed in terms of a multiplier defined by:

$$m_A = \left(1 + \alpha\cdot\frac{nld}{365}\right)\cdot\left(1 - t - t\cdot(\alpha - \rho_D\cdot\varpi_D)\cdot\frac{nld}{365}\right)^{-1}\cdot(1-t)\cdot u$$

In the cost approach, the change in revenues is provided by:

$$\Delta R(m_A, \alpha, R) = (1 - m_A)^{-1}\cdot\left[COS(IT(\alpha), \alpha) - R\right]$$

In this approach, the change in revenues is related to the multiplier, the rate of return, and revenues. The difference between cost-of-service and revenue appears in the bracketed term on the right-hand side above. Cost-of-service is based on a given rate of return for both income and income taxes and excludes any change in uncollectible expenses. The multiplier is used to account for the change in uncollectible expenses associated with the change in revenues.

The bracketed term on the right-hand side represents the change in “net” revenues, and escalation by means of the multiplier provides the change in “gross” revenues. With the change in revenues known, the total revenues are given by:

$$R\left(m_A, \alpha, R\right) = R + \Delta R\left(m_A, \alpha, R\right)$$

$$= COS\left(IT(\alpha), \alpha\right) + u \cdot \Delta R\left(m_A, \alpha, R\right)$$

This equation completes the ratemaking problem, i.e, it provides the revenues required to recover all costs at a given rate of return, consistent with the relations regarding cash working capital, interest expense, income taxes and uncollectibles. Total revenue requirement and total cost-of-service are equivalent. Cost-of-service is separated into two components, one unrelated to revenues, but the other is related to revenues.

D. Inconsistencies

1. The average of schedules' rates of return for a given function, weighted by relative rate base, will not equal the jurisdictional average assumed when imputing revenues to functions and determining income taxes by function.

2. The effective state income tax applied to schedules within a function will not equal the blended state income tax rate.

3. The effective state income tax rate, reflecting the sum of the functions of a schedule, will not equal the blended state income tax rate.

4. Calculating cash working capital, interest expense and income taxes directly for a schedule does not equal the sum of a schedule's functional amounts

system (*) => jurisdictions $(*)_j$ => functions $(*)_{j,f}$ CWC, INT & IT vs other costs
system (*) => functions $(*)_f$ => jurisdictions $(*)_{f,j}$

5. differences in rates of return earned by schedules => relatively small

6. differences in changes in revenues for schedules => relatively large

[When integrating jurisdictional revenue requirement with class cost-of-service, is it appropriate to reconsider the role of the change in uncollectibles associated with the change in revenues?]

QUESTION: If income taxes are allocated on an income-before-tax factor rather than rate base, is it appropriate to ignore the multiplier when determining the change in revenue necessary for a schedule to earn the jurisdictional average rate of return?