Determining the Construction Work in Progress Factor

Background

In the Philippines, the regulatory framework for the determination of Construction Work in Progress Factor (CWIP Factor) is outlined in two documents, the Transmission Wheeling Rate Guidelines (TWRG), and the Regulatory Reset Issues Paper (Issues Paper). In these two regulatory issuances, the term CWIP Factor is interpreted to account for the time value of money during the construction period.

Most of the projects of TransCo have construction periods that extend from a few months to several years, depending on the type and size of the project. The Energy Regulatory Commission (ERC or the Regulator) has allowed the recognition of the time value of money to compensate for the time lag between the start of the construction period through to the commissioning date. The TWRG provides the guidelines for the computation of the CWIP Factor. Under 4.6.9 of the TWRG, the CWIP Factor shall be calculated using a typical spend profile for the assets of the relevant type at the regulatory WACC over the typical construction period.

The regulatory WACC is the appropriate measure and not the cost of debt as the WACC represents the average financing cost during construction, taking into account the average funding of the business between debt and a commensurate return to equity-holders. The CWIP Factor shall then be added to the nominal asset value to produce a true measure of the investment.

Regulatory Framework of the CWIP Factor

In the Section 4.6.9 of the TWRG, the following definitions were made:

> *The CWIP Factor must be derived from a calculation method approved by the ERC which may include:*
>
> - *Uniformly escalating the ODRC of the revalued assets by a constant factor*
> - *Directly estimating the investment cost of for specific past projects and adding this cost to the ORC of the revalued assets*
> - *Another method approved by the ERC*
>
> *The CWIP Factor may be the same for all revalued assets or may differ between Asset Categories*

Other issues related to the CWIP Factor are raised in Section 2.8.3 of the Issues Paper:

> *The ERC recognizes that the simplicity of a single escalation factor to all asset categories may be offset by perceived inaccuracy of an allowance of recovery of this reasonable investment cost. Issues which need to be considered include whether:*
> *(a) one factor for all assets categories is sufficient;*
> *(b) one factor for transmission line and one for substations would be sufficient;*
> *(c) over what time frames do the average transmission line and average substation investment occur, prior to commissioning;*

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(d) the discount rate used to estimate the CWIP factor should be the regulatory WACC or just the estimated cost of debt;
(e) there is an average capital expenditure profile which should be used to estimate the cost of investment prior to commissioning.

Current Methodology Used by TransCo

With respect to the concerns raised in the Issues Paper, it is useful to look at how TransCo currently accounts for the time value of money in its asset values.

Most of the construction projects of TransCo are outsourced. They have two major categories of contracts for construction projects, which they term *Local (or Split Contract)*, and *Turnkey*. For Local projects, procurement of supplies and materials is separate from construction and assembly work. TransCo can either procure materials itself, or bid out a separate procurement contract. The materials are turned over to the construction contractor for assembly and installation at the site. These projects are generally limited to expansion or upgrade projects (elsewhere classified as Minor Capital Projects). The use of Split Contracts has brought problems and efficiency concerns for TransCo. In certain cases, the procurement of the construction contract takes a longer period leaving the already sourced materials and equipment to deteriorate. Further, the difference between the materials procurement and the actual start of construction results to higher carrying costs and can be inefficient.

Due to reasons cited, TransCo's recent contracts are Turnkey Projects where the contractor will be in charge of the entire construction process, from procurement to installation. These contracts are generally awarded to large multinational trading, engineering or construction firms that have an efficient global network for procurement. It is also not unusual to find a consortium or joint venture between a multinational company and a local construction entity. The former handles the procurement or sourcing of materials while the latter takes charge of the actual construction.

Using the Turnkey structure, the contractors are generally paid, on a monthly basis, based on the percent value of accomplishment for that particular month. Note that this is based on the value and not on the actual percentage of the construction work on the project that was accomplished. With this scheme, the percent value accomplished actually serves as a substitute for percent accomplishment, which is more difficult and complicated to determine. However, there are a few Turnkey Projects on which lump sum payments are being made on the basis of milestones agreed upon in the construction contract.

TransCo currently records Interest During Construction (IDC) in its books of accounts. The IDC, as opposed to the CWIP Factor allowed by the Regulator, refers to the actual interest capitalized during the construction period and largely depends on the funding of the specific project. For projects that are constructed under various commercial and non-commercial loans, the rate used to compute the IDC is the actual rate, and therefore not uniform across projects. The IDC is calculated across the time frame the project is under construction using the actual interest rate applicable to loan drawdown plus the commitment fee on the undrawn amount. No IDC is capitalized for internally (i.e. equity) funded projects.

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CWIP Issues

In this portion, a discussion on each of the issues identified by the ERC under Section 2.8.3 of the Issues Paper as critical points for consideration will be made.

Whether one factor for all asset categories is sufficient

Although there are several asset categories that are to be considered under the TWRG and Terms of Reference issued by TransCo for the Asset Revaluation Project, under the general principle of only including assets that are directly connected to the provision of regulated transmission services, Section 4.6.10 of the TWRG excludes several of them:

> *CWIP Factor must not be applied to the extent the asset is categorized as part of spares, easement, buildings, civil works and establishment, or non-network assets.*

As metering installations do not need long periods of time to install, and non-network assets are excluded, this effectively reduces the major asset categories to be considered eligible for the computation and application of CWIP Factor to the following:

- Transmission Lines
- Transmission Substations
- Interconnection Submarine Cables and Facilities

Whether one factor for transmission line and one for substations would be sufficient

Most construction projects of TransCo are done by external contractors on a per contract basis. This contract often combines the construction of transmission lines and substations in one project. However, TransCo can generate typical project profiles for each of these asset categories. As there are differences in the typical expenditure cycle in the construction of these major assets, a different factor for each of the three asset categories was computed and applied.

Over what time frames do the average transmission line, (average submarine cable) and average substation investment occur, prior to commissioning?

The TWRG and the Issues Paper suggest that a uniform CWIP Factor can be used for all projects. The difficulty with applying a uniform factor will be that Electric Capital Projects (ECP) will not usually fit to one type of project expenditure profile. Specifically, the time needed to complete an ECP will be the most critical for the calculation of the CWIP Factor. The factors which will affect construction period include:

- Length of Line: The time needed to construct or upgrade a transmission line or submarine cable is dependent on its length.

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- Voltage/Capacity: Transmission Lines and Substations with higher voltages will take longer to construct or upgrade. Since voltages in each sub-grid are different, standardization was done based on the recently completed and currently on-going projects of TransCo.

- Location: Depending on the delivery infrastructure and terrain, it may be more difficult to implement ECPs in less developed locations such as Mindanao and in other remote areas. The sample projects obtained include projects located in various parts of the country and are believed to be representative of the general conditions considered in calculating the CWIP Factor.

The standardized construction period for each of the three major asset categories are presented in Figure 7.

In addition to the assets commissioned as of December 31, 2004, Section 4.6.10 (b) of the TWRG also allows recognition of CWIP for actual or budgeted capital expenditures that will be included in the rolled-forward depreciated RAB. The capital expenditures that will be included in the roll-forward are understood to refer to new assets that will be completed and commissioned for 2005. In effect, these capital expenditure projects will take between 0-12 months (average 6 months) before they can be recognized as part of the RAB and hence a generator of revenue for TransCo. It is believed to be reasonable and justifiable to add an extra 6 months to the typical construction period for these new capital expenditures to account for the lag in the regulatory process. The same concept should apply to new projects in the annual roll-forward that TransCo will submit to the Regulator. The additional 6 months is not applicable to assets existing as of December 31, 2004.

Whether the discount rate used to estimate the CWIP factor should be the regulatory WACC or just the estimated cost of debt

For this report, the WACC will be used to determine the CWIP Factor. Using the estimated cost of debt will result in some variability in the computation, because TransCo project funding ranges from Official Development Assistance (ODA), to internally generated funds, to commercial loans. The Regulator recognizes that the business is financed by debt and equity and the Regulator, in determining the WACC, has made an assumption as to how an efficient transmission business would structure its debt to equity ratio. Whilst the business may for any project have differing finance levels, any change in the basis of financing will have a corporate impact. For instance, if a specific project is 100% debt financed, this will restrict the business's ability to raise further debt for other projects and these would then have to be finance out of equity. The regulator has therefore set the benchmark to the average total cost of finance for any specific project.

Further, the cost of debt does not provide compensation to the equity holders and is not a complete measure of the time value of money. The WACC is considered to be a more appropriate measure of return, not just to debt-holders. Also, since the assets are regulated, the Regulator is likely to insist on the use of the regulated WACC, even though this may differ from the investment hurdle rate required by the business.

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In the TWRG, the ERC in several instances, indicates its preference that the CWIP Factor be calculated using the appropriate regulatory WACC. Section 4.6.9 of the TWRG states that:

> *The CWIP is intended to compensate for the investment cost (or time value of money), calculated using a typical spend profile for assets (at a WACC determined by ERC) over the typical period from the commencement of construction to the commissioning of the asset (excluding any periods of unjustified delay).*

Because the asset revaluation process involves revaluing each sub-component value at the cost level of the day (completion day), the interest rate used for determining IDC should be nominal to match the data being used to generate the cumulative expenditure profile. A pretax nominal WACC is thus being used to bring a pretax nominal cash flow series to a future value, as is standard for discounted cash flow analysis.

The Issues Paper has presented a post-tax nominal regulatory WACC of 13% – 14.6%. Since the marginal tax rate used in the Issues Paper is 0%, no other adjustment was made to bring this post-tax nominal regulatory WACC to a pre-tax nominal regulatory WACC. The higher end of this range was used considering the recent economic data of higher inflation rate due to continuing rise in oil prices. Likewise, higher country risk premium was used given the current political situation. These conditions are expected to persist through to the start of the second regulatory period.

Whether there is an average capital expenditure profile which should be used to estimate the cost of investment prior to commissioning

As earlier mentioned, we have looked at sample projects considered to be representative of the typical expenditure profile for each major asset category. These were used to generate a standard expenditure curve for each asset category. The proposed methodology for computing the CWIP Factor, using the regulatory WACC as the discount rate, will then be applied to this standard curve. The approach using the expenditure S-curve will be discussed in a latter section.

The general approach to estimating the CWIP Factor

Formula for calculating CWIP Factor

The simplest method to estimate the CWIP Factor begins by tracking expenditure detailed item by item for a particular project, over the construction period. The value of this expenditure, including the WACC return on capital, can be found by finding the future value (FVt) of the capex cash flow stream, at the point of commissioning[1]. Here 't' is the number of months over which the project occurs prior to commissioning.

Assuming in the normal course of business, the capex each month for a particular project is recorded and aggregated to a total nominal value (NVt) at the point of commissioning. This would be expected from most accounting and project management

[1] Future value (FV), computed from the required return on capital (WACC) over the period under consideration.

systems. Then the total will represent a sum of nominal project cash flows at the point of commissioning that have not been corrected for the WACC return on capital investment.

Therefore, one practical measure of the CWIPt is the difference between the FVt of the capex profile and NVt, at the point of commissioning. In percentage terms, it can be represented by equation (1). The result of Equation 1 would represent the % increase in the Project Cost due to the CWIP Factor. Box 1 provides a simple overview of the financial mathematics involved in the calculation of the CWIP Factor.

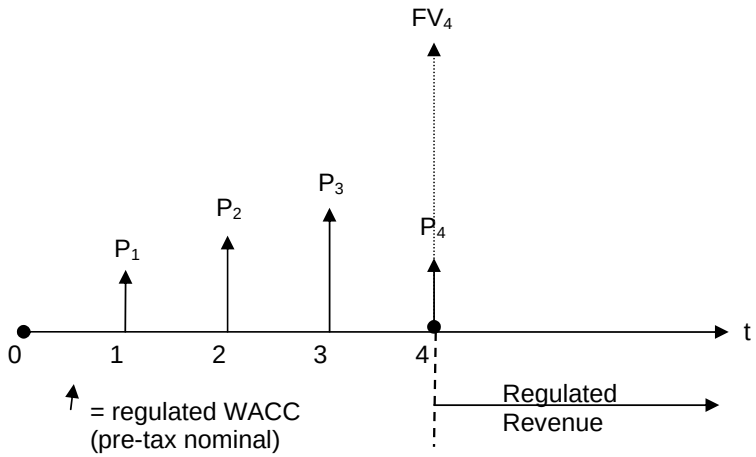
Equation (1)

$$CWIPt = FVt / NVt - 1$$

Box 1

Assume a project expenditure over four periods, where commissioning occurs at the end of period 4. The cash flow series can be represented as follows:

Figure 1. Representation of Periodic Cash Flows



FV_4 = Future value including the time value of money at time 4.

Equation (2)

$$FV_4 = P_1(1+r)^3 + P_2(1+r)^2 + P_3(1+r)^1 + P_4$$

NV_4 = Total of the nominal cash flows up to period 4.

Equation (3)

$$NV_4 = P_1 + P_2 + P_3 + P_4$$

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Thus one estimate of CWIP Factor is found by dividing equation (2) by equation (3) and subtracting 1.0. This is the % escalation factor on the cumulative nominal capex which might be captured by a transmission business' project management accounting system. The CWIP Factor for a 4 period project is provided in the following equation (4):

Equation (4)

$$CWIP_4 = ([P_1(1+r)^3 + P_2(1+r)^2 + P_3(1+r)^1 + P_4] / [P_1 + P_2 + P_3 + P_4]) - 1$$

This four period project can be generalized into a standard equation as in equation (1), where t = the number of construction periods. In long form, this is expressed as:

Equation (5)

$$CWIP_t = ([P_1(1+r)^{t-1} + P_2(1+r)^{t-2} + \ldots + P_t] / [P_1 + P_2 + \ldots + P_t]) - 1$$

If the denominator in the main brackets is divided into the components of the numerator individually, it is evident that each cash flow becomes the percentage of the total nominal cash flow in that period. Thus equation (5) follows:

Equation (6)

$$CWIP_t = ([\%P_1(1+r)^{t-1} + \%P_2(1+r)^{t-2} + \ldots + \%P_t] - 1$$

where:

$$\%P_i = P_i / [P_1 + P_2 + \ldots + P_t] \text{ and } i = 1, 2, \ldots, t.$$

Note that the CWIP Factor is a function of % expenditure profile ($\%P_t$), the rate of return (r) which is the regulatory WACC, and the period of construction (t). As a result, construction escalation tables can be developed for different expenditure profiles (i.e. different types of projects or assets), different rates of return, and different construction periods.

Expenditure S-Curves

The quantity of assets involved in a valuation and the difficulty of dealing with many individual projects make it impracticable to compute a CWIP Factor for each. Hence, we propose to apply a typical expenditure profile based on the expenditure data of recently completed and on-going projects provided by TransCo. This will be based on actual and projected monthly progress reports provided by the Projects Planning and Development Department of TransCo. These documents would exemplify the "typical" construction profile of the specified asset groups for which the computation of the CWIP Factor applies.

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For electricity substations and transmission projects, expenditure normally follows an "S – curve" pattern (see Graph in Box 2 below). The duration of the expenditure varies, for each asset category and is determined by the typical projects identified by TransCo. Other development costs are incurred before the start of actual construction. Surveys and right-of way acquisitions occur prior to the construction period. Right-of-way is considered a separate asset category for this asset revaluation project and the TWRG specifically excludes CWIP in the valuation of easements. Other costs incurred before actual construction work begins are for the conduct of Feasibility Studies, Geological and Geotechnical Surveys, Environmental Impact Assessment, and Social Engineering. However, the Regulator is only interested in the treatment of the time value of the installed facilities during the construction period, so the CWIP Factor is computed excluding the time period for these preliminary project activities.

The Interconnection Submarine Cables and Facilities are treated slightly different. The expenditure profile starts from the marine surveying and manufacturing of cables. This is not considered unusual as evidenced by recent contracts entered into by TransCo with respect to Leyte-Cebu interconnection projects.

While substation and transmission line works (the major components of TransCo's asset base) may have slightly differing lead times and expenditure profiles, TransCo rarely if ever constructs purely substation or purely line projects. The actual expenditures on mixed projects (based on the Progress Report for Luzon, Visayas and Mindanao, as of February 2004) were also looked at in detail, to isolate the expenditure profile for each asset category

Box 2

S-Curve Computation Based on Normalized Construction Curves

It is perhaps instructive to look at what CWIP Factors will be generated using a Standard S-Curve based on a normal probability distribution. To produce a standard S-Curve over the construction period of the project, this assumes that capital expenditure follows a normal distribution pattern over the life of the project, that 50% of the project is completed at the midpoint of the construction period, and that the standard deviation is one-fourth of the range. Also, due to the fact that the values are derived from a continuous normal distribution curve, whatever residual funds that are left undisbursed are paid out in the last period. A sample cumulative (monthly) expenditure curve over a two-year construction period is shown below.

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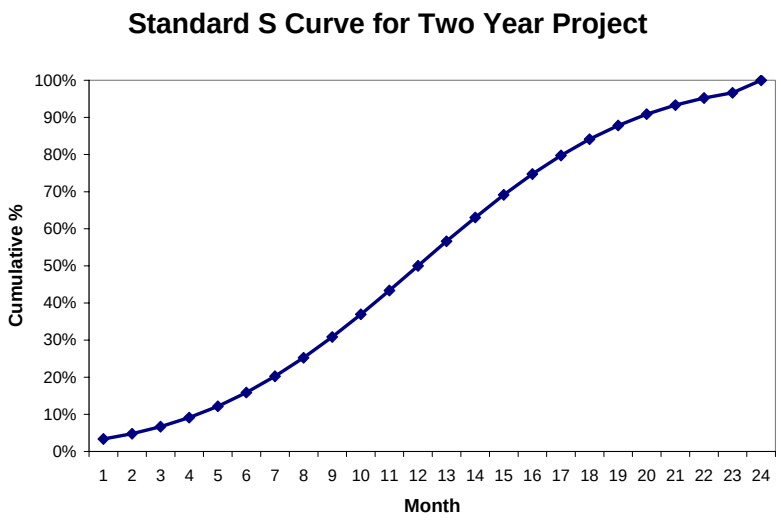
Figure 2.



Using the standard S-Curve, CWIP Factor computations were made using a pre-tax nominal WACC of 14.6% for all construction projects assuming both monthly (end-of-month) and quarterly (end-of-quarter) disbursements for different lengths of construction periods. The resulting computed CWIP Factors are summarized in the following table:

Figure 3. Table of Normal CWIP Factors

Construction Period	Computed CWIP Factor (%)	
	Monthly Payments	Quarterly Payments
1 year	6.94%	5.58%
1 .5 years	10.97%	9.52%
2 years	15.20%	13.63%
2 .5 years	19.61%	17.93%
3 years	24.24%	22.43%

The value of this exercise is that if for some reason there is an absence of a clear basis for estimating the capital expenditure curve of a project, this is an alternative, defensible, statistically valid methodology that may provide a fairly reasonable approximation of how systems can behave.

The numbers imply that assuming a normal distribution of payments during a three-year construction period, a project for which the contractor is paid on a monthly basis will have a CWIP of 24.24% over the nominal project cost, given a pre-tax nominal WACC of 14.6%.

Time Frames on the Implementation of Typical Projects

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Some difficulties were encountered in gathering data on typical projects from TransCo because this was limited to ongoing or recently completed projects for which project monitoring documents are available. From this data pool, typical projects were identified for the three major asset categories for which CWIP is to be applied. Minor projects (minor upgrades and expansions) were excluded from the analysis. For the following asset categories, the projects listed were identified for inclusion.

Other things affect construction projects, including ordering and delivering of overseas components, sub-assembly and assembly sequencing of large machinery, foundation work followed by construction work. However, these are already factored in by TransCo in the Project Activity Cycle. From interviews with the engineering and construction group, the construction period of projects is usually very predictable and generally is accurately predicted by the forecast timetables. Most of the delays during construction of projects come from unresolved issues involving rights-of-way, and difficulty of scheduling shutdowns in the grid needed to facilitate interconnection. The typical S-curves used for the computation of the CWIP Factor do not include rights-of-way acquisitions as well as any project delays caused by inefficiencies and other force-majeure circumstances.

The Regulatory WACC used for the project, computed according to the methodology specified under the Section 4.9 of the TWRG, is 14.6%. This is used to bring forward the values of the assets and capital expenditures.

Seven recently completed or ongoing projects (three substations, three transmission lines, and 1 submarine cables) have been considered for the purpose of our analysis.

Transmission Lines:

For Transmission Lines, there are relatively few recent projects for constructing new lines, considering that the last time new major power plants were on-stream was in 2001. The following projects were sampled for Transmission:

- Batangas - Makban T/L Project (20 months)
- Makban – Calamba T/L Project (17 months)
- Ormoc- Maasin T/L Project (14 months)

Averaging the time periods of these projects results in a 17 month typical project profile. The mean S-curve was estimated and normalized for the sample. The graph below shows a representation of the S-curve generated for Transmission Line construction. Using the S-Curve generated, the CWIP Factor for Transmission projects is 11.4%.

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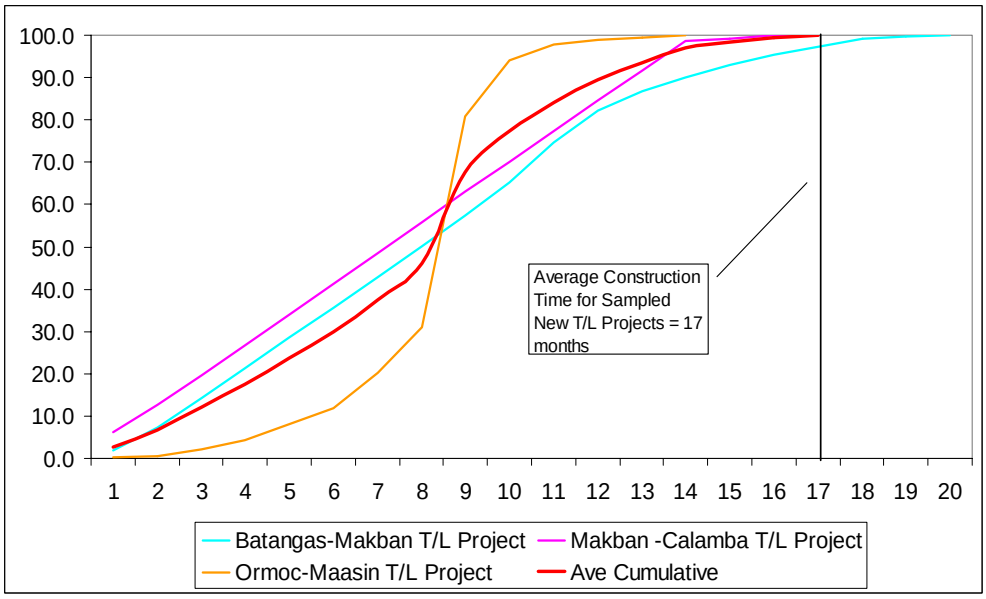
Figure 4. S-Curve for Transmission Projects (% Completion vs. Time in months)



Substations:

For Substations, most of the recent projects are for upgrading and the installation on new capacitor banks to existing stations. The following new substation projects are considered typical:

- Makban Substation Project (12 months)
- Batangas Substation Project (17 months)
- MACO Substation Project (15 months)

Averaging the time periods of these projects results in a 15 month typical project profile. The mean S-curve was estimated and normalized for the sample. The graph below shows a representation of the S-curve generated for new Substation construction. Using the S-Curve generated, the computed CWIP Factor for Substation Assets is 9.81%.

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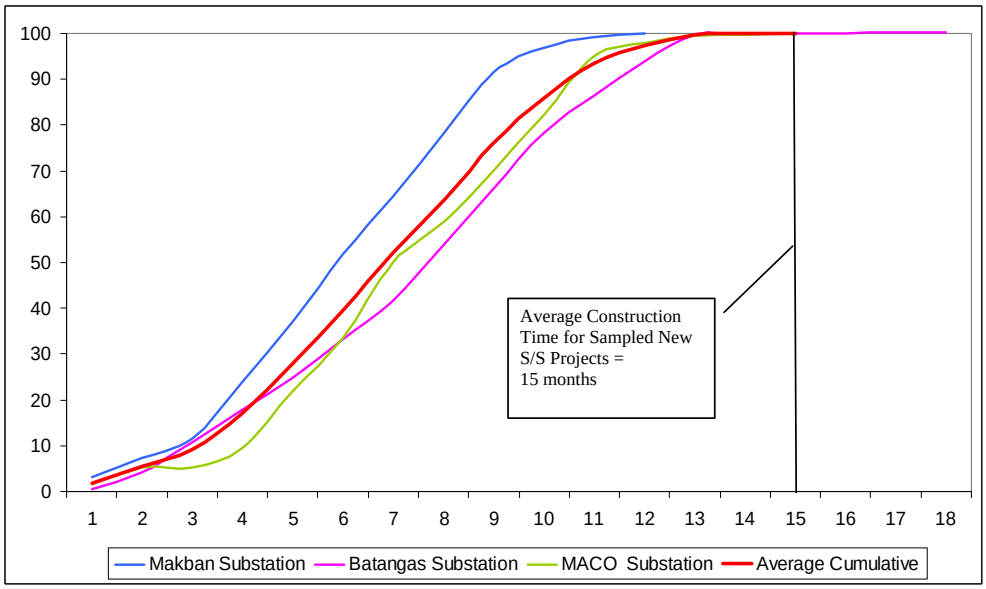
Figure 5. S-Curve for Substation Projects (% Completion vs. Time in months)



Submarine Cables and Facilities:

For this asset category, only the undersea portion of the Leyte-Cebu interconnection project (16 months) was deemed relevant for sampling. This is because the other submarine cable projects are non-comparable (e.g., the Panay – Boracay Interconnection Project, which is very small), or have not yet started construction, thus no S-curves are available for study (The Cebu-Negros Interconnection Uprating Project)

The following graph represents the construction profile for the Leyte-Cebu interconnection, which will serve as a typical project profile for purposes of calculating the CWIP Factor for TransCo's second regulatory period.

The CWIP Factor computed from the profile is 7.09%, the lowest among the three asset categories, because the expenditure profile for the underwater construction profile is somewhat back-loaded. Since most of the expenditure on the sample project occurs near the end of the construction cycle, it accumulates less cost of money than the other two asset categories.

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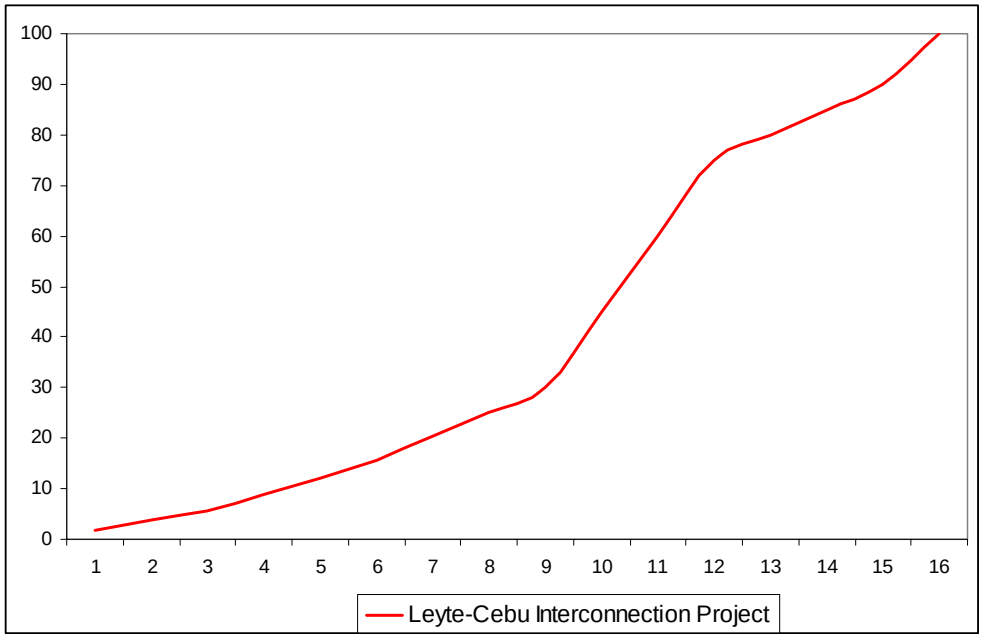
Figure 6. S-Curve for Submarine Projects (% Completion vs. Time in months)



Results of CWIP Estimates

The analysis of the 'typical' profile, based on the regulatory WACC specified above, indicates that the CWIP for the three asset categories ranges between 7.09-11.4% of the nominal cost of the assets. Thus, the total nominal capex for transmission lines, for example, from the project management accounting systems at the point of commissioning should be escalated by a factor of 1.114 to achieve the 'market value' of the asset to be included in the RAB. Details of the computation are provided in a separate worksheet.

The CWIP was calculated by applying a compounding monthly interest rate equivalent to the regulatory WACC to each of the project outlays incurred during the construction period. The result of incorporating CWIP Factor is that the nominal value of the assets is grossed up by the future value of the required return on outlays incurred during the construction period.

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The following table summarizes the computed CWIP Factor for each asset category.

Figure 7. Summary of CWIP Factors

Asset Category	Construction Period Used	Computed CWIP Factor
Transmission Lines	17 months	1.114
Substations	15 months	1.0981
Submarine Cables	16 months	1.0709

Adjustments for Regulatory Delay

When the construction of an asset is finished in the Year 2005, the new asset is included in the rolled-forward analysis to arrive at the 31 December 2005 RAB under the TWRG. Since the completion of any asset will probably be anytime within the Year 2005, the CWIP Factor may be adjusted to compensate for the delay in inclusion of the asset in the RAB as of 31 December 05. Because this delay will average out to half a year, or 6 months, the additional factor is computed as:

$$Total\ Factor = \left((CWIP\ Factor)\times(1+WACC)^{1/2}\right)-1$$

Figure 7. Summary of Total Factors

Asset Category	Computed CWIP Factor for the RAB as of 31 December 2004	With 6 Months WACC Applicable to Capital Expenditures in 2005
Transmission Lines	1.114	1.193
Substations	1.0981	1.176
Submarine Cables	1.0709	1.146

Conclusions

It is reasonable to include CWIP in the initial RAB, i.e. 31 December 2004 and forecast capital expenditures for Year 2005. This CWIP Factor can be estimated in a number of ways, but the most practical way is an escalation factor to be applied to the total capital expenditure from the project accounting systems, up to the date of commissioning of the assets into service.

For the purposes of the Asset Revaluation Project, it is proposed that the CWIP Factor computed using the Regulatory WACC be used to escalate the nominal investment cost for each asset category, to set the correct price signals and to promote efficiency.

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