The Allen Consulting Group

AlintaGas Networks Proposed Access Arrangement Revisions

Working Capital Requirement

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Report to the Economic Regulation Authority

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Chapter 1

Overview

1.1 The brief

The Economic Regulation Authority of Western Australia has engaged The Allen Consulting Group to review the working capital proposals contained in AlintaGas Network's (AGN) proposed revisions to its Access Arrangement for the Mid West and South West Gas Distribution Systems. Under the brief from the Authority, the review was to address the following issues:

- the approach of AGN to consideration of the costs of working capital in determination of Reference Tariffs under its existing (approved) Access Arrangement;
- the approach of AGN to consideration of the costs of working capital in determination of Reference Tariffs under proposed revisions to its Access Arrangement;
- a recommended approach to consideration of the costs of working capital in determination of Reference Tariffs, taking into account the approaches adopted with respect to working capital by regulators in other Australian jurisdictions.

1.2 Summary of findings

In determination of Reference Tariffs under AGN's current Access Arrangement, an amount of working capital was determined on the basis of 100 days of 'net lag' between expenses being due and revenue being received. This approach corresponded to an estimated working capital stock of a nominal $10 million in 2000 and each successive year. This amount was multiplied by the nominal pre-tax WACC to determine a nominal cost of working capital of $1.1 million in each year.

The approach currently being proposed by AGN is based on total target revenue with respect to receivables and on operating and maintenance costs with respect to payables and other timing issues associated with the cash cycle. Under the proposed AGN approach, a nominal cost of working capital of approximately $1.1 million per annum is included in the Total Revenue.

In providing objectives, principles and guidelines for the determination of Reference Tariffs, section 8 of the Code does not explicitly refer to costs arising from the working capital requirements of a service provider. However, as the requirement for working capital arises from consideration of timing of cash flows, section 8.4 of the Code may be relevant. Section 8.4 provides for the Total Revenue calculated for a gas pipeline to include a rate of return on the capital assets that form part of the pipeline. To the extent that an amount of working capital comprises a necessary part of the capital assets of a pipeline business, a return on working capital may fall within this component of Total Revenue. Section 8.4 also provides that the Total Revenue should be calculated in accordance with 'generally accepted industry practice'. This may include consideration of timing issues in respect of the service provider incurring costs and receiving revenues. Ultimately, the determination of 'generally accepted industry practice' and determination of reasonable assumptions as to timing of costs and revenues are empirical issues.

Assumptions about the timing of costs and revenues are implicit in the various formulae that may be used to determine Total Revenue. In this regard the formula previously applied by the Authority in respect of AGN's current Access Arrangement is consistent with that employed by most Australian regulators. It is a simple formula that assumes annual discounting, when in fact revenues are earned more evenly over the year. This creates a source of benefit to AGN, since cash flows from sales are received relatively continuously. Applying even unrealistically pessimistic assumptions about delays to receipt of cash, AGN would derive a significant benefit from a 'timing bias' in the Total Revenue calculation that is likely to outweigh the claim that AGN has made in relation to costs of working capital. This bias in favour of AGN arises in respect of the 'capital component' of Total Revenue: the return on capital and depreciation.

Given that the capital component of the AGN target revenue allowance is biased in favour of AGN, an allowance for costs of working capital with respect to this component would not appear justified, as it would over-compensate AGN for costs actually incurred. A reworking of AGN's working capital proposal by considering only the 'operating and maintenance' component of Total Revenue and applying AGN's 'lead' and 'lag' assumptions results in an allowance for costs of working capital of around $350,000 per annum in nominal terms.

In conclusion, the options facing the Authority in respect of AGN's allowance for working capital are as follows.[1]

a) Follow the same methodology that was applied in the previously approved Access Arrangement, based on a 'net lag' of 100 days applied to only the 'operating and maintenance component' of Total Revenue. This approach corresponds to an allowed cost of working capital of about $1.1 million per annum in nominal terms.

b) Allow the nominal $1.2 million per annum provision for costs of working capital as proposed by AGN using a different methodology that applies a shorter average net lag to Total Revenue.

[1] It should be noted that the allowance for working capital amounts quoted in this section are based on AGN's assumptions about the cash cycle and the appropriate rate of return to apply.

c) Allow provision for costs of working capital only on the operating and maintenance component of Total Revenue on the grounds that the capital component already over-compensates AGN for costs actually incurred. This would imply a provision for costs of working capital, in nominal terms, of about $350,000 per annum under AGN's cash cycle assumptions.

d) Disallow an allowance for costs of working capital on the grounds that the over-compensation in cash flows provided in AGN's determination of Total Revenue for the 'capital component' of costs is considerably higher than the allowance for working capital justified by reference to the 'operating and maintenance component'.

The Allen Consulting Group does not support option (a), as there is no justification for a 100 day 'net lag' assumption and this approach would result in a significant over-compensation of AGN for costs actually incurred. For the same reason, The Allen Consulting Group does not support option (b) as this would also result in a significant over-compensation of AGN.

The approaches taken by other regulators in respect of working capital vary. The ACCC and ESC have adopted option (d) in consideration of Access Arrangements for other pipelines covered under the Code for reasons of relative simplicity and transparency in the regulatory process. That is, these regulators have chosen not to estimate (by employing a more complex target revenue formula) the overcompensation to Service Providers, and have chosen not to allow any working capital adjustment. ESCOSA is in a process of consultation with respect to an electricity distribution price review, and has recommended an approach that would apply a 'net lag' of 39 days,[2] which it proposes to apply to only the 'operating and maintenance component' of target revenue. IPART and the QCA have in past decisions chosen to provide an allowance for costs of working capital based on total target revenue.

The Allen Consulting Group supports the stance of applying a relatively simple Total Revenue model, and recommends that the Authority continue to do so. It may be concluded that on the basis of an analysis of both the capital component and operating and maintenance component of AGN's Total Revenue, the Service Provider is, on balance, over-compensated under the simple formula. Given the precedent provided by the ACCC and the ESC, the Authority would have some justification in applying option (d) and completely disallowing an allowance for working capital. The Authority would need to balance the increasing precision and efficiency of this approach against the benefits of continuity in regulation provided by the continuing provision of an allowance for working capital, even if it is based on just the operating and maintenance component of Total Revenue. Adopting the latter view would imply accepting option (c), an allowance for costs of working capital on only the operating and maintenance component utilising AGN's cash cycle assumptions.

It should be noted that The Allen Consulting Group has not examined the validity of AGN's assumptions regarding the days of lead and lag in cash cycle variables. In order to examine these issues further, it would be necessary to undertake a detailed analysis of AGN's accounts.

[2] The AGN 'lead and 'lag' assumptions, when applied to the 'operating and maintenace component' are equivalent to a 37 days 'net lag', which is slightly lower than ESCOSA's assumption of 39 days.

Chapter 2

AlintaGas Networks' working capital proposal

2.1 Approach adopted for the first Access Arrangement Period

In its proposed Access Arrangement submitted to the then Independent Gas Access Regulator in 1999, AlintaGas made provision for a value of working capital of $1.4 to $1.5 million per annum in nominal terms.

The Authority (then the Independent Gas Access Regulator) required an alternative approach to be adopted:[3]

> The Regulator considered that the level of working capital should be determined on the basis of the number of days, on average, that expenses are due prior to review being received – the 'net lag'. By reference to other distribution businesses in Australia, the Regulator considers a net lag of 100 days to be a reasonable value for the AlintaGas distribution business, corresponding to a working capital requirement of $10.0 million in 2000.
>
> AlintaGas has proposed escalating the value of working capital each year by a factor of one plus the rate of change in the CPI, and calculating a return on working capital by multiplying by the nominal pre-tax rate of return. However, the Regulator considered it inappropriate to escalate the working capital requirement for inflation.

On this basis, provision was made for costs of working capital of $1.1 million (nominal) in each year of the Access Arrangement Period.

2.2 Approach proposed for the second Access Arrangement Period

For its proposed revisions to its Access Arrangement, AGN indicates the following treatment of working capital.[4]

> 4.2.10 Return on Working Capital
>
> An allowance for a return on the working capital employed in providing Reference Services has been included in the forecast total cost from which the Reference Tariffs have been determined. This is consistent with the approach adopted in the First Access Arrangement Period and consistent with the Code requirements to cover the efficient cost of providing Reference Services.

For the second Access Arrangement period, AGN is proposing to calculate an amount of working capital outstanding at the end of each year of the Access Arrangement Period and calculate a required return on that stock of working capital over the year. AGN proposes to include this amount of required return on working capital in the Total Revenue to be recovered through Reference Tariffs.

The return on working capital is calculated by multiplying the real pre-tax WACC by the end-of-year stock of working capital:

$$RWC_t = r.WC_t^{end} \qquad (1)$$

[3] Independent Gas Access Regulator Western Australia, 30 June, 2000, Final Decision: Access Arrangement Mid-West and South-West Gas Distribution Systems, p.114.

[4] Access Arrangement Information, 1 April 2004.

where, RWC_t is the return on working capital for year t, r is the real pre-tax WACC and WC_t^{end} is the stock of working capital at the end of each year t within the regulatory period.

This approach is consistent with the approach applied by the Independent Pricing and Regulatory Authority (IPART) in New South Wales, and the Queensland Competition Authority (QCA), but not with the approaches that have since been adopted by other Australian regulators.[5]

AGN's determination of the stock of working capital is based on a typical payment and receipt cycle, and with the following key assumptions evident in AGN's financial model for determination of Reference Tariffs for the proposed revisions to the Access Arrangement:

- receivables are received in 35 days;
- inventory stands for 7 days between cost and sale;
- prepayments are made for an average of 15 days; and,
- creditors are paid after 20 days.

Applying these assumptions to the Total Revenue (excluding the working capital allowance), AGN calculates the working capital allowance as shown in Table 2.1 below. It should also be noted that the calculation of each of these items is referenced to the revenue or cost base to which they relate. This relationship is as follows:

- receivables are related to total sales revenue (net of the working capital requirement); and,
- inventory, prepayments and creditors are all related to the sum of operating and maintenance expenditure and capital expenditure through the year.

Table 2.1 below shows how the AGN calculates the working capital requirement. For example, receivables are based on an assumed lag of 35 days in payment. With 365 days of sales, 35 days will be receivable at any point in time. Hence, 9.6% (35/365) of the sales revenue of $119.7 million, or $11.47 million will be outstanding over the course of a year, and need to be funded by working capital. In a similar manner, inventory, prepayments and creditors are related to outlays associated with 'operating and maintenance costs' and 'capital expenditure'.

[5] This aspect of comparative regulatory approach is discussed in more detail in section 4.2 below.

Table 2.1

CALCULATION OF WORKING CAPITAL: AGN PROPOSAL ($M)

	Days	2005	2006	2007	2008	2009
1. Total Revenue		119.66	118.89	118.59	119.96	121.61
2. Operating and Maintenance Cost		40.45	39.66	38.81	38.75	38.75
3. Capital Expenditure		27.61	27.05	25.24	30.96	31.66
4. Total		68.06	66.70	64.05	69.71	70.41
5. Receivables [(35 ÷ 365) × (1)]	35	11.47	11.40	11.37	11.50	11.66
6. Inventory [(7 ÷ 365) × (4)]	7	1.30	1.28	1.23	1.34	1.35
7. Prepayments [(15 ÷ 365) × (4)]	15	2.80	2.74	2.63	2.86	2.89
8. Creditors [(20 ÷ 365) × (4)]	20	-3.73	-3.665	-3.51	-3.82	-3.86
Working Capital [(5) + (6) + (7) + (8)]		**11.85**	**11.77**	**11.72**	**11.88**	**12.05**

Source: AGN revised Access Arrangement. Note: this table is in real terms.

AGN determines the cost of working capital by multiplying the real estimated stock of working capital at the end of each period (as shown in Table 2.1 above) by the real pre-tax WACC of 8.5% to yield the required allowance for working capital. The values thus derived are indicated in Table 2.2. For comparability, the projected required return on working capital is also presented in nominal terms by applying a 2.2% CPI assumption, consistent with AGN's proposals.[6] On average, the nominal return on working capital for the period would be approximately $1.1 million under these assumptions.

Table 2.2

CALCULATION OF WORKING CAPITAL ALLOWANCE: AGN PROPOSAL ($M)

	2005	2006	2007	2008	2009
Working Capital (real value)	11.85	11.77	11.72	11.88	12.05
Real Return on Working Capital	1.01	1.00	1.00	1.01	1.02
Nominal Return on Working Capital	1.03	1.04	1.06	1.10	1.14

Source: AGN revised Access Arrangement

[6] See The Allen Consulting Group, May, 2004, *AlintaGas Networks Revised Access Arrangement: Proposed Rate of Return*, Report to Economic Regulation Authority, p.2.

2.3 Comparison with the approach adopted in the first Access Arrangement Period

Applying the same methodology used in calculating a cost of working capital in the first Access Arrangement Period, including a 'net lag' assumption of 100 days, but substituting AGN's pre-tax nominal WACC assumption of 10.79% and 2.2% inflation assumption, would result in working capital allowances of approximately $1.2 million per annum in nominal terms, as shown in Table 2.3.[7]

Although it arrives at a similar allowance for working capital as currently proposed under revisions to the Access Arrangement, the approach currently being proposed by AGN is not consistent with the approach that was adopted for the first Access Arrangement Period. This is because the original approach calculated a working capital requirement only in respect of the operating and maintenance cost component of Total Revenue, while AGN's current proposal is based on a working capital allowance for both the operating and maintenance and capital components of total revenue.

Table 2.3

AGN WORKING CAPITAL ALLOWANCE: APPROACH USED IN FIRST ACCESS ARRANGEMENT ($M)

	2005	2006	2007	2008	2009
Operating and Maintenance Cost	41.34	41.42	41.43	42.27	43.20
Working Capital	11.33	11.35	11.35	11.58	12.84
Return on Working Capital	1.22	1.22	1.22	1.25	1.28

Source: AGN Revised Access Arrangement and ACG analysis. Numbers are in nominal terms.

[7] Working capital required is calculated as 27.4% (100/365 days) of the revenue, which is equal to the 'operating and maintenance cost component'.

Chapter 3

Guidance provided by the Gas Code

3.1 Guidance provided by Section 8.1 of the Code

The Code provides no explicit guidance as to whether a specific allowance for working capital should be made in the determination of Total Revenue. Neither does the Gas Code's supporting legislation nor the Attachment A of the Code, which sets out a detailed list of cost items that may be taken into account when assessing reference tariffs.

Section 8.1 of the Code lists a number of objectives, which are to be achieved:

> A Reference Tariff and Reference Tariff Policy should be designed with a view to achieving the following objectives:
>
> (a) providing the Service Provider with the opportunity to earn a stream of revenue that recovers the efficient costs of delivering the Reference Service over the expected life of the assets used in delivering that Service;
>
> (b) replicating the outcome of a competitive market;
>
> (c) ensuring the safe and reliable operation of the Pipeline;
>
> (d) not distorting investment decisions in Pipeline transportation systems or in upstream and downstream industries;
>
> (e) efficiency in the level and structure of the Reference Tariff; and
>
> (f) providing an incentive to the Service Provider to reduce costs and to develop the market for Reference and other Services.

In order to achieve these objectives it is necessary that the Total Revenue determined in accordance with section 8 of the Code be sufficient to ensure that the service provider has appropriate incentives to continue to invest in the Reference Service. On the other hand, it would not be an efficient solution for the service provider to be allowed a target revenue that was more than that required to provide the Reference Service at least cost. What investors require, then, is to be provided with an expectation that that with efficient management they will earn the opportunity cost of funds employed in the provision of the Reference Service.

This can be represented mathematically. Denoting a project's cost as PC, investors will continue to invest, if over the time periods (i) of its life (T) the expected revenue (R_i) less expected cost (C_i), when discounted at the cost of capital (r) to a present value will equal or exceed PC. This assumes that the project has no market value at the end of time T, and can be expressed as follows:

$$PC = \sum_{i=1}^{T} \frac{R_i - C_i}{(1+r)^i} \qquad (2)$$

If the market value of the future cash flows (R_i - C_i) associated with the project at the end of period n is denoted MV_n, then equation (2) can be re-stated as:

$$PC=\sum_{i=1}^{T}\frac{R_i-C_i}{(1+r)^i}+\frac{MV_n}{(1+r)^n} \quad (3)$$

These expressions imply that the target revenue determined by a regulator, taking account of all assets required to perform the Reference Service, should provide an expected revenue, R_i, such that:

$$RAB_0=\sum_{i=1}^{T}\frac{R_i-C_i}{(1+r)^i}+\frac{RAB_n}{(1+r)^n} \quad (4)$$

where RAB_0 is the regulated asset base at the beginning of a regulatory period, and RAB_n is the regulatory asset base at the end of period n, and R_i and C_i denote all revenues earned and costs incurred at each time i within the regulatory period. Whilst regulators often express the 'target revenue' implicit in equation (4) in an accrual accounting version, it can be demonstrated that these approaches are equivalent.[8]

In summary, the objective for a Reference Tariff, as outlined in section 8.1 of the Code, is to provide the Service Provider with the opportunity to earn a stream of revenue that recovers efficient costs and therefore continues to attract the appropriate level of investment into the industry and provides incentives for cost minimisation. The *ex ante* target revenue set in such a process must satisfy the requirement set out formally in equation (4), notwithstanding the fact that the Service Provider may through superior efficiency and/or the stimulation of additional demand, earn an *ex post* rate of return that exceeds r, the opportunity cost for the investment of resources in a project of the same risk as that faced by the Service Provider in the regulated activity. Whilst the issue of working capital is not considered explicitly under Section 8.1 of the Code, equation (4) implies that all the capital stock incorporated in the regulatory asset base, and all of the revenues and costs should be considered in the provision of an opportunity to earn the recovery of efficient costs, including taking into consideration the timing of the revenue and costs.

3.2 Guidance provided by section 8.4 of the Code

Under Section 8.4 of the Code, three alternative and equivalent approaches are described which may be applied in the derivation of the Total Revenue:

- *Cost of service approach* – Total Revenue is calculated as the sum of a return (the estimated cost of capital) on the regulatory asset base, depreciation, and operating and maintenance costs;

[8] This equivalence is demonstrated in Appendix A in The Allen Consulting Group (March 2002), *Working Capital: Relevance for the Assessment of Reference Tariffs*, Report to the Australian Competition and Consumer Commission.

- *NPV approach* – Total Revenue is calculated by finding the amount of revenue that would provide a present value of future revenue (plus residual value at the end of the regulatory period), equal to the value of assets at the start of the period employing a discount rate which is the estimated cost of capital; and
- *IRR approach* – target revenue is calculated by solving for the revenue that would yield an internal rate of return (IRR) equal to the estimated cost of capital.

It will be seen that the approach to finding the target revenue, which was specified in equation (4) above corresponds exactly with the NPV and IRR approaches set out in section 8.4 of the Gas Code. In fact, all three approaches are consistent with the application of equation (4). As noted in section 3.1 above, the analysis of cash flows requires a consideration of the timing of those cash flows. However, Section 8.4 does not provide specific guidance with respect to timing except to require that the methodologies be applied 'in accordance with generally accepted industry practice', which is not itself defined.

At one time, discounting at intervals of a year appears to have been generally accepted industry practice.[9] However, with increased sophistication being brought to the task of business valuation and investment, and the payment of bi-annual and quarterly dividends[10] it appears that practice has shifted considerably. Indeed, the application of yearly discounting is today seen as an instance of potentially excessive conservatism, since the difference between inaccurate yearly discounting and discounting at more frequent intervals could mean the difference between rejection and acceptance of an investment proposal. Financial analysts in Australia generally calculate forward cash flows on at least a bi-annual basis to capture seasonality effects, which is consistent with a practice of at least bi-annual discounting. It has even been suggested in Brealey and Myers, a leading finance text, that the continuous compounding of cash flows may be more appropriate:[11]

> There is a particular value to continuous compounding in capital budgeting, where it may often be more reasonable to assume that a cash flow is spread evenly over a year than that it occurs at year's end.

[9] Even then, yearly cash flows would have been calculated by reference to monthly cash flow models in which free cash flow in earlier months is compounded at a cash rate to the year end.

[10] The payment of quarterly dividends in the US would also be expected to have influenced quarterly discounting of dividends.

[11] Brealey, R. and S. Myers, (1996), *Principles of Corporate Finance*, McGraw-Hill, 5th Ed., p.44.

In summary, 'generally accepted business practice' with respect to the timing of discounting in investment analysis encompasses approaches ranging from annual to continuous compounding. Therefore, Section 8.4 does not provide any more detailed guidance as to the timing assumption, than is provided by Section 8.1. In particular, the section does not mandate a specific timing assumption, nor does it preclude more precise within-year discounting of cash flows. However, if the timing of cash flows justifies an additional return on working capital, as it does for companies operating in competitive markets, the 'generally accepted business practice' is to calculate the net working capital investment at the time of the investment, which in practice can be undertaken on the basis of monthly accounts. For a regulated monopoly the situation is less straightforward, since the total revenue allowance approved by a regulator has a generally higher degree of certainty than for unregulated firms, and may impart a bias in favour of, or against, the investors in the Service Provider.

3.3 Efficient investment and working capital

Ideally, once the best estimate of the cost of capital (r) has been made, the best estimate of the appropriate target revenue will be obtained through a precise analysis of cash inflows and outflows. Indeed, AGN's proposal on working capital attempts to arrive at a more precise valuation of the cash flows than annual discounting by taking account of leads and lags associated with revenues and expenses over periods as short as seven days. In the limit, a more comprehensive approach would apply discounting on a daily basis, so that required target revenue would reflect precisely the expected cash flows to the capital committed by investors to the service provider's operations, and the opportunity cost associated with that investment. Applying such an approach would require finding $R_{i,t}$ in equation (5) below, such that:

$$RAB_{t,open} = \sum_{i=1}^{365+} \frac{R_{i,t} - C_{i,t}}{(1+r)^{i}} + \frac{RAB_{t,close}}{(1+r)^{365}} \qquad (5)$$

where $R_{i,t}$ and $C_{i,t}$ now denote forecasts of daily revenue and costs respectively for year t, $RAB_{t,open,}$ and $RAB_{t,close}$ denote the regulatory asset base of the assets at the opening and closing of year t, and the other variables are defined as before.[12]

In practice, regulators do not apply the precise model of cash flows represented by equation (5). Instead, regulators make various simplifying assumptions about the timing of cash flows. A simple approach to the timing of cash flow forecasting and discounting reduces the costs of regulatory compliance as well as aiding the transparency associated with the regulatory process. The cost of adopting a simple approach to timing is that it may, under certain circumstances, produce a bias in favour of, or against, the service provider.

[12] The number of days is given as 365+ because the frequency of sales and lags in receiving cash will push the period of cash receipts beyond the end of the year.

3.4 Conclusion on guidance provided by the Code

Whilst the issue of working capital is not considered explicitly under Section 8.1 of the Code, it is a requirement that the service provider be provided with the opportunity to earn a stream of revenue that recovers efficient costs. All the capital stock incorporated in the regulatory asset base, and all of the revenues and costs should be considered, including taking into consideration the timing of the revenue and costs through discounting.

Section 8.4 of the Code implies that, 'generally accepted business practice' should be followed with respect to the timing of discounting in investment analysis. Generally accepted practice varies widely, encompassing timing approaches ranging from annual to continuous compounding. The timing applied in the regulatory process in deriving the Total Revenue is important, as alternative assumptions may be biased in favour of, or against, the Service Provider's investors relative to customers of the Reference Service. Ultimately, this is an empirical question, which is considered in the next two chapters.

Chapter 4

Timing bias in determination of Total Revenue

4.1 Determination of Total Revenue

Abstracting from inflation and taxation issues for simplicity, the formula applied in determination of Total Revenue by the Authority in assessment of AGN's current Access Arrangement was:

$$TR_t = r.\left(\frac{RAB_{t,open} + RAB_{t,close}}{2}\right) + Dep_t + O\&M_t \qquad (6)$$

where TR_t denotes target revenue for year t, r is the opportunity cost of capital, $RAB_{t,open}$ ($RAB_{t,close}$) is the regulated asset base at the commencement (end) of year t, Dep_t is the regulatory depreciation allowance (or return of capital) for year t, and $O\&M_t$ is the forecast of operating and maintenance costs for year t. The initial element, $r.RAB_{t,open}/2 + r.RAB_{t,close}/2$, represents the 'return on capital' component of the target revenue. The 'capital-related' share of target revenue is thus comprised of the depreciation component and return on capital component.

The assumptions implicit in this determination of Total Revenue (equation 6) about the intra-year timing of cash flows can be summarised as follows.

- Half of the annual depreciation is received and half of the annual capital expenditure is undertaken, at the start of the year, with the remainder being received or spent at the end of the year.
- The remainder of the capital-related component of revenue is received at the end of the year (which includes the share of revenue derived from the return on assets in place at the start of the year).
- The timing of the share of revenue in respect of operating and maintenance expenditure is aligned with the timing of these costs.

4.2 Approaches Applied by Other Regulators

The target revenue formula applied by the ACCC is given by:[13]

$$TR_t = r.RAB_{t,open} + Dep_t + O\&M_t \qquad (7)$$

where TR_t denotes target revenue for year t, r is the opportunity cost of capital, $RAB_{t,open}$ is the regulated asset base at the commencement of year t, Dep_t is the regulatory depreciation allowance (or return of capital) for year t, and $O\&M_t$ is the forecast of operating and maintenance costs for year t.

[13] See The Allen Consulting Group, March 2002, p. 14, footnote. 23, which references the ACCC (October 2001), *Post-Tax Revenue Handbook*, p. 12.

The following assumptions about the intra-year timing of cash flows are implicit in this determination of Total Revenue: .

- The share of revenue related to capital costs (return on assets and depreciation) is received at the end of the year.
- Capital expenditure occurs at the end of each year (and therefore enters the opening RAB of the following year).
- The timing of the share of revenue in respect of operating and maintenance expenditure is aligned with the timing of these costs.

By providing a return on the opening assets for the whole of the year, this formulation of Total Revenue would be expected to impart bias in favour of the Service Provider, since the Service Provider is also being provided with a return of capital through depreciation. However, the assumption that capital expenditure is incurred at the end of the year would impart bias against the Service Provider, as capital expenditure can be expected to be incurred throughout the period. As with equation (6), any bias in relation to the revenue component derived by reference to operating and maintenance costs would depend on the relative sizes of leads and lags in the cash cycle, which is ultimately an empirical issue.

The 'capital component' of the Total Revenue as previously determined by the Authority (equation 6) and as determined by the ACCC (equation 7) can be expressed as:

Authority: $$TR_t^{Cap} = r.RAB_{t,open} + \frac{r.(Capex_t - Dep_t)}{2} + Dep_t \qquad (8)$$

ACCC: $$TR_t^{Cap} = r.RAB_{t,open} + Dep_t \qquad (9)$$

where $Capex_t$ is capital expenditure in year t.

From equations (8) and (9) it can be seen that, other things being equal, if the service provider's capital base is growing and $Capex_t > Dep_t$, the Authority's approach (equation (8)) will provide a greater bias in favour of the service provider to the extent of the expression $r.(Capex_t - Dep_t)/2$. The intuition behind this differential is that it provides a return equal to half the new capital investment that would be expected to be made throughout the year and deducts half the return on the depreciating capital base.

Table 4.1 below demonstrates how a number of Australian regulatory bodies approach the derivation of target revenue and their policies in relation to working capital allowances.

All regulators except the ACCC have in the past applied equation 8 (consistent with past practice in Western Australia).

IPART and QCA have applied a full allowance for working capital on total revenue. That is, the working capital allowance is calculated on a value of working capital derived from the full value of target revenue.

In respect of the current Access Arrangement for AGN, the Western Australian Regulator determined a cost of working capital calculated on a value of working capital derived from the operating and maintenance component of Total Revenue. For the component of target revenue that is justified as a return on or return of capital, no working capital allowance has been provided. The logic of this approach is that the capital component of revenue has already been over-provided on a net present value basis.

The ACCC and the ESC (previously the Office of the Regulator General, ORG) have justified providing no allowance for working capital on the grounds that modelling has shown that under either equation 8 or 9, the timing bias in favour of the Service Provider in the derivation of Total Revenue more than compensates for any working capital requirement.

Table 4.1

PAST REGULATORY APPROACHES TO WORKING CAPITAL

Full Working Capital amount allowed on Total Revenue	Working Capital allowance only on O&M component of Revenue	No Working Capital allowance
IPART (Equation. 8)	Regulator/Authority (Equation 8)	ACCC (Equation. 9)
QCA (Equation 8)		ORG/ESC (Equation. 8)

Source: Various decisions of regulatory bodies

The ACCC has articulated its position on working capital in connection with the Eastern Australian Pipeline's (EAPL) application to the National Competition Council (NCC) for partial revocation of the Moomba-Sydney Pipeline System in the following terms:[14]

> The modelling adopted by the Commission assumes that all cash flows occur at the **end of the year**, when in reality cash flows occur during the course of the year… Were the Commission to include an allowance for working capital, it would have to adopt more sophisticated modelling techniques which more accurately reflect the timing of cash flows over the course of the year. Any allowance for a return on working capital would likely be significantly offset by a reduction in revenue as a result of greater precision in the modelling of cash flows.

In September 2001 the ESC (then the ORG) produced a Position Paper in connection with the 2003 Review of Gas Access Arrangements, drawing on studies conducted in relation to price reviews for electricity distribution. With respect to working capital it was concluded:[15]

> The office assessed whether [equation 8] was likely to lead to a shortfall for the electricity distributors, having regard to the likely timing of revenue received, and costs incurred, within each year for the businesses. Its conclusion was that, far from leaving a shortfall, this formulation would be expected to provide a *surplus*. In that instance, the Office chose not to deduct the estimated premium, not to explore a more complex formulation that may have eliminated the surplus, but just concluded that an additional allowance for working capital is not required.

[14] Australian Competition and Consumer Commission (September 2002) *EAPL's application to the NCC for partial revocation of coverage of the Moomba to Sydney Pipeline System*, p. 10.

[15] Office of the Regulator-General (September 2001) *2003 Review of Gas Access Arrangements – Position Paper*, p. 47.

Similarly, in its Discussion Paper published in connection with the Electricity Price Review, ESCOSA has followed the ESC's logic:[16]

> Given the likely similarities in the within-year timing of cash flows between ETSA Utilities and the Victorian electricity distributors it would … suggest that the use of the … target revenue formula set out above – but with no additional allowance in respect of working capital – may be appropriate. An alternative would be to undertake an empirical analysis of the within-year timing of cash flow for ETSA Utilities, and potentially to derive a target revenue formula that provides a closer fit to costs.

In a subsequent 'Preliminary Views' paper,[17] ESCOSA chose to recommend applying the simpler target revenue formula that over-compensates the Service Provider, and to include an additional return in respect of working capital, but only on the 'operating and maintenance component' of target revenue. A 'net lag', from the incurring of expenditure to the receipt of revenue, of 39 days was recommended. The formula recommended for estimating working capital was:

$$Working\ Capital = \left(\frac{Lag(Days) - Lead(Days)}{365} \right) x\ Operating\ Expenditure$$

where the 'net lag' of 39 days was estimated from a revenue lag of 73 days and an expense lead of 34 days. Applying this formula to ETSA Utilities, ESCOSA suggested a working capital allowance of $1.1 million per annum would be appropriate rather than the current allowance of around $9 million per annum.

4.3 Bias in the capital component of Total Revenue

Table 4.2 below shows the extent of bias that would be created by the timing assumptions inherent in the Total Revenue formula previously applied by the Economic Regulation Authority in Western Australia if it were to be applied for the Access Arrangement Period of 2005 to 2009.

The first column of Table 4.2 shows that for 2005, assuming an opening RAB of $634.4 million, depreciation of $25.2 million, capital expenditure of $27.6 million and a real pre-tax WACC of 8.5%, the 'capital component' of Total Revenue would be $79.23 million. The present value of the capital component at the start of 2005, discounted at the WACC, is $73.02 million. This is the present value of future cash flow in the regulatory model that is required to justify the current (start of 2005) regulatory asset base of $634.4 million given the end of 2005 regulatory asset base of $636 million. The regulatory model applies annual discounting of cash flows, whilst quarterly discounting is applied to the three cash-cycle scenarios.

[16] Essential Services Commission of South Australia (August 2003) *Electricity Distribution Price Review: Return on Assets*, Discussion Paper, p.50.

[17] Essential Services Commission of South Australia (January 2004) *Electricity Distribution Price Review: Return on Assets, Preliminary Views,* pp. 86-88.

Table 4.2

BIAS CREATED IN THE 'CAPITAL COMPONENT' OF TOTAL REVENUE IN 2005 BY THE ECONOMIC REGULATION AUTHORITY'S TOTAL REVENUE FORMULA ($ MILLION)

	Total Revenue formula previously applied by the Authority	30 day frequency and 30 day delay	60 day frequency and 30 day delay	90 day frequency and 30 day delay
2005 start	0.05			
2005 quarter 1		13.20	13.20	
2005 quarter 2		19.81	13.20	19.81
2005 quarter 3		19.81	26.41	19.81
2005 quarter 4	79.18	19.81	13.20	19.81
2006 quarter 1		6.60	13.30	19.81
Sum of target revenue	79.23	79.23	79.23	79.23
PV of target revenue	73.02	74.80	74.55	73.79
Bias in AGN's favour		1.78	1.53	0.76

Source: AGN, ERA and ACG analysis

The first column in Table 4.2 calculates the present value of the Total Revenue formula that was previously applied by the Authority (equation 8). The first component of this column, $0.05 million, is the return on half the depreciation less half the capital expenditure that is assumed to be obtained at the beginning of the year. The other half, together with the return on the asset base and depreciation, amounts to $79.23 million, and is assumed to be obtained at the end of the year. Together, these amounts have a present value of $73.02 million when discounted on an annual basis.

The last three columns of Table 4.2 calculate the present value of the Total Revenue to AGN under alternative assumptions about customer billing (frequency) and delay (days receivables). The Total Revenue is assumed to be earned evenly in each of the four quarters of the year.[18] If billing is every 30 days with a 30-day delay, applying quarterly discounting to the cash flows yields a present value of $74.8 million. In this case the bias in favour of AGN in the 'capital component' of Total Revenue is $1.78 million, because a set of cash flows would be generated by AGN valued at $1.78 million more than is required to justify the opening valuation of the RAB at AGN's WACC. If billings were only undertaken every three months (90 days) with a further 30-day collection period, the bias in favour of the service provider falls to $760,000. If more frequent periodic discounting were applied, the extent of bias in favour of the AGN would be greater.

[18] This is a simplifying assumption, and one that would bias the result against AGN, however it has a small PV effect given that there is relatively slow growth in revenues from year to year. To be more precise, it would be necessary to incorporate the full implications of seasonality in sales revenue.

In summary, the Total Revenue formula previously applied by the Economic Regulation Authority in assessment of AGN's 2000 to 2004 Access Arrangement is consistent with that employed by most Australian regulators. It is a simple formula that includes annual discounting, contrary to the fact that revenues earned by AGN would be spread over the year. This creates a source of benefit to AGN. For example, quarterly receipt of the cash flows received by AGN on the 'capital component' of Total Revenue, even with unrealistically pessimistic assumptions about billings and delays to receipt of cash, would result in a significant benefit to AGN that is likely to be similar to or in excess of the claim that AGN has proposed in relation to working capital (i.e. approximately $1 million per annum in real terms).

Given the that the 'capital component' of the AGN Total Revenue provides a bias in favour of the Service Provider, it follows that any working capital allowance should not double count by providing an allowance based on that component of Total Revenue that comprises a return on capital and depreciation.

4.4 The operating and maintenance component of Total Revenue

Given that the capital component of Total Revenue does not require a further allowance for financing, the working capital allowance proposed by AGN may be recalculated considering only the operating and maintenance cost component. This calculation is undertaken below using the same basic assumptions about cash cycle leads and lags that AGN is proposing, and AGN's proposed real pre-tax WACC of 8.5%.

The reworked working capital allowance in Table 4.3 shows the returns required for the financing of the operating and maintenance component of Total Revenue. The result is a significant reduction in the working capital allowance from around $1.1 million per annum to around $350,000 per annum.

Table 4.3

AGN'S WORKING CAPITAL DETERMINED FROM THE OPERATING AND MAINTENANCE COMPONENT OF TOTAL REVENUE ($MILLION)

	2005	2006	2007	2008	2009
Operating and maintenance costs	40.45	39.66	38.81	38.75	38.75
Receivables	3.88	3.80	3.72	3.72	3.72
Inventory	0.78	0.76	0.74	0.74	0.74
Prepayments	1.66	1.63	1.60	1.60	1.60
Creditors	-2.22	-2.17	-2.13	-2.12	-2.12
Working capital	4.10	4.02	3.93	3.93	3.93
Real return on working capital	0.35	0.34	0.33	0.33	0.33
Nominal return on working capital	0.36	0.36	0.36	0.36	0.37

Source: ACG analysis based on AGN data

Table 4.3 applies the same formula as Table 2.1 to derive the working capital allowance, but obtains a much smaller requirement as it is based on only the 'operating and maintenance component' of Total Revenue. We have seen that this is justifiable in view of the fact that the other, larger, 'capital component' of the target revenue is over-compensated by a large margin.

4.5 Conclusion on the re-estimated AGN working capital allowance

The estimated cost of working capital for AGN derived on the basis of solely the 'operating and maintenance component' of Total Revenue is around $350,000 per annum. However, the extent of over-compensation of AGN on the 'capital component' probably exceeds the allowance for working capital that would be made if AGN's assumptions relating to the whole of the target revenue were to be accepted. Hence, there is an argument for concluding that no allowance for working capital should be made: an approach that has been adopted by the ACCC and ESC.