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Comment on Select Submissions to the Commission's Input Methodologies Review

A report for Powerco

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1. Introduction and Summary

Powerco has asked us to review and comment on two expert reports that were submitted in response to the Commerce Commission's (the Commission's) invitation to contribute to the problem definition phase of the input methodologies (IMs) review,[1] namely:

- Ireland, Wallace and Associates Limited (IWA)'s report on behalf of the Major Electricity User's Group (MEUG) regarding the application of Black's Simple Discount Rule; and
- CME's report on write-downs of stranded electricity network assets, submitted by Sustainable Electricity Association New Zealand (SEANZ).

In relation to the IWA report, we find that:

- despite its name, applying Black's Simple Discount Rule (in any meaningful way) to regulated entities would be far from simple and, in our opinion, it is highly unlikely such analysis would be useful to the Commission; and
- IWA has misapplied the rule by comparing undiscounted cash flow streams – by contrast, a comparison of discounted cash flow streams indicates a much closer relationship than suggested by IWA (bearing in mind that we have not carefully reviewed the assumptions underpinning IWA's 'certainty equivalent' transformation).

Our review of CME's paper finds that:

- investment in embedded generation and battery storage is highly unlikely to reduce the value that consumers derive from maintaining a connection to the electricity network;
- further, it is unlikely investment in such capability will significantly reduce the cost of providing network services (and, in some circumstance, may increase it); and
- the regulatory regime has consciously not been designed in such a way as to provide for the writing-down of assets on account of their 'stranding'.

We are not aware of any evidence that solar PV in New Zealand has resulted in the 'stranding' of network assets. Notwithstanding, even if this were to be the case, the regulatory regime has been designed on the basis that it would be inappropriate to write-down the value of any 'stranded' assets without some form of regulatory compensation for the affected lines businesses.

The remainder of this report is structured as follows:

- section 2 provides a brief synopsis of Black's Simple Rule and the paper by Loderer, et al before reviewing IWA's application of the rule to Transpower; and
- section 3 comments briefly on SEANZ's proposal regarding asset revaluations in light of growing investment in embedded generation assets.

[1] Commission (June 2015) *Input methodologies review – Invitation to contribute to problem definition*

2. Black's Simple Discount Rule

Following the Commission's invitation to contribute to the topics considered in the context of its IMs review, MEUG asked IWA to:

(a) demonstrate how the 'Black's Simple Discount Rule' (Black's rule) can be used as a potential cross-check for price-quality control paths based on cost of capital; and
(b) prepare two, related spreadsheet outputs, being the replication of the example used by Loderer *et al* and a version adapted to illustrate a framework referencing the recent Transpower individual price-quality path determination.

As a result of its application of Black's Rule, IWA concluded that:[2]

> While the [net cash flows] NCFs are not strictly comparable, based on the stated set of assumptions the MAR derived NCFs materially exceed Black's Rule certainty equivalent NCFs over the term of the regulatory period.

Powerco has asked us to review IWA's analysis and comment on its implications. This report therefore considers IWA's report and the academic paper it draws upon, by Loderer, Long and Roth (2008).[3] In short, we conclude that:

- despite the name, applying Black's Simple Discount Rule (in any meaningful way) to regulated entities would be far from simple and, in our opinion, it is highly unlikely such analysis would be useful to the Commission; and
- IWA has misapplied the rule by comparing undiscounted cash flow streams – by contrast, a comparisons of discounted cash flow streams indicates a much closer relationship than suggested by IWA (bearing in mind that we have not carefully reviewed the assumptions underpinning IWA's 'certainty equivalent' transformation).

2.1 The theory, as described by Loderer *et al*

The underlying theory behind Black's Rule is that there are two alternative ways of measuring the value of a business, both of which should arrive at the same answer:

1. discount 'expected' cash flows by a discount rate that is commensurate with the risk profile of those cash flows; or
2. derive 'certainty equivalent' cash flows from the risk profile of the cash-flow items and discount these by the risk free rate.

In essence, a certainty equivalent cash flow is the risk-free cash flow at which the investor would be indifferent between it and the more risky expected cash flow.

In practice, arriving at certainty equivalent cash flows is far from simple; Loderer *et al* recognise this limitation, stating that:[4]

> Estimating conditional mean [net cash flows] is not straightforward, which has probably dissuaded textbooks from recommending the rule and discouraged practitioners from adopting it…The rule, however, moves the focus of the analyst away from assessment of the discount factors and puts

[2] IWA (August 2015) *Input Methodology Review – "Black's Simple Discount Rule" a cross check on the IM Cost of Capital*, a report for Major Electricity Users' Group, paragraph 5.3

[3] Claudio Loderer, John Long and Lukas Roth (2008) *Black's Simple Discounting Rule*, the Bradley Policy Research Centre Financial Research and Policy Working Paper No. FR 08-25

[4] Claudio Loderer, John Long and Lukas Roth (2008) *Black's Simple Discounting Rule*, the Bradley Policy Research Centre Financial Research and Policy Working Paper No. FR 08-25, p 1

> it squarely on the more challenging, and arguably more relevant problem of gauging the project's relevant cash flows.

The application of Black's Rule set out in Loderer's paper is based on the assumption that there is a security with a return that is linearly related to the project's cash flow. The return on that security is referred to as the 'benchmark return'.

The net cash flows of the project can then be expressed in terms of the risk free rate and a premium that is related to the benchmark return. This can be re-expressed as the value of the conditional expected cash flows discounted by the risk free rate, where the conditional expected cash flows are equivalent to assuming that the benchmark return equals the risk-free rate. At this point, the cash flow of the business will be at its 'certainty equivalent' level.

This equivalency can then be manipulated to show that the project can be valued on the basis of the conditional cash flows and the risk free rate.

However, as Loderer states:[5]

> The problem in applying Black's rule is the estimation of conditional mean NCFs. As we have said, these cash flows are those we observe on average when the return on a benchmark portfolio equals the risk-free rate. Yet it is not clear how we can easily obtain meaningful estimates of those cash flows.

Loderer *et al* address this by comparing the probability distribution of the benchmark security with the probability distribution of the project cash flows. This can then be used to determine the cash flow stream that equates with the benchmark security providing a rate of return equivalent to the risk free rate. Using a simplifying assumption that returns are normally distributed, Loderer *et al* suggest that only two data points (ie, mean and standard deviation) are required from the project managers.

In other words, for the purpose of valuing a the cash flows anticipated to arise from a project, using the (lower) risk free rate of return requires the use of (adjusted, lower) cash flows in order to arrive at a valuation that properly takes account of the riskiness in expected cash flows.

In our opinion, although this approach would, as matter of principle, be able to be implemented by regulated businesses in New Zealand, it is highly unlikely to provide an easier, less information-intensive, or more precise alternative to the building block/rate of return current methodology for deriving default or customised price paths. Loderer *et al* conclude by stating:[6]

> The hurdles that our implementation of Black's rule has to clear are mainly two. We have to find a benchmark security with the appropriate characteristics, and managers have to be able to ignore idiosyncratic risk in their cash flow projections. Even though traditional valuation approaches are also confronted with these two problems, our procedure is not always better, easier or more precise than traditional valuation methods. Our approach, however, is a feasible and theoretically sound alternative to those methods. It is therefore a helpful addition to the tool box of valuation.

2.2 IWA's application of Black's Rule

It is difficult to identify from IWA's paper and spreadsheets how MEUG envisages the Commission using this valuation approach for the purposes of deriving the cash flow projections that underpin default or customised price paths. However, in its analysis of Transpower's revenues, IWA concludes at paragraph 5.3 that:[7]

[5] Page 8

[6] Page 29

[7] IWA (August 2015) *Input Methodology Review – "Black's Simple Discount Rule" a cross check on the IM Cost of Capital*, a report for Major Electricity Users' Group, paragraph 5.3

> While the [net cash flows] NCFs are not strictly comparable, based on the stated set of assumptions the [maximum allowable revenue] MAR derived NCFs materially exceed Black's Rule certainty equivalent NCFs over the term of the regulatory period.

From this statement, the reader is presumably intended to infer that Transpower's regulated MAR has been set at a level that is too high.

In reaching this conclusion, MEUG has compared:

- the (undiscounted) capital charge provisions incorporated into the MAR over the (financial years) 2016 to 2020; with
- IWA's assessment of the (undiscounted) 'certainty equivalent' of those capital charge provisions.

IWA has based its analysis of the capital charge on the assumption that this will equate to Transpower's net operating profit after tax.

Leaving aside the many questions that are likely to arise in relation to IWA's assessment of profits and certainty equivalents, in making this comparison IWA has misinterpreted the fundamental underpinning of Black's Rule – namely, that it is the *discounted* streams of expected and conditional cash flows that should equate to one another, rather than the sum of the undiscounted cash flows. In other words, IWA should have compared:

- the discounted capital charge provisions – discounted by the regulatory WACC; with
- the estimated 'certainty equivalent' capital charge provisions – discounted by the risk free rate.

By its very nature, the undiscounted value of the certainty equivalent cash flows will lie below the undiscounted value of the expected cash flows. The difference is the value of the risk associated with the uncertain expected cash flows.

We have not reviewed the way in which IWA has arrived at its certainty equivalent cash flow stream and offer no comment on the validity of its estimates. However, we do note that correcting for IWA's fundamental error brings the valuation of the two cash flow streams significantly closer together than otherwise suggested. Whereas IWA found a difference of $253m between the undiscounted cash flow streams, the difference between the discounted cash flow streams is $57.96m.

We set out these calculations in the table overleaf.

Table 1 Comparison of discounted and undiscounted cash flows ($m)

Year	Capital Charge Allowance in MAR, $m (discount rate = 7.19%)[1]		IWA's certainty equivalent[4], $m (discount rate = 2.94%)	
	Undiscounted[2]	Discounted[3]	Undiscounted	Discounted
2016	332.5	310.20	301.15	292.41
2017	339.1	295.13	295.55	278.64
2018	342.8	278.34	290.15	265.62
2019	345.9	262.02	285.81	254.05
2020	346.6	244.94	280.31	241.94
2016-2020	1,706.9	1,390.63	1,453.0	1,332.67

Sources: (1) WACC, paragraph 3.4 of Companion paper to final determination of Transpower's individual price-quality path for 2015-2020 *(2)IWA report, Appendix B (3) HoustonKemp calculations (4) All figures in these columns from IWA's report, Appendix D*

The simplifying assumptions upon which IWA has relied are unlikely to be sufficient to base any credible assessment of whether the allowed rate of return is above or below that suggested by a benchmark security. Undertaking such an exercise to a sufficiently rigorous standard would necessarily draw on the views of businesses regarding the probability distribution of their future cash flows. The unverifiable nature of such information would further complicate any attempted implementation of Black's Rule.

Further, care must be taken in interpreting any difference between the NPVs of these cash flows, because the regulatory WACC enters the estimated NPV of both the expected and certainty equivalent cash flows. As the regulatory WACC increases:

- the NPV of the certainty equivalent will increase due to the impact on cash flows:
  - certainty equivalent cash flows will increase, albeit by less than the expected cash flows; but
  - there will be no impact on the applied discount rate;
- the NPV of the regulatory allowance will be affected in two ways:
  - expected cash flows will increase; and
  - the discount rate will also increase; in consequence
  - the net impact on the NPV is positive (based on Transpower's information).

We provide a simple estimate of how an increase in the WACC may feed through the analysis in the following table. This indicates that increasing the regulated WACC *reduces* the difference between the two valuation approaches. It should be noted that this is based on maintaining the relationship between the expected and certainty equivalent cash flows as set out by IWA. We provide this purely for illustrative purposes without commenting on the validity of IWA's approach to estimating certainty equivalent cash flows. Nonetheless, this example illustrates a further facet of the complexity of trying to apply Black's Rule as a cross check in the current context.

Table 2 Comparison of discounted and undiscounted cash flows with higher regulatory WACC ($m)

Year	Capital Charge Allowance in MAR, $m (discount rate = 8%)[1]		IWA's certainty equivalent[4], $m (discount rate = 2.94%)	
	Undiscounted[2]	Discounted[3]	Undiscounted	Discounted
2016	369.96	342.55	335.13	292.41
2017	377.30	323.48	328.79	278.64
2018	381.41	302.78	322.89	265.62
2019	384.87	282.89	318.00	254.05
2020	385.64	262.46	311.88	241.94
2016-2020	1,899.19	1,514.16	1,616.69	1,484.86

2.3 Conclusion

Black's Rule provides a theoretical, alternative valuation technique for the purposes of valuing a stream of cash flows that may be associated with a project or a business.

However, in our opinion Black's Rule is not well-suited to providing a cross-check on the regulated rate of return in the current context, since:

- its application would be information-intensive and costly;
- determining the certainty equivalents would be highly controversial and reliant on 'soft' information regarding probabilities and expectations that are not easily verifiable;
- it is unclear how the Commission should interpret results from the application of Black's Rule:
  - the relatively untested nature of Black's Rule makes it likely the Commission could have less confidence in its results than the current WACC methodology, rendering the results of such (expensive and time-consuming) analysis moot; and
  - given the complex way in which the regulatory WACC feeds through to the NPV calculations, it is not easy to interpret a difference between the two NPVs.

In our opinion, it is highly unlikely such analysis would be useful in the current context.

Furthermore, although we have not undertaken a detailed review of the certainty equivalents proposed by IWA (which would require considerable information from Transpower) we note that the fundamental flaw in the analysis renders IWA's conclusions invalid.

3. Revaluing Network Assets

CME's paper (submitted by SEANZ but written for Australia's Consumer Advocacy Panel and sponsored by Australia's Total Environmental Centre) argues that the value of network assets should be written-down because the level of the services these assets provide is declining in the face of increased investment in embedded generation assets. CME notes:[8]

> Networks will still be valuable in an environment of pervasive distributed generation and storage but it is difficult to see that they will be anywhere near as valuable as they have been in the traditional model of monopoly shipper from centrally-dispatched production, to consumers who at that time had no or limited ability to substitute their electricity demand.

We have three, overarching comments on CME's observation:

1. investment in embedded generation and battery storage is highly unlikely to reduce the value that consumers derive from maintaining a connection to the electricity network;
2. further, it is unlikely that investment in such capability will significantly reduce the cost of providing network services (and, in some circumstance, may increase it); and
3. the regulatory regime has consciously not been designed in such a way as to provide for the writing-down of assets on account of their 'stranding'.

We are not aware of any evidence that solar PV in New Zealand has resulted in the stranding of network assets. Notwithstanding, even if this were to be the case, the regulatory regime has been designed on the basis that it would be inappropriate to write-down the value of any 'stranded' assets without some form of regulatory compensation for the affected lines businesses.

3.1 Customers will continue to value network connection

Electricity systems throughout the world have been experiencing unprecedented change as significant investment takes place in renewable, intermittent generation sources (IGS). Solar PVs in particular are affecting the role of electricity networks, which are increasingly being used to transmit power between customers, rather than simply from large, centralised generators to customers. One consequence is that networks have taken on the dual role of providing:

- a source of power to customers with IGS at times when own consumption exceeds their own IGS output; and
- the means by which those customers can 'sell' electricity to others within the network.

Analysis by a range of independent, third parties[9] systematically demonstrates that the practicalities of solar PV mean that it will become part of the mix of energy sources rather than providing the basis for customers to eliminate their need for continued network connection. Solar PV output is highly affected by weather conditions and cannot be depended on to provide electricity at all times.

Further, as is the case for most energy systems, the periods when solar PV output in New Zealand is at its greatest tend not to coincide with either daily or annual network coincident peak demand periods. Although battery technology is advancing, it is unlikely that consumer level energy storage costs will fall by enough to make it economically viable for any significant number of New Zealand customers to choose to disconnect from the grid.

[8] CME (April 2015) *Write-downs to address the stranded assets of electricity networks in the National Electricity Market: evidence and argument*, Page 35

[9] See, for example, Grattan Institute (May 2015) *Sundown, sunrise – How Australia can finally get solar power right*

New Zealand customers investing in solar PV are, then, unlikely to change their network capacity (peak usage) requirements in any significant way. To put this another way, customers will continue to value the option of being able to draw electricity from the network at any time, and thereby to offset the risks associated with solar PV electricity not being available during cloudy periods or non-daylight hours. Further, as recognised by SEANZ, customers with solar PV will also value the network as a means by which they are able to sell any excess electricity to other customers during periods of peak solar PV output.

3.2 Investment in embedded generation unlikely to reduce network costs

Embedded generation sources change the role of a network from the simple transmission of electricity from large, centralised generators, to transmission between customers. The resultant changes in power flows across the network have a number of potential implications, including:

- a reduction in the need for network upgrades to satisfy increases in peak electricity demand – for example, localised generation may delay or avoid the need for substation capacity upgrades (a benefit);
- a reduction in the cumulative stress placed upon the network from the over-loading of components over extended periods (a benefit); and
- a reduction in voltage stability in localised parts of the network, due to the intermittent nature of solar PV output, leading to the need for network investment to maintain power quality (a cost).

The costs and benefits to a network from increased solar PV investment depend on the particular circumstances of that network and the relevant weather conditions. Capacity requirements are a more significant determinant of the cost of providing network services than total usage. Since most solar PV generation in New Zealand does not coincide with either daily or annual network coincident peak demand periods, it is unrealistic to expect that network costs will be significantly reduced.

3.3 The nature of the regulatory regime

The IMs do not specifically address asset stranding, but the Commission's *Reasons Paper* states that:[10]

> For various reasons, the use of an asset, or demand for the service that asset provides may fall away unexpectedly during the asset's lifetime. Where this happens, the asset becomes 'stranded'.
>
> The IM Determinations do not explicitly address stranded assets. As a result, where demand for the asset falls away, regulated suppliers may retain the asset in the RAB value for the purpose of ID, and continue to depreciate the asset over its remaining asset life. Where a regulated supplier anticipates that this will occur in the future:
>
> a. under the standard depreciation approach the supplier may reduce the physical asset life, where the asset meets the criteria for a 'reduced life asset'…; or
>
> b. the supplier may apply to implement accelerated depreciation through a CPP.

There is no reason to presume that this approach, including the option of accelerating depreciation, would not be appropriate should lines businesses identify that certain assets are likely to be stranded in the future (say, through widespread disconnection from the network) due to solar PV investment.

It is on the basis of this proposed treatment of asset stranding risk that the allowed rate or return or regulatory weighted average cost of capital (WACC) has been established by the Commission, and businesses investment decisions duly undertaken. Network prices have not been set as if lines businesses are to bear the risk of asset stranding in the form of uncompensated asset write-downs.

[10] Commission (December 2010), paragraphs E11.1 to E11.2

Altering the regulatory approach, without making recompense to businesses, would reduce confidence in the regulatory framework and, ultimately, risk increasing costs to consumers.

3.4 Conclusion

Although investment in solar PV generation is altering the way in which consumers utilise the electricity network, it seems highly unlikely to result in consumers choosing to disconnect from the network or in network investment costs being significantly reduced. Cost-based pricing, reflecting the costs that various customers impose on the network service provider, are required to send appropriate investment signals to both consumers and service providers.

At this point, we are not aware of any evidence that solar PV investment has resulted in the 'stranding' (say, through significant disconnection from the network) of elements of New Zealand's electricity network. However, in the event such developments were to become a realistic prospect, the regulatory framework is capable of addressing this risk by allowing businesses to accelerate the recovery of network investment costs (ie, depreciation) rather than through (uncompensated) asset write-downs. Changing the regulatory framework such that businesses were required to bear the risk of asset stranding without being compensated for this risk would be inconsistent with outcomes under workably competitive conditions.

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