Compensation for Directions in Queensland on 28 and 29 March 2017

Independent Expert Draft Report by Harding Katz Pty Ltd

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1. Introduction

1.1. Background

At 1425 hrs on Tuesday 28 March 2017, AEMO reclassified the loss of multiple transmission lines between Nebo and Ross as a credible contingency due to tropical cyclone Debbie (Market Notice 58264).

For the period of the reclassification, AEMO applied a network constraint to limit the Ross cutset flow to be equal to or less than 260 MW. AEMO issued directions to Mt Stuart Units 2 and 3, as there was insufficient market response to maintain this 260 MW limit (Market Notices 58266, 58276 and 58279). In particular:

- AEMO issued multiple directions to Origin Energy Electricity Limited (Origin) between the Dispatch Interval (DI) ending 1445 hrs on 28 March 2017 and the DI ending 0400 hrs on 29 March 2017 (the Directions).
- The Directions required Origin to synchronise Mt Stuart Units 2 and 3 as soon as possible and follow dispatch targets.
- Origin acted in accordance with the Directions.

AEMO has determined that the Directions relate to the provision of energy, with the affected periods for the purpose of the Direction compensation being:

- for Mt Stuart Unit 2, from DIs ending 1505 hrs on 28 March 2017 to 0400 hrs on 29 March 2017; and
- for Mt Stuart Unit 3, from DIs ending 1445 hrs to 1500 hrs on 28 March 2017, and from DIs ending 1605 hrs on 28 March 2017 to 0400 hrs on 29 March 2017.

AEMO determined the total compensation amount for Origin to be $187,868.45 for Mt Stuart Unit 2 and Mt Stuart Unit 3. The compensation amount was calculated in accordance with Clause 3.15.7(c) of the National Electricity Rules (the Rules).

Origin subsequently claimed additional compensation of $645,326 under clause 3.15.7B(a) of the Rules.

In accordance with Clause 3.15.7B(c)(1) of the Rules, AEMO appointed Harding Katz Pty Ltd as an Independent Expert to assess and determine the compensation for Origin, comprising:

- the amount of compensation Origin is entitled to receive under clause 3.15.7 of the Rules; and

- the claim for additional compensation made by Origin under clause 3.15.7B of the Rules.

This draft report has been produced pursuant to this appointment and in accordance with clause 3.12.3 of the Rules.

1.2. Invitation for Submissions

In accordance with clause 3.12.3(c)(2) of the Rules and AEMO's intervention settlement timetable, submissions are invited on this draft report from Origin, being the *Referred Affected Participant*, by close of business on Wednesday 16 August 2017.

Submissions should be in writing and sent by email to isaac@hardingkatz.com.au.

2. Rules provisions

The Rules set out a formula for calculating the compensation that AEMO should pay to a Directed Participant for the provision of energy[1]. To summarise, the formula sets the compensation price at the 90th percentile of the prices in that region for the 12 months immediately preceding the trading day in which the direction was issued.

In accordance with this formula, AEMO calculated the compensation amount to be $187,868.45 and notified Origin accordingly by email on 27 April 2017. While Origin is entitled to compensation calculated in accordance with this formula, it is also able to claim additional compensation in accordance with clause 3.15.7B of the Rules. Specifically, the Rules allow a Directed Participant to make a written submission to AEMO claiming an amount equal to the sum of[2]:

- the aggregate of the loss of revenue and additional net direct costs incurred by the Directed Participant; less
- the compensation payable in accordance with the formula described above; less
- the aggregate amount the Directed Participant is entitled to receive in accordance with clause 3.15.6(c) for the provision of a service rendered as a result of the direction, which we understand from Origin to be zero.

Claims can only be made in respect of a single intervention price trading interval, if the amount of the claim in respect of that intervention price trading interval is greater than $5,000.[3]

The Rules provide guidance on the meaning of "additional net direct costs" in calculating the compensation amount, noting that it includes without limitation[4]:

(1) fuel costs in connection with the relevant generating unit or scheduled network services;

(2) incremental maintenance costs in connection with the relevant generating unit or scheduled network services;

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1 Clause 3.15.7(c)

2 For the exact word of the Rules, please refer to clause 3.15.7B(a).

3 Cause 3.15.7(B)(a4).

4 Cause 3.15.7(B)(a3).

(3) incremental manning costs in connection with the relevant generating unit or scheduled network services;

(4) acceleration costs of maintenance work in connection with the relevant generating unit or scheduled network services, where such acceleration costs are incurred to enable the generating unit or scheduled network services to comply with the direction;

(5) delay costs for maintenance work in connection with the relevant generating unit or scheduled network services, where such delay costs are incurred to enable the generating unit or scheduled network services to comply with the direction;

(6) other costs incurred in connection with the relevant generating unit or scheduled network services, where such costs are incurred to enable the generating unit or scheduled network services to comply with the direction; and

(7) any compensation which the Directed Participant receives or could have obtained by taking reasonable steps in connection with the relevant generating unit or scheduled network services being available.

The Rules also require that the submission for compensation must[5]:

(1) itemise each component of a claim;

(2) contain sufficient data and information to substantiate each component of a claim for loss of revenue and additional direct costs incurred and the reasonable rate of return, as the case may be; and

(3) be signed by an authorised officer of the applicant certifying that the written submission is true and correct.

In this report, we assume that all information received from Origin is true and correct.

[5] Cause 3.15.7(B)(b).

3. Origin's compensation claim

3.1. Initial submission

Origin initially claimed an additional $645,326 above the compensation and pool revenue that it has already received. Origin's submission comprised:

- a covering letter from Origin to AEMO, dated 5 May 2017;
- two spreadsheets[6]; and
- evidence of the fuel costs, being a fuel order request to Caltex.

Origin's covering letter explained that the compensation calculated by AEMO and outlined in an email from AEMO, dated 27 April 2017, did not cover the costs of the directions. In accordance with the Rules, Origin's letter included a statement that the submission was "true and correct".

The accompanying spreadsheets set out supporting information in relation to the following claim for additional compensation.

Table 1: Summary of Origin's initial compensation claim

	Mt Stuart Unit 2	Mt Stuart Unit 3	Total
Fuel costs	$429,976	$346,900	**$776,877**
Start up costs	$35,268	$25,157	**$60,425**
Total costs claimed	**$465,244**	**$372,057**	**$837,302**
Remove trading intervals below $5,000	($1,707)	($2,400)	**($4,108)**
Less compensation received	$100,664	$87,205	**$187,868**
Additional compensation claimed	**$362,873**	**$282,452**	**$645,326**

6 '*Start costs Method analysis - Detailed monthly by unit.xlsx*' and '*MT STUART2 Direction on 28 and 29 Mar 2017 - Energy Compensation_for Origin -Origin fuel and start costs.xlsx*'

We identified some minor errors in Origin's supporting spreadsheets, which meant that the compensation calculations did not reconcile with the summary amount claimed. Specifically:

- "Energy Compensation-Unit 2" cell R30, should reference "Summary" cell B9, not cell B8.
- There is an inconsistency in the tabs "Energy Compensation-Unit 2" and "Energy Compensation-Unit 3" in removing periods below $5,000, in cell R32.

These errors were inconsequential because the "Summary" tab is consistent with the supporting information and the amount claimed in Origin's covering letter.

As shown in Table 1, a substantial majority (93%) of the total costs claimed by Origin relates to fuel costs, with the remaining costs relating to start up.

To substantiate its claim for fuel costs, Origin provided an invoice from Caltex (dated 1 April 2017) setting out a fuel cost per litre. This information is commercially sensitive and is not disclosed in this report.

In relation to start up costs, Origin provided a cost analysis which detailed the estimated scheduled inspection, maintenance and refurbishment costs, over the next 40 years, the timing of which is driven by the estimated number and timing of turbine starts. Origin uses this information to derive start up costs relating to the Directions for each unit.

Origin presented four alternative methods to determine the start up costs, as follows:

- 'LRMC method', being the present value of the projected[7] maintenance and refurbishment costs divided by the present value of the projected number of starts.
- 'Average cost method', being the projected maintenance and refurbishment costs divided by the total projected number of starts.
- 'Discounted average cost method', being the present value of the projected maintenance and refurbishment costs divided by the projected number of starts.
- 'Single cycle method', being the estimated total maintenance and refurbishment costs for the life of the original operating equipment from its commissioning date divided by the estimated total number of starts over the life of the equipment.

[7] In this context, 'projected' values are forward-looking estimates.

For the first three methods, Origin presented four alternative cost estimates for each unit, reflecting different time horizons:

- a remaining life reflecting the plant's assumed whole life for accounting purposes (which is 25 years from the date of commissioning);
- the remaining physical life of the plant;
- the remaining useful life of the plant; and
- a 10 year period.

A single estimate was provided by Origin for each unit, using the fourth cost calculation method (the 'single cycle method').

In total, therefore, Origin presented 13 different cost estimates for the start up costs for each unit. In its compensation claim, Origin adopted the 'LRMC method' calculated using a 10 year period.

3.2. Information requests and further submissions

Following our preliminary review of Origin's compensation claim, we requested the following additional information in accordance with clause 3.12.3(c)(6) of the Rules[8]:

1. Evidence to substantiate Origin's fuel consumption for each unit.
2. An explanation of Origin's forecast maintenance and refurbishment expenditure, which it used to estimate the start up costs for each unit.
3. An explanation of the basis for the projected number of starts for each unit.
4. Origin's reasons for adopting 10 years as the appropriate period for the LRMC calculation, rather than the expected life of each unit.
5. An explanation of Origin's weighted average cost of capital and the inflation rates used to estimate the present value of the start up costs for each unit.

We received written responses from Origin[9], including a revised spreadsheet[10] containing a detailed breakdown of the cost estimates. Origin's responses to our queries are summarised below:

[8] Emails from Harding Katz to Origin, 8 and 19 June 2017.

1. Origin provided a turbine start log to substantiate the fuel consumption for each unit.

2. Origin explained that the forecast expenditures used to estimate start up costs were based principally on the actual costs of similar works or recent quotations. In some instances, cost estimates were based on competitive tenders, which produced savings compared to recently completed works. The timing of the required expenditure reflected the manufacturer's recommendations.

3. Origin's projected starts depend on pool price forecasts and Origin's trading position in the market, which are commercially sensitive.

4. The 10 year forecasting period is an appropriate method because of the difficulty in forecasting the running profile beyond this period, especially given regulatory uncertainty, increased renewable energy penetration and the load shedding in SA and NSW last summer.

5. Origin's metrics for the WACC are commercially sensitive. Inflation is set at the mid-point of the RBA monetary policy objective of between 2% and 3%.

We identified two further issues in relation to Origin's revised spreadsheet:

- The start up costs claimed in relation to Unit 3 do not reconcile with the detailed supporting information provided.

- The breakdown of the start up costs claimed in relation to Unit 3 are materially different to the costs previously submitted.

We discussed these issues in a teleconference with Origin on Friday 7 July, which Origin followed up with a written response, explaining that:

- costs have been revised downwards as part of the budgeting process for FY18;

- short term trading pressures can lead to changes in expenditure plans;

- forecast expenditure originally related to new parts, which have now been substituted with refurbished parts;

- recent annual inspections have indicated that major works can be deferred;

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9 Emails from Origin to Harding Katz, dated 13 June 2017 and 5 July 2017.

10 '*AEMO Mt Stuart Start costs Method analysis - Master.xlsx*'

- learnings from recent outages across the Frame 9E fleet indicate that greater use can be made of internal resources, rather than specialist original equipment and manufacturer's contractors;
- competitively quoted prices have dramatically reduced in the last 6 to 8 months, which has helped drive down the cost of new and refurbished parts;
- while Origin follows the original equipment manufacturer's recommended maintenance schedules, condition based monitoring allows Origin to avoid unnecessary spend and to defer outages to avoid critical trading periods; and
- the revised costs reflect the most up-to-date information and scope of works.

The table below presents the range of Origin's revised estimates of its start up costs.

Table 2: Origin's revised range of estimated start up costs

Estimating Method	Mt Stuart Unit 2		Mt Stuart Unit 3	
	Low	High	Low	High
LRMC	$10,210	$35,268	$12,050	$17,178
Average cost method	$9,562	$38,767	$11,850	$21,790
Discounted average cost method	$8,497	$26,439	$6,048	$12,837
Single cycle method	$29,232		$9,986	

As noted in Table 1, the start up costs claimed by Origin in its initial submission were $35,268 and $25,157 in relation to Units 2 and 3 respectively, based on the LRMC method applied over the period to 31 December 2027. Origin's revised estimate is unchanged in relation to Unit 2 and $17,178 in relation to Unit 3.

4. Assessment by Harding Katz

4.1. Fuel costs

The fuel costs claimed by Origin are substantiated by:

- an invoice from Caltex, which establishes the cost per litre of fuel; and

- the Turbine Start Log, which establishes the total fuel consumption during the direction.

Origin's claimed fuel costs of $776,877 should therefore be accepted. As already noted, fuel costs are 93 per cent of Origin's original compensation claim.

4.2. Start up costs

Gas turbines require inspection, maintenance and refurbishment in accordance with good engineering practice. Conceptually, the Direction brings forward this future cost stream, thereby imposing additional costs (in present value terms) on Origin. Origin is claiming compensation in relation to this cost.

The magnitude and timing of Origin's future maintenance and refurbishment expenditure depend on a number of uncertain factors, including:

- the current and future condition of the turbines;
- market conditions for refurbishment and maintenance works; and
- the running profile, which depends on pool prices and Origin's trading position.

We note that Origin's estimates of these costs have changed markedly in relation to Unit 3 compared to its original compensation claim. While we accept the veracity of Origin's submissions, the change in the cost estimates illustrate the extent to which the future cost profile is uncertain.

As already noted, cause 3.15.7(B)(a3) of the Rules provides for compensation in relation to the "additional net direct costs incurred by the Directed Participant," where "additional net direct costs" is defined as including without limitation:

(1) […]

(2) incremental maintenance costs in connection with the relevant generating unit or scheduled network services

(3) incremental manning costs in connection with the relevant generating unit or scheduled network services

(4) acceleration costs of maintenance work in connection with the relevant generating unit or scheduled network services, where such acceleration costs are incurred to enable the generating unit or scheduled network services to comply with the direction

(5) […]

(6) other costs incurred in connection with the relevant generating unit or scheduled network services, where such costs are incurred to enable the generating unit or scheduled network services to comply with the direction.

A threshold question is whether the start up costs claimed by Origin fall within the definition of "additional net direct costs *incurred* by the Directed Participant." Origin does not claim that any maintenance or refurbishment costs have actually been incurred as a result of the Direction. Origin's compensation claim is that the Direction will lead to costs being incurred sooner than would otherwise be the case.

In our view, Origin should be compensated for start up costs. While additional costs have not yet been incurred, there is a cost associated with each start up. The purpose of clause 3.15.7B of the Rules is to compensate the directed participant for taking action that it would not otherwise have taken. On this basis, it would be unreasonable for Origin to be denied the recovery of start up costs in its compensation for the Direction.

Origin has indicated that it prefers its LRMC approach to be applied over a 10 year period to calculate start up costs. Origin argues that projecting costs and running profiles beyond 10 years is too uncertain (although we note that Origin has provided forecasts well beyond the 10 year period). Origin's submissions do not discuss the four alternative cost estimation methodologies presented, nor do they set out why Origin prefers the LRMC approach.

We have reviewed Origin's four alternative cost estimation methodologies and the timeframes that it applied in relation to the three forward-looking methods. In principle, we have no difficulty with Origin's selection of the LRMC method. This methodology is more accurately described as an "Average Incremental Cost" (AIC), as it calculates the average cost per turbine start (over a period of at least 10 years), rather than the marginal cost of an additional start using the perturbation method.

The AEMC discussed the difference between the Average Incremental Cost and the perturbation method in its determination of the Rules for distribution network pricing[11]:

> "A number of different methodologies have been traditionally used to estimate the LRMC of providing network services. Some of the more common methodologies include:

[11] AEMC, Rule Determination, National Electricity Amendment (Distribution Network Pricing Arrangements) Rule 2014, 27 November 2014, page 122.

(i) Average Incremental Cost methodology (AIC). This methodology estimates LRMC by identifying the stream of capital, operations and maintenance expenditure needed to satisfy projected demand growth, typically over 10 years, and then dividing this by projected demand growth. It then calculates the present value of the expenditure required and divides this by the present value of incremental demand growth to estimate the LRMC.

(ii) […]

(iii) Perturbation or 'Turvey' methodology. This methodology involves a number of steps. First a small increment or decrement "shock" is applied to a known demand forecast. Then, a change is calculated in the present value of costs over the investment planning period resulting from this shock compared to the base case. Finally, this result is divided by the demand increment or decrement to arrive at the LRMC estimate."

The AEMC highlighted an important potential weakness with the AIC methodology[12]:

> "A key weakness of the AIC methodology is the level of cost averaging inherent in the way it estimates LRMC.
>
> […]
>
> The AIC methodology does not take into account the lumpy nature of new expenditure or existing levels of excess capacity in the network."

We acknowledge the AEMC's comments on the AIC methodology. While this methodology may be appropriate, care needs to be taken where the forecast expenditure is lumpy. In particular, the period over which costs are evaluated should reflect the expected life of the service potential provided by 'lumpy' expenditure. In this instance, Origin's analysis shows that its future inspection and maintenance expenditure will occur in relatively large and infrequent lumps. For example, approximately 50 per cent of Origin's total projected maintenance cost is forecast to occur in 8 to 10 years from now.

Origin's selection of a 10 year period (to 31 December 2027) captures a significant proportion of the lifetime maintenance and refurbishment costs, but does not recognise the additional service potential that this expenditure will provide in terms of future starts beyond the end of the 10 year period. As a consequence, the LRMC method proposed by Origin is sensitive to the period chosen, and in this instance, the adoption of Origin's proposed evaluation period is likely to overstate the start up costs of the Direction.

This point is best illustrated by shortening the evaluation period to exactly 10 years from the date of the direction (i.e. to March 2027), rather than to December 2027 as

[12] Ibid, pages 126 and 127.

calculated in Origin's spreadsheet. For Unit 3, truncating the analysis to exactly 10 years reduces the estimated start up costs from $17,178 to $3,501, a reduction of 80%. We do not suggest that $3,501 is a reasonable estimate of start up costs, but it illustrates the arbitrariness of selecting a fixed period in the cost analysis.

We have used the information provided by Origin to calculate the marginal costs of the Direction using the perturbation method. As explained by the AEMC, this methodology calculates the change in the present value of the costs arising from a relatively small increase in the number of starts. The marginal cost is calculated by dividing the cost change by the number of additional starts. For both units, we find that the perturbation method produces a lower estimate of the start up costs compared to Origin's estimate.

As explained by the AEMC, the perturbation method also has shortcomings[13]:

> "…while the perturbation methodology more efficiently signals LRMC, it is also a more complex methodology to implement compared with the AIC methodology. It requires a number of additional steps to be taken, such as calculating how existing investment programs would change under a range of different demand and generation investment scenarios. The perturbation methodology also requires that an appropriate demand increment is chosen as the basis of the perturbation. LRMC estimates will differ significantly depending on the size of the demand increments or decrements used in the calculation."

We agree with the AEMC that the perturbation method is sensitive to the increment chosen (in this case, the number of starts). In addition, in this instance the method is more sensitive to the weighted average cost of capital than the AIC methodology. In this regard, we also note that the weighted average cost of capital is both contentious and commercially sensitive.

In light of the above discussion, we accept that it was reasonable for Origin to propose the LRMC method (AIC) for estimating the start up costs, and we also note that the 10 year time period proposed by Origin is consistent with the standard method described by the AEMC. However, in this instance applying the methodology over the period to 31 December 2027 overstates the costs incurred in relation to the Direction. It is the lumpy nature of Origin's expenditure profile, rather than the choice of methodology, which results in this outcome.

While Origin has certified that its forecasts are "true and correct", we also accept Origin's view that expenditure and running profile forecasts beyond a 10 year period should be treated with caution. Furthermore, we recognise that the significant expenditure projected by Origin to occur within the next 10 years may not eventuate.

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13 Ibid, page 129.

Given the difficulty in selecting a measurement period – and the shortcomings of the LRMC and perturbation methods – our view is that the compensation for start up costs should reflect the 'single cycle method'. As already noted, this method calculates the average cost per start up, using Origin's estimated total maintenance and refurbishment expenditure for the life of the original operating equipment from its commissioning date, divided by the total number of starts over an entire single life cycle. This calculation is not dependent on the measurement period applied; the assumed timing of the expenditure or running profile; or the weighted average cost of capital.

We prefer the 'single cycle method' to Origin's two other estimation methods for the reasons set out below:

- The 'average cost method' - being the projected maintenance and refurbishment costs divided by the total projected number of starts - is reasonable, but it requires an assumption to be made regarding the remaining commercial life and running profiles of each turbine. For the reasons already explained, making such assumptions is problematic.

- The 'discounted average cost method' - being the present value of the projected maintenance and refurbishment costs divided by the total projected number of starts - expresses the future costs in present value terms and divides it by the undiscounted number of starts. Given the long timeframes in this analysis, this approach is likely to understate restart costs.

We recognise that the single cycle method provides a measure of the average cost per start over the assumed life of the equipment from the date of commissioning. This does not necessarily reflect the marginal cost of the Direction. It could, therefore, be argued that the single cycle method has the same limitations noted in relation to the 'average cost method'.

In our view, however, the single cycle method is preferable in circumstances where the future expenditure and running profiles are highly uncertain. The method essentially reverts to an average cost based on the original life cycle of the asset. In circumstances where forecast data were more reliable, our preference would be to adopt the LRMC method over the remaining life of the asset. However, such circumstances do not apply in this instance and therefore the best method for setting compensation is the single cycle method. Origin's start up costs using the single cycle method are:

- for Unit 2, a compensation amount of $29,232 compared to the claim of $35,268; and

- for Unit 3, a compensation amount of $9,986 compared to the revised claim of $17,178.

4.3. Other independent expert reports

In preparing this report we considered the approaches adopted by other independent experts in setting compensation for Directions, including our own previous independent expert reports. These expert reports set a fair payment price based on the long run marginal cost, being the variable costs plus an allowance to reflect the marginal cost of capital employed in relation to the Direction.

These earlier independent expert reports were concerned with setting the fair payment price for services other than energy and ancillary services, in accordance with clause 3.15.7A of the Rules. In contrast, this report sets compensation in relation to Directions to provide energy. For the avoidance of doubt, this report does not conflict with the approaches taken by previous independent experts. The differences in approaches reflect the different Rules provisions applying in the circumstances; the nature of the services provided; and the circumstances of each case.

5. Calculation of Compensation Amount

The table below sets out the additional compensation amount in relation to the Directions, calculated in accordance with clause 3.15.7B of the Rules. It shows that the additional compensation should be **$624,118**. This amount compares with Origin's initial claim of $645,326 and its revised claim of $637,347.

Table 3: Calculation of compensation amount

Rules clause	Calculation step	Mt Stuart Unit 2	Mt Stuart Unit 3	Total
	Fuel costs	$429,976	$346,900	**$776,877**
	Start up costs	$29,232	$9,986	**$39,218**
3.15.7B(a)(1)	**Additional net direct costs**	**$459,208**	**$356,886**	**$816,094**
3.15.7(B)(a4)	Remove trading intervals below $5,000	($1,707)	($2,400)	**($4,108)**
3.15.7B(a)(2)	Deduct compensation notified pursuant to clause 3.15.7(c)	$100,664	$87,205	**$187,868**
3.15.7B(a)(3)	Deduct aggregate amount received in accordance with clause 3.15.6(c)	0	0	**0**
3.15.7B	**Additional compensation**	**$356,873**	**$267,281**	**$624,118**