RAISE CONTINGENCY FCAS – CONTRACT DESIGN AND PRICING

17 December 2010

Final Report

Intelligent Energy Systems

Executive Summary

Reason for Review

On 24 July 2009, the Tasmanian Energy Regulator (Regulator) gave written notice of an intention to declare the supply of raise contingency frequency ancillary services (fast raise, slow raise and delayed raise) by Hydro Tasmania to meet the Tasmanian local requirement as declared electrical services. This was followed in December 2009 with the publication of its “Statement of Reasons”. The Regulator considers that Hydro Tasmania has substantial market power in the supply of the defined services and the promotion of competition, efficiency and the public interest warrants the declaration of the defined services.

The Regulator has commenced, in accordance with the requirements of the Electricity Supply Industry (Price Control) Regulations 2003, the process for making a determination that regulates the prices that may be charged by, and specifies the price control mechanisms imposed on, Hydro Tasmania for raise contingency frequency control ancillary services (FCAS) to meet the Tasmanian local requirement. At the commencement of the process the Regulator decided to conduct the review in two stages.

Stage 1

As part of Stage 1 of the review, Intelligent Energy Systems (IES) was retained by the Regulator to analyse and advise on the reasonable options for price control mechanisms to regulate the prices for the FCAS services. IES recommended the regulation of Hydro Tasmania’s provision and pricing of FCAS hedge contracts as the most appropriate price control mechanism to regulate the declared electrical services (being raise contingency frequency control ancillary services supplied by Hydro Tasmania to meet the Tasmanian local requirement). The Regulator adopted the IES recommendation.

Stage 2

As part of Stage 2 of the review, the Regulator has retained IES to design the terms and conditions, price methodology and parameters for a general FCAS hedge contract that will be offered by Hydro Tasmania to other Tasmanian generators for raise contingency FCAS (the three raise FCAS products) supplied by Hydro Tasmania to meet the Tasmanian local requirement. These FCAS hedge contracts will be regulated for a period of five years.

Scope of Stage 2

Under the scope of Stage 2, IES is required to

- establish the terms and conditions, pricing methodology and parameters for a general FCAS hedge contract in which the price for the supply of the declared electrical services reflects the opportunity cost of provision of the services in terms of foregone revenue in the energy and Renewable Energy Certificate (REC) markets where:

  - the terms and conditions, pricing methodology, parameters and prices are to be reflected, where appropriate, in Hydro's existing template contract for hedges, being the International Swaps and Derivatives 2002 Master Agreement, Hydro Tasmania's Schedule to the 2002 Master Agreement, and "Confirmation" document; and
  - the values of the input parameters can, to the greatest extent possible, be objectively determined.
- take account of the Final Report prepared by IES, in so far as it is relevant to this consultancy;
- note the information provided by Hydro Tasmania in its submission to the IES Draft Report, entitled Hydro Tasmania Submission on IES Draft Report on Raise Contingency FCAS – Price Control Mechanism, which describes Hydro Tasmania's hedge pricing principles including its cost components, and subsequent presentation by Hydro Tasmania to the Regulator on 26 July 2010;
- detail all key assumptions affecting the pricing methodology, parameters, terms and conditions and the sensitivity of changes in these assumptions;
- advise on the principles and methodology for a six monthly adjustment of the pricing inputs, price parameters and/or price methodology in advance of their application in an FCAS hedge contract;
- consider the means by which rare events, such as Basslink and Gordon Power Station outages should be treated, if at all, in the pricing of the services (for example, should a risk premium be paid to Hydro Tasmania, over and above its opportunity costs, to limit its risk exposure, or should rare events be excluded from the general contract); and
- advise on the extent to which confidentiality should be attached to the pricing of each of the parameters; in doing so, the consultant is to advise whether disclosure of the price could affect Hydro Tasmania's competitive position in the Tasmanian market or the National Electricity Market or is considered to be commercially sensitive for some other reason.

Principal Findings

In accordance with its scope, IES has established the terms and conditions, pricing methodology and parameters for a general FCAS hedge contract in which the price for the supply of the declared electrical services reflects the opportunity cost of provision of the services in terms of foregone revenue in the energy and Renewable Energy Certificate (REC) markets. The general hedge contract has been designed as a "safety-net contract" with the aim of providing a high quality hedge not subject to any special conditions (other than those concerned with self provision and new sources of supply) or exclusions. A pricing methodology has been developed, along with pricing parameters and the basis for setting each parameter value. The pricing methodology aims to be transparent and the proposed basis for determining each parameter value is meant to be as objective as possible.

The Final Report by IES on the first stage of the investigation “Raise Contingency FCAS – Price Control Mechanism”, 28 July 2010, concluded that “the regulation of Hydro Tasmania’s provision and pricing of FCAS contracts should be the preferred price control mechanism”. IES also concluded that the Regulator should approve a general contract design and that pricing parameters be determined in advance on a periodic basis rather than set by Hydro Tasmania and subject to limited disclosure. IES recognised the opportunity cost of foregone generation as the proper basis for pricing and that this should be valued as “the sum of the foregone electricity value, based on an appropriate water value or proxy, and the expected foregone REC value”. The methodology developed by IES in stage 2 is consistent with these conclusions. IES also expressed the view in its stage 1 Final Report that the cost to Hydro Tasmania of providing system inertia (by running certain generator units in synchronous condenser mode) should not be included as a cost for the purpose of pricing FCAS hedge contracts. Accordingly, our proposed methodology does not provide for the inclusion of this cost.

IES has considered the information provided by Hydro Tasmania in its submissions and presentations to the Regulator in respect of stage 1 of the investigation. Our views on these submissions and presentations are set out in our stage 1 Final Report.

Also, IES has considered the information provided by Infratil, Aurora / AETV and Hydro Tasmania in their submissions in respect to the draft report for stage 2 of the investigation. Our views on these submissions and presentations are set out in this report and we have revised some aspects of the proposed methodology accordingly.

In this report we set out all key assumptions affecting the pricing methodology, parameters and terms and conditions. We also indicate the basis for setting each parameter on a period basis in advance of their application in an FCAS hedge contract.

With respect to rare events which might take the form of exclusions in the contract, we have proposed that the safety-net contract not include such exclusions leaving counterparties to negotiate separately for their inclusion.

We do not consider that confidentiality should be attached to any of the pricing parameters or standing data we have specified or identified. We do not believe that Hydro Tasmania’s competitive position in the Tasmanian market or the National Electricity Market is likely to suffer any material detriment by disclosing any of these parameter values and identified standing data generally.

Summary Recommendations

IES recommends

- the general hedge contract serve as a "safety-net" contract providing a high quality hedge with no exclusions, and that generators be encouraged (but not required) to negotiate price discounts in respect of any exclusions and special conditions they are willing to accept;
- the adoption of the pricing methodology set out in this report along with the identified parameters and proposed basis of setting parameter values;
- that the methodology, current values of parameters, standing data and "safety-net" contract documentation be published on Hydro Tasmania's website.

Changes to Methodology and Parameter Values Based on Submissions

After considering submissions made in respect of the draft report, a number of aspects of the methodology and basis of pricing have been amended. The main changes are as follows:

- the use of the Victorian flat swap price rather than peak swap price as the basis for the opportunity cost valuation of energy;
- the use of a binary strike price which will assume a zero value when the local FCAS requirement is less than 40MW; and
- basing consideration of the materiality of new supply on the liability of non Hydro Tasmania generators rather than the total liability for Tasmania.

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Glossary

Term	Definition
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AETV	Aurora Energy Tamar Valley
AGC	Automatic Generation Control
FCAS	Frequency Control Ancillary Services
IES	Intelligent Energy Systems
LRAC	Long Run Average Cost
LRMC	Long Run Marginal Cost
NCAS	Network Control Ancillary Services
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
OTTER	Office of the Tasmanian Economic Regulator
REC	Renewable Energy Certificate
SRMC	Short Run Marginal Cost
WACC	Weighted Average Cost of Capital

1 Introduction and Scope

1.1 Reason for Review

On 24 July 2009, the Tasmanian Energy Regulator (Regulator) gave written notice of intention to declare the supply of raise contingency frequency ancillary services (fast raise, slow raise and delayed raise) by Hydro Tasmania to meet the Tasmanian local requirement as declared electrical services. This was followed in December 2009 with the publication of its “Statement of Reasons”. The Regulator considers that Hydro Tasmania has substantial market power in the supply of the defined services and the promotion of competition, efficiency and the public interest warrants the declaration of the defined services.

The Regulator has commenced, in accordance with the requirements of the Electricity Supply Industry (Price Control) Regulations 2003, the process for making a determination that regulates the prices that may be charged by, and specifies the price control mechanisms imposed on, Hydro Tasmania for raise contingency frequency control ancillary services (FCAS) to meet the Tasmanian local requirement.

1.2 Stage 1 and 2 of the Review

At the commencement of the process the Regulator decided to conduct the review in two stages.

Stage 1

As part of Stage 1 of the review, Intelligent Energy Systems (IES) was retained by the Regulator to analyse and advise on the reasonable options for price control mechanisms to regulate the prices for the FCAS services. IES recommended the regulation of Hydro Tasmania’s provision and pricing of FCAS hedge contracts as the most appropriate price control mechanism to regulate the declared electrical services (being raise contingency frequency control ancillary services supplied by Hydro Tasmania to meet the Tasmanian local requirement). The Regulator adopted the IES recommendation.

Stage 2

As part of Stage 2 of the review, the Regulator has retained IES to design the terms and conditions, price methodology and parameters for a general FCAS hedge contract that will be offered by Hydro Tasmania to other Tasmanian generators for raise contingency FCAS (the three raise FCAS products) supplied by Hydro Tasmania to meet the Tasmanian local requirement. These FCAS hedge contracts will be regulated for a period of five years.

1.3 Scope of Stage 2

Under the scope of Stage 2, IES is required to

- establish the terms and conditions, pricing methodology and parameters for a general FCAS hedge contract in which the price for the supply of the declared electrical services reflects the opportunity cost of provision of the services in terms of foregone revenue in the energy and Renewable Energy Certificate (REC) markets where:
  - the terms and conditions, pricing methodology, parameters and prices are to be reflected, where appropriate, in Hydro's existing template contract for hedges, being the International Swaps and Derivatives 2002 Master Agreement, Hydro Tasmania's Schedule to the 2002 Master Agreement, and "Confirmation" document; and
  - the values of the input parameters can, to the greatest extent possible, be objectively determined.
- take account of the Final Report prepared by IES, in so far as it is relevant to this consultancy;
- note the information provided by Hydro Tasmania in its submission to the IES Draft Report, entitled Hydro Tasmania Submission on IES Draft Report on Raise Contingency FCAS – Price Control Mechanism, which describes Hydro Tasmania's hedge pricing principles including its cost components, and subsequent presentation by Hydro Tasmania to the Regulator on 26 July 2010;
- detail all key assumptions affecting the pricing methodology, parameters, terms and conditions and the sensitivity of changes in these assumptions;
- advise on the principles and methodology for a six monthly adjustment of the pricing inputs, price parameters and/or price methodology in advance of their application in an FCAS hedge contract);
- consider the means by which rare events, such as Basslink and Gordon Power Station outages should be treated, if at all, in the pricing of the services (for example, should a risk premium be paid to Hydro Tasmania, over and above its opportunity costs, to limit its risk exposure, or should rare events be excluded from the general contract; and
- advise on the extent to which confidentiality should be attached to the pricing of each of the parameters; in doing so, the consultant is to advise whether disclosure of the price could affect Hydro Tasmania's competitive position in the Tasmanian market or the National Electricity Market or is considered to be commercially sensitive for some other reason.

1.4 Principal Findings

In accordance with its scope, IES has established the terms and conditions, pricing methodology and parameters for a general FCAS hedge contract in which the price for the supply of the declared electrical services reflects the opportunity cost of provision of the services in terms of foregone revenue in the energy and Renewable Energy Certificate (REC) markets. The general hedge contract has been designed as a "safety-net contract" with the aim of providing a high quality hedge not subject to any special conditions or exclusions. A pricing methodology has been developed, along with pricing parameters and the basis for setting each parameter value. The pricing methodology aims to be transparent and the proposed basis for determining each parameter value is meant to be as objective as possible.

The Final Report by IES on the first stage of the investigation "Raise Contingency FCAS – Price Control Mechanism", 28 July 2010, concluded that "the regulation of Hydro Tasmania's provision and pricing of FCAS contracts should be the preferred price control mechanism". IES also concluded that the Regulator should approve a general contract design and that pricing parameters be determined in advance on a periodic basis rather than set by Hydro Tasmania and subject to limited disclosure. IES recognised the opportunity cost of foregone generation as the proper basis for pricing and that this should be valued as "the sum of the foregone electricity value, based on an appropriate water value or proxy, and the expected foregone REC value". The methodology developed by IES in stage 2 is consistent with these conclusions. IES also expressed the view in its stage 1 Final Report that the cost to Hydro Tasmania of providing system inertia (by running certain generator units in synchronous condenser mode) should not be included as a cost for the purpose of pricing FCAS hedge contracts. Accordingly, our proposed methodology does not provide for the inclusion of this cost.

IES has considered the information provided by Hydro Tasmania in its submissions and presentations to the Regulator in respect of stage 1 of the investigation. Our views on these submissions and presentations are set out in our stage 1 Final Report.

Also, IES has considered the information provided by Infratil, LMS, Aurora / AETV and Hydro Tasmania in their submissions and related communications in respect to our draft report for stage 2 of the investigation. Our views on this information are set out in this report. We have revised some aspects of the proposed methodology and parameter pricing accordingly.

In this report we set out all key assumptions affecting the pricing methodology, parameters and terms and conditions. We also indicate the basis for setting each parameter on a period basis in advance of their application in an FCAS hedge contract.

With respect to rare events which might take the form of exclusions in the contract, we have proposed that the safety-net contract not include such exclusions leaving counterparties to negotiate separately for their inclusion. However we do consider it appropriate to include conditions relating to self provision and new sources of supply.

We do not consider that confidentiality should be attached to the pricing of any of the parameters we have specified. We do not believe that Hydro Tasmania's competitive position in the Tasmanian market or the National Electricity Market is likely to suffer by disclosing these parameter values generally.

1.5 Structure of Report

The report is structured as follows:

- Chapter 2 addresses the principal contract design features,
- Chapter 3 specifies the contract pricing methodology,
- Chapter 4 provides a summary of submissions made in respect of the draft report,
- Chapter 5 identifies the inputs required by the pricing methodology and proposes the basis for setting the value of each; and
- Chapter 6 provides summary recommendations.

2 Principal Contract Design Features

2.1 Introduction

The FCAS contract will be structured as a forward commodity contract (swap contract). Under such contracts, counterparties exchange fixed for floating price payments in respect of a defined notional quantity.

Relevant terms include the specification of fixed and floating prices, designation of the fixed and floating price payers, contract duration in terms of effective date and termination date, and any special conditions or exclusions.

2.2 "Safety Net" Contract

IES recognises that the number of possible standard contract designs is potentially large, and that in practice counterparties can be expected to have strong incentives to negotiate around particular terms and conditions. Clearly it will be impracticable to anticipate all the desirable contract variations and regulate the price in each case. Consequently, IES considers it appropriate to regulate the price of a single "safety net" contract. This particular design should

- serve as an effective hedge of FCAS exposure for the buyer of the contract, and
- should not be subject to any special conditions or exclusions.

In this way, the price control mechanism will provide a reference price for a high quality hedging product.

The "safety net" contract will be for all raise contingency products, although IES is of the view that the cost of Hydro Tasmania providing other than the 6s raise service is not significant. Further, IES considers that

- the pricing of the "safety net" contract should be highly transparent with a relatively simple underlying pricing methodology and relatively few pricing parameters and assumptions.

While the "safety net" contract will be a high quality hedging product, IES considers that its availability should not be an impediment to any possibility of achieving a more efficient risk transfer between counterparties. Accordingly, IES is of the view that the party seeking to hedge its FCAS exposure, should be encouraged (but not required) to negotiate with Hydro Tasmania in relation to particular additional terms, conditions and exclusions with a view to achieving a lower price for the service consistent with its risk preferences. Should the parties fail to negotiate a mutually satisfactory commercial contract, Hydro Tasmania will be required to offer the party the "safety net" contract.

2.3 Bundled Contract

The "safety net" contract will be for a bundle of 6s raise, 60s raise and 5 minute raise FCAS. This is because the provision of the 6s raise service by Hydro Tasmania results in the provision of the other services as well, due to the nature of Hydro Tasmania's generation plant.

In section 3.2, IES concludes that providing the 6s raise FCAS service dominates the costs of providing all of the three raise contingency services and that the 60s raise and 5 minute raise services can be delivered largely as by-products of Hydro Tasmania's dispatch for energy and 6s raise FCAS. Consequently, we recommend that the contract quantities be bundled quantities for all three raise contingency services.

2.4 Notional Quantity

The notional quantity could be defined potentially in various ways. It could be for example a specified fixed quantity for all periods or for each defined period. It could be a forecast quantity set at the beginning of a defined period with or without the facility for periodic renomination.

In our view, the notional quantity defined in the "safety net" contract ought to reflect the buyer's actual liability. In this way it serves as an effective hedge for the buyer, while avoiding the creation of an exposure which Hydro Tasmania, as the seller, may be unable to manage in the physical market. For the purpose of calculating the fixed price for a contract, the buyer will need to provide Hydro Tasmania with indicative requirements. In our opinion, this will reasonably include a maximum requirement or maximum requirements[1] which will serve to cap actual quantity. Settlement will be based on actual requirements capped by the specified maximum requirement.

Since the "safety net" contract will be for a bundle of 6s raise, 60s raise and 5 minute raise FCAS the quantities for each of the services will be related. The ratio of the maximum requirement quantities for these services will be:

1.0 MW 6 second raise : 1.75 MW 60 second raise : 2.0 MW 5 minute raise.

The actual quantity determined in the hedge will be based on the actual liability based on the generator's output for the dispatch period. This being:

Hedge quantity for service = Minimum (Cap quantity for service, actual liability).

IES's recommendation that the contract quantities be bundled quantities for all three raise contingency services leads to several possibilities for the determination of the contract quantity for each dispatch interval. These are to determine the contract quantity based on :

- the 6s raise service MW liability;

[1] The maximum requirements could be by some time periods such as peak or off peak periods or quarters or both.

- the average of the 6s raise liability, 60s raise liability / 1.75 and the 5 minute raise liability / 2.0; and
- the maximum of the 6s raise liability, 60s raise liability / 1.75 and the 5 minute raise liability / 2.0.

The options above all assume that the actual liabilities are below the cap quantities for each of the services. IES recommends that the first option be used as the 6s raise service is the most costly of the local services.

2.5 New Supplier

A new supplier of contingency raise FCAS in Tasmania might either be capable of :

1. providing some of the local Tasmanian requirements but not enough to substantially remove the present dependency of the local market on Hydro Tasmania to provide the service; or
2. providing sufficient of the local Tasmanian requirements to substantially remove this dependency.

In the first case, the contract design and pricing methodology would be unaffected by the entry of the new supplier. In the second case the Regulator would rescind the declaration and the “safety net” contracts would terminate.

It is noted that a new generator or interruptible load[2] that could provide 20 MW of 6s raise on a highly reliable basis would obviate the need to use Hydro Tasmania’s capability to provide 6s FCAS for all of the non Hydro Tasmania generators most of the time.

2.6 Self Provision and Contracting With Alternative Providers

IES recognises that Hydro Tasmania’s ability to support these contracts in practice will be subject to the existence and operations of other FCAS providers. Consistent with the safety-net contract functioning as an effective hedge for the buyer on one hand, and not creating unmanageable exposures for Hydro Tasmania on the other, there ought to be provision for the quantity specified in this contract to be reduced to the extent the buyer provides services of its own (self provision) or has been able to contract with alternative providers.

In the case of self provision, IES expects that this reduction would be based on the spot market quantities that the counterparty to Hydro Tasmania is dispatched for in the FCAS market rather than a reduction in the cap quantity based on the counterparty’s capability to provide the 6s raise service. Under this arrangement Hydro Tasmania is hedging the contracting party to the degree that they have an exposure to FCAS raise contingency costs subject to cap on quantities.

Similarly, if the counterparty has been able to contract away some of its FCAS liability with another supplier then Hydro Tasmania would be hedging the

[2] An interruptible load of around 10 MW which could be instantaneously tripped would be deemed to be providing 20 MW (2 x 10 MW) of 6s raise based on the current definitions of the FCAS.

contracting party to the degree that they have an exposure to FCAS raise contingency costs subject to cap on quantities.

Under the self provision clause of the safety-net contract, the buyer will be obliged to disclose to Hydro Tasmania such details of its self provision and FCAS contracts it holds with other providers to allow settlement quantities to be determined.

2.7 Hydro Tasmania Production Efficiency Improvements

Another form of new supply would occur when Hydro Tasmania improves its own capability to deliver FCAS contingency services. This improvement could be the result of investment in existing generation plant. In this case nothing would change regarding existing or new contracts. The methodology would remain the same as would the assumptions about lost power generation due to running at inefficient generation levels. The reason for this approach is to give Hydro Tasmania the same incentives as any other provider to improve its efficiency in providing FCAS.

2.8 Contract Duration, Termination, and Repricing

Generators can expect that “safety net” contracts with a high degree of transparency around pricing principles will be available until the end of the five year determination period, or until the Regulator decides the supply of the relevant services is competitive and therefore the “safety net” contracts are no longer required.

While the determination period is five years, IES does not consider it necessary that the price of “safety net” contracts be fixed for the full period or for any period longer than a year. However IES does consider that the price should be fixed for at least six months and notes that transparency around methodology and assumptions will assist in informing interested parties as to the likely range of future “safety net” contract prices.

To provide this transparency, IES suggests that the methodology be published on the Hydro Tasmania website together with assumptions for the current and previous pricing periods.

The price of the “safety net” contract will be recalculated on a six monthly basis according to the published methodology and current published assumptions prior to the commencement of each six month period.

3 Contract Pricing Methodology

3.1 Introduction

IES's preferred method for estimating Hydro Tasmania's cost for providing an FCAS hedge is to determine Hydro Tasmania's costs of physically delivering to the spot market the amount of FCAS that is nominated in the hedge contract. In a sense this mimics the operation of a competitive market in the longer term in that the value of a swap contract should roughly correspond to the average spot price which in turn should roughly correspond to the marginal costs of delivering that spot market service.

Determining a generator's costs of providing various FCAS raise contingency services is not as clear cut as it might seem. The FCAS services and energy are joint products from the same generator and hence the provision of one service affects the provision of the others. Thus to estimate the cost of providing a raise service requires an understanding of how providing this service affects the provision of energy and other FCAS and what are the associated opportunity costs.

3.2 FCAS Opportunity Costs

Determining the opportunity cost of being enabled to provide raise FCAS services is not always straight forward. There are three distinct situations which could result in different opportunity costs.

The first situation is when the unit's energy output is not altered by the amount of FCAS raise services for which it is enabled. In this case the unit's energy dispatched is not changed from what it would have been had no FCAS raise service been enabled. Thus the generator's energy output is not changed. In the case of a hydro-electric generation unit, its water use and any other variable costs have not changed. Consequently, in this case the opportunity cost of being enabled is zero. On the rare occasions that the contingency service is required, the generator may have an increased output but this should be largely compensated through the energy spot market.

The second situation is when the unit's energy output is altered by the amount of FCAS raise services for which it is enabled. In this case the unit's energy dispatched is changed from what it would have been had no FCAS raise service been enabled. Because the generator's energy output is changed, its water use and any other variable costs will have changed as well. Additionally, the unit may have its energy market dispatch reduced to provide raise FCAS.

The third situation is when the unit is dispatched primarily to provide FCAS and the energy output is really just a result of providing FCAS. In this case the unit's energy dispatched is changed from being zero and the unit being offline to a positive energy dispatch in order to provide the desired FCAS raise service. In this case the unit may suffer two opportunity costs. The first one is due to being dispatched to an inefficient energy target to provide the required service. The second one is the opportunity cost of being dispatched to a non zero value in the energy market when the generator did not want the unit to be dispatched in the energy market at all. For example if the generator had a fuel cost or marginal water value of $50/MWh and was dispatched in the energy market when the spot price was $30/MWh, it would be losing $20/MWh in the energy market.

The opportunity costs of providing each of the raise contingency services: 6 second raise, 60 second raise and five minute raise are likely to be different for Hydro Tasmania. We will look at each service in turn.

3.2.1 5 minute raise service

For the 5 minute raise services the opportunity costs would be zero or very small because the services can be provided by units that are on line and operating around their optimal energy dispatch points[3]. The most efficient output for most units is somewhere between 80% and 90% of the unit's maximum output. Thus units operating at the most efficient points have the ability to provide additional output following a contingency. Any additional amounts of this service required would be provided by units which are being dispatched to provide the 6 second raise service. Thus given that Hydro Tasmania has to provide an amount of 6 second raise service there should be no additional cost to Hydro Tasmania of providing the 5 minute raise service.

3.2.2 60s raise service

Like the situation for the 5 minute raise service, the 60 second raise service would generally be provided by units on line and operating at their optimal energy dispatch points. Any additional amounts of this service required would be provided by units which are being dispatched to provide the 6 second raise service. Thus given that Hydro Tasmania has to provide an amount of 6 second raise service there should be no additional cost to Hydro Tasmania of providing the 60 second raise service.

3.2.3 6s raise service

The 6 second raise service is the most difficult for a hydro generator to supply. In most power systems this service is provided by steam based thermal generation. Many of Hydro Tasmania's units can supply little or no 6s FCAS and many of the others can only supply small amounts when they are significantly backed off and operating at significantly lower water use efficiencies. However the Gordon and John Butters power station units can supply significant amounts of 6s FCAS relatively efficiently in the Tasmanian system.

[3] In other hydro systems with units that can start faster than Hydro Tasmania's some of the 5 minute service could be provided by units which are offline but armed to start with an under frequency event.

3.3 Hydro Tasmania's Opportunity Cost of Providing 6s Raise

3.3.1 Approach

IES's approach to determining the opportunity cost of providing the 6s raise service is to split the problem into two parts.

- The first part is concerned with determining the physical opportunity cost of providing the 6s raise service in terms of reduced generation efficiency and the consequential additional water consumption.
- The second part is concerned with valuing the additional water use associated with providing the 6s raise service.

3.3.2 Physical Opportunity Costs of Providing 6s FCAS

The two power stations which can provide substantial amounts of 6s raise service are John Butters and Gordon. Both of these power stations have units which can operate at relatively low outputs and provide substantial amounts of 6s raise. However, the operation at low output levels does come at the price of reduced efficiency with which water is converted from potential energy to electrical energy. Figure 1 and Figure 2 show the efficiency curves for John Butters and Gordon units. Note that at very low outputs the generation efficiencies of these units drop from around 90% at the most efficient points to 20% to 40% at very low outputs.

Figure 1 John Butters Unit Generation Efficiency Curve

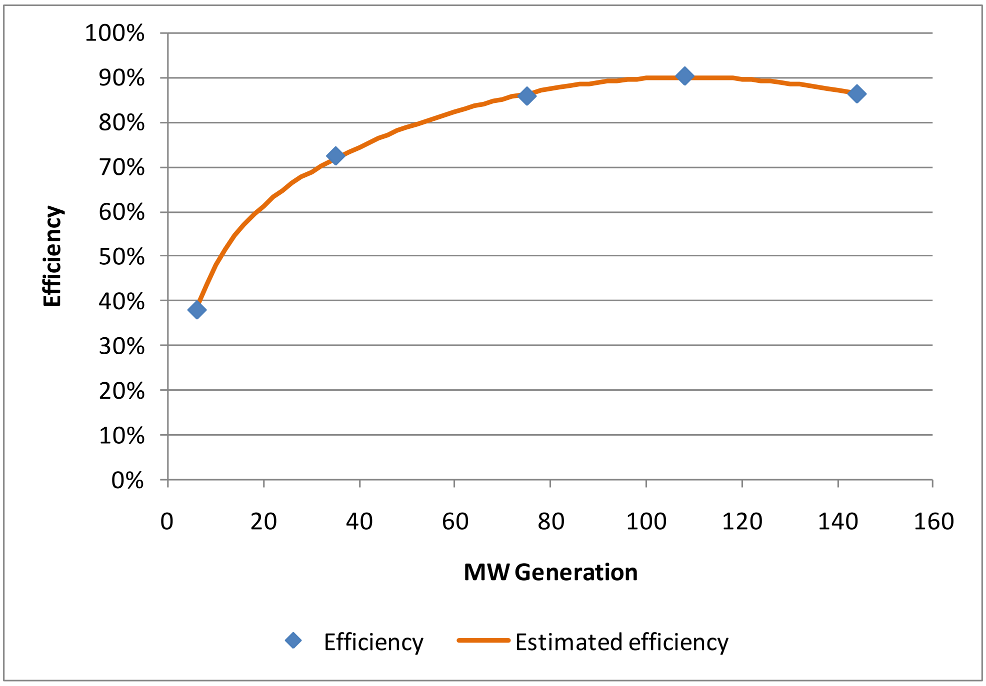


Figure 2 Gordon Units Generation Efficiency Curve

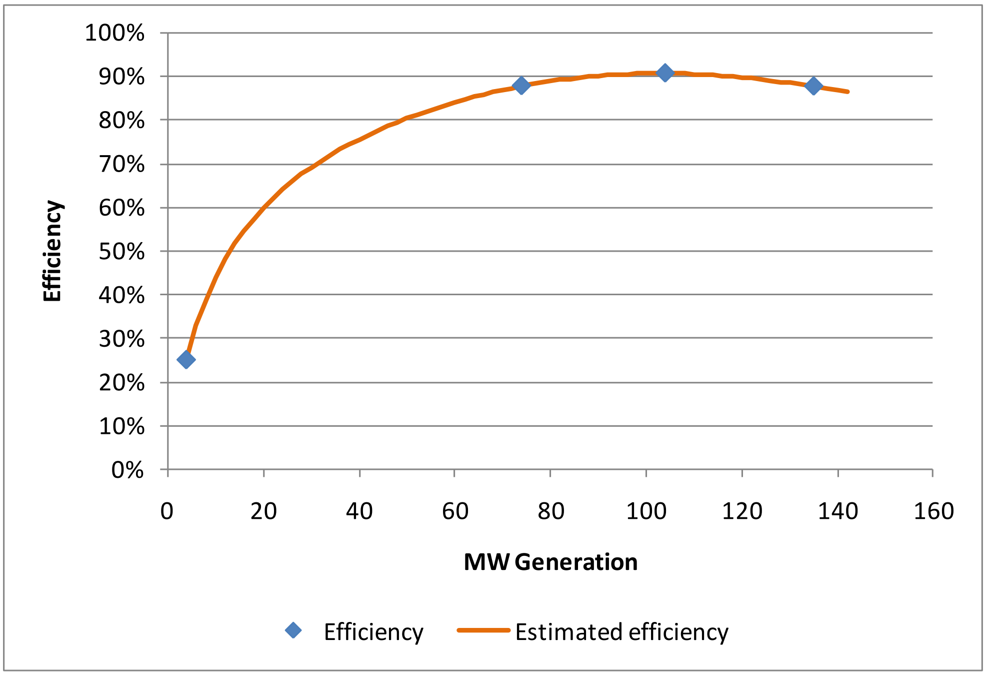


Figure 3 and Figure 4 show the maximum amounts of 6s raise that can be provided versus MW power output. The figures also show the opportunity costs in terms of water power losses incurred when operating away from the most efficient generation points. Please note that the Gordon information is for when just one unit is operating.

Figure 3 John Butters 6s Raise Capability and Water Power Losses Due to Operating Away from Maximum Efficiency Point

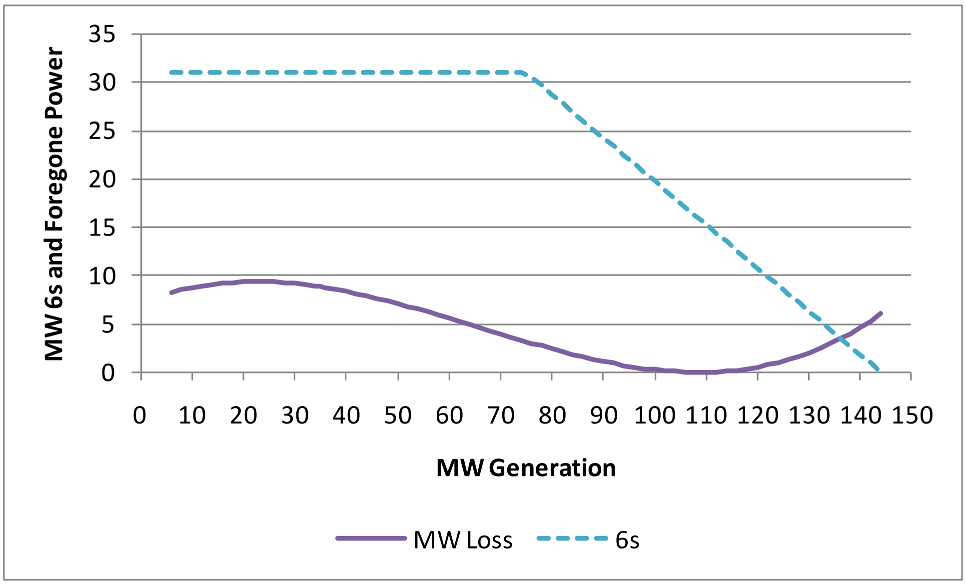
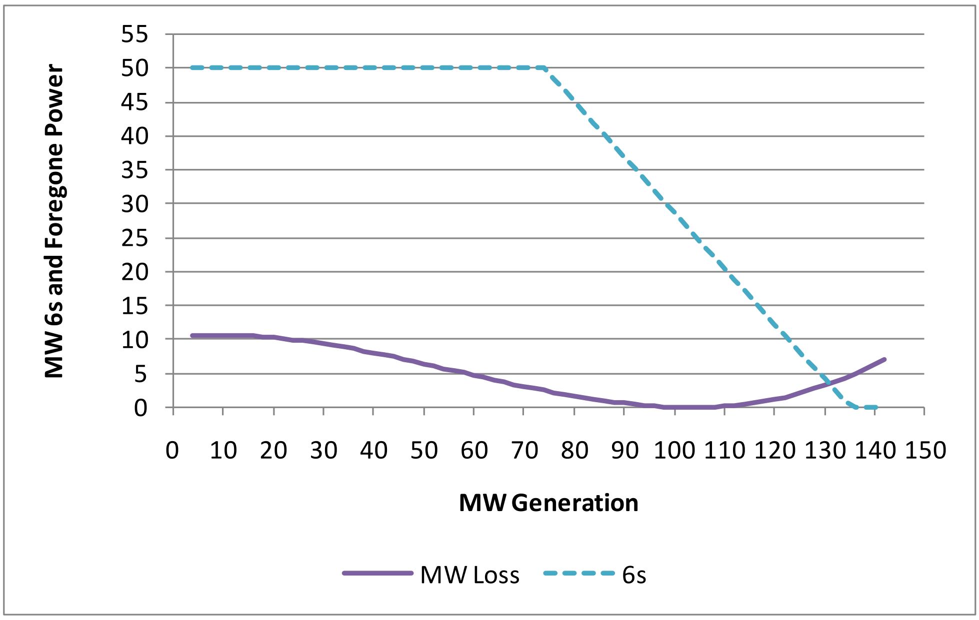


Figure 4 Gordon 6s Raise Capability and Water Power Losses Due to Operating Away from Maximum Efficiency Point



The amount of 6s raise that can be provided from Gordon power station does not increase linearly with the additional units operating. This is because the units share a common pipeline (penstock) which with increasing flows diminishes the speed with which the units can increase their outputs. The maximum amounts of 6s raise that can be supplied from Gordon are as follows:

Number of units committed	Maximum MW 6s raise[4]
1 unit running	50 MW
2 units running	87 MW
3 units running	100 MW

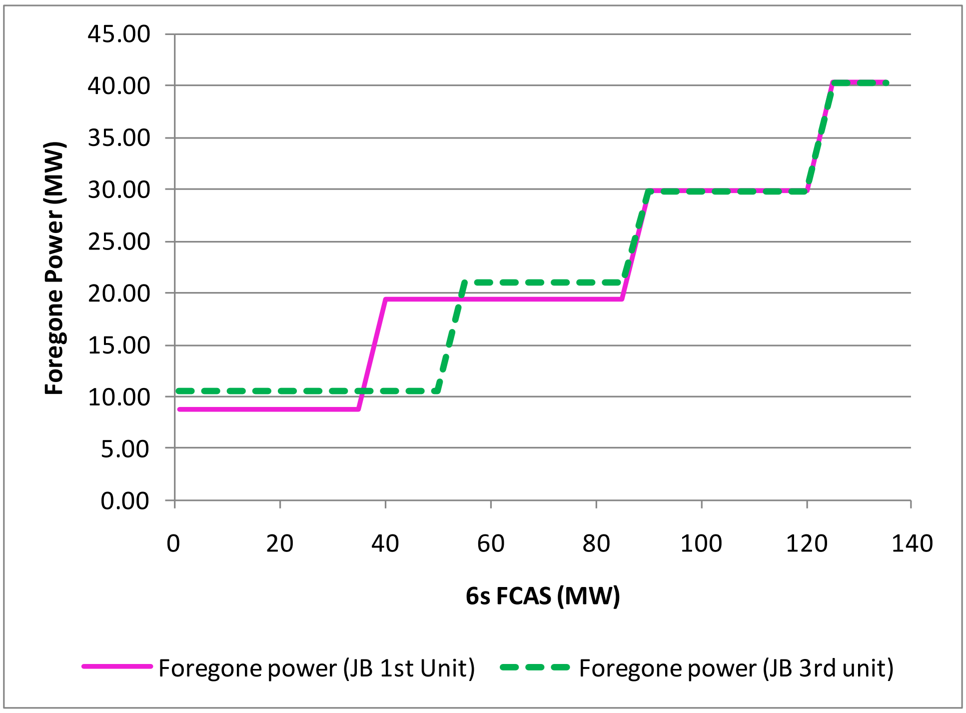
IES combined the information on the amount of 6s raise service and the water power opportunity costs versus power output to produce a supply curve for providing 6s raise. IES's model assumed the marginal amounts of 6s raise were being supplied by only John Butters and Gordon power stations.

Figure 5 shows a graph of the foregone power versus amount of 6s raise provided. There are two lines: the pink solid line is the FCAS supply curve when John Butters power station has the first unit committed to run to provide 6s FCAS and then additional units are committed from the Gordon power station to meet increasing amounts of 6s FCAS as required. The green dotted line is for when units from Gordon power station are committed first. The staircase appearance of these lines is due to additional FCAS requiring additional units being committed and these units providing blocks of additional 6s raise at no additional

[4] These figures are based on a mid range of operating heads.

cost once the unit has been committed. These supply curves have been constructed on the basis that the FCAS is being required at the time of Basslink imports and that the power generation and consequent water use at Gordon and John Butters is to be minimised at these times.

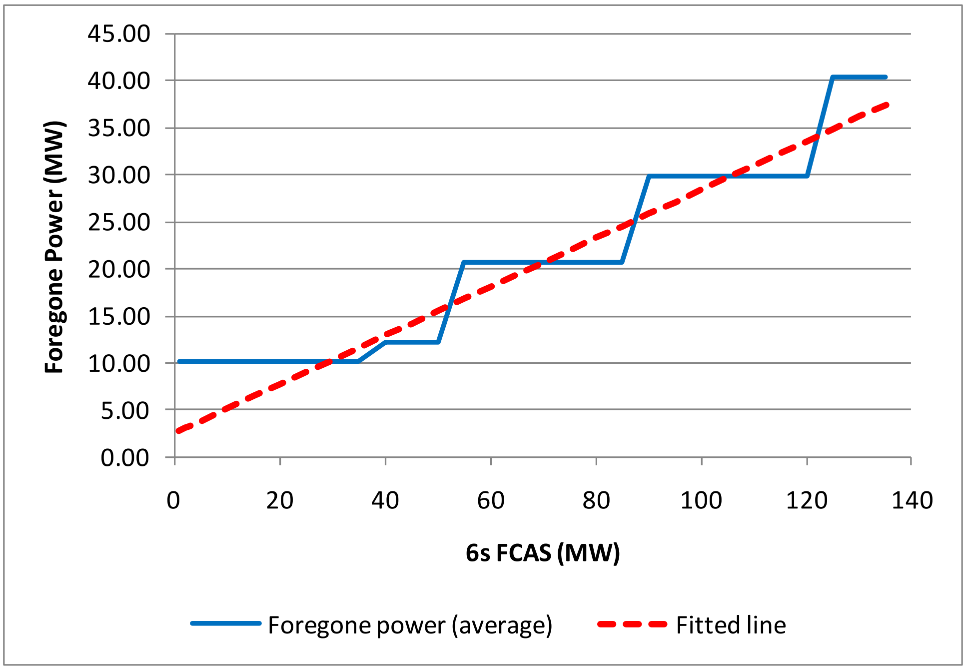
Figure 5 Supply Curves: Foregone Power versus 6s Raise



If we assume that for 20%[5] of the time the John Butters unit is operating to provide 6s raise FCAS when there is a Tasmanian requirement for a local 6s raise service, then the expected opportunity cost for foregone power is the blue solid line in Figure 6. This line is a weighted combination of the two lines in the previous graph. The red dotted line is a fitted straight line which is based on the average amount of foregone power per MW of 6s raise for a 85 MW requirement. This is equivalent to 0.26 MW of foregone power per 1 MW of 6s raise supplied. This line has an intercept of 2.6 MW. This intercept can be interpreted as a fixed cost of providing 6s raise.

[5] The figure of 20% was supplied by Hydro Tasmania.

Figure 6 Average Supply Curve: Foregone Power versus 6s Raise



3.3.3 Calculation of the Value of Foregone Power Generation

Conceptually, calculating the value of foregone power generation is simply a matter of determining the amount of foregone power and valuing this in terms of lost generation and REC sales. However there are a number input values (parameters) to this calculation that need to considered and sourced. These include:

- A price for the foregone generation;
- A price for the foregone RECs;
- A probability that the foregone water power output would have produced RECs;
- The relative proportion of the time that John Butters would be providing 6s raise FCAS and as a consequence expected foregone generation at John Butters and Gordon; and
- The proportion of the time water released from Gordon and John Butters respectively could be attributed to the need to meet environmental flow requirements.

3.3.4 Value of Lost Electricity Sales

The value of the lost electricity sales in the future could be approximated by a number of methods including the following:

- Using the Victorian prices for a one year flat swap or futures contract;

  - For example the average price of the d-cypha SFE Australian Electricity Futures market[6] base contract for the following twelve months at a predetermined date or at the time of the contract, for instance the prices on the last business day prior to the commencement of the contract.
- Using the Victorian prices for a one year peak period swap contract;
  - For example the average price of the d-cypha peak contract for the following twelve months at a predetermined date or at the time of the contract.
- The long run average cost of generation; and
- The long run marginal cost of generation.

In the draft report IES stated it favoured using the price for a one year Victorian peak swap contract starting from the next quarter. This was based on the consideration that the large water storages associated with John Butters and in particular Gordon generation would provide substantial discretion in targeting generation into periods of high electricity prices, and the long term annual average capacity factors of these power stations suggested that on average generation would earn a price similar to the average peak period power price. In considering submissions on its draft report, IES has accepted the point made by Infratil that although on average these power stations might earn the peak power price, at the margin, the appropriate valuation would be the spot price expected to be exceeded a percentage of time equal to the average capacity factor. Based on analysis set out in Chapter 4, IES has adopted the view that the flat swap price rather than the peak swap price should be used.

Since there are several sources of swap prices including d-cypha SFE Australian Electricity Futures market, Australian Financial Markets Association (AFMA) and Next Generation Energy Solutions, the price used for energy should be based on a mutually agreed source and be based on an average of a week of price data at the time of the contract or at a predetermined date. If no agreement can be reached then IES favours the use of d-cypha SFE Australian Electricity Futures market data as this is publicly available and is a reflection of actual exchange traded transactions.

3.3.5 Value of Lost Renewable Energy Certificate Sales

The value of the lost renewable energy certificates in the future could be approximated by the current spot price of RECs or the futures price for RECs to be delivered in January the following year. There are several sources of this price information including Australian Financial Markets Association (AFMA) and Next Generation Energy Solutions (Nextgen) in their Green Room publication. The price used for RECs should be based on a mutually agreed source and be based on an average of a week of price data at the time of the contract or at a predetermined date.

[6] The electricity futures contract prices are available on d-cyphaTrade's website: http://d-cyphatrade.com.au/market_futures/vic#A

3.3.6 Probability of RECs

Because the baselines for pre 1997 hydro plant reflect their long term average outputs, one would expect that, due to the nature of the variability of inflows into hydro storages, that RECs should be produced in 50% of years over the long term. Depending on the state of storage levels, for some years the probability will be higher than 50% and in other years the probability will be lower than 50%.

3.3.7 John Butters Operation in Providing FCAS

Hydro Tasmania has suggested that the unit at John Butters would be providing 6s raise FCAS 20% of the time when there is a local Tasmania requirement. Such a number could be validated by historical NEM data.

However, the proportion of the time that John Butters is providing 6s raise does not affect the calculation greatly, never the less IES suggests that this proportion be determined based on the historical percentage using the last 12 months of operations. This information can be obtained from NEM published data.

3.3.8 Environmental Flows

If there are requirements for environmental flows and to satisfy these requirements necessitates units at Gordon or John Butters operating at low or inefficient outputs then it could be argued that the provision of 6s raise in these cases does not increase the amounts of water released and hence does not result in Hydro Tasmania incurring any additional opportunity costs.

Hydro Tasmania has informed IES, that the operation of John Butters is not affected by environmental flows but Gordon is. In the case of Gordon there is a minimum flow required of 10 cubic metres per second (m^3/s or cumecs) during the summer months and 20 cubic metres per second during the winter months.

A 10 cumec flow corresponds to a Gordon unit operating at 5 MW and providing 50 MW of 6s raise. A 20 cumec flow corresponds to a Gordon unit operating at 21 MW and providing 50 MW of 6s raise.

Thus during months of the summer period, none of the water passed through the turbines of a second unit could be attributable to environmental flows. Thus the marginal provision of FCAS from a second unit during this period would have no reduction in opportunity cost due to environmental flows.

For the winter months the situation is different. During these months a second unit could be run at 5 MW and this would satisfy the 20 cumec environmental flow requirement. The opportunity cost of running the second unit compared to running one unit is 21 MW – 10 MW = 11 MW. Whereas if there had been no environmental flow requirement then the opportunity cost for running two units at 5 MW would have been 2 x 10.5 MW = 21 MW. Thus the requirement for environmental flows has reduced the lost opportunity by 10 MW which as a percentage is 10/21 = 48%. Consequently if we assume that there are 6 months of the summer regime and 6 months of the winter regime of environmental flows, this gives an estimate that 25% of the lost power due to providing the marginal

FCAS at Gordon power station, requiring a second Gordon unit to be operating, would have been required to satisfy environmental flows anyway.

3.3.9 Example Calculation of the Variable Opportunity Cost

The following is an example of a calculation of the opportunity cost to Hydro Tasmania of providing the marginal MWs of 6s raise FCAS. The calculation determines the amount of foregone generation per MW 6s raise provided. For this calculation IES has assumed that the total Tasmanian requirement for 6s raise is 80 MW and the assumed parameters for energy and REC prices etc are in Table 1. Some of the values, such as REC and energy prices, are for illustrative purposes and do not accurately represent the current values. John Butter's 36 MW capability is its registered value rather than its operating capability of around 31 MW.

In essence the calculation of the marginal cost of providing FCAS uses the following steps and assumptions:

- The marginal FCAS is provided from either a Gordon unit or a John Butters unit;
- The physical amount of power foregone is determined for the marginal MW of FCAS provided. This marginal cost calculation is approximated by assuming a linear opportunity cost function for Gordon and John Butters units. The slope of this linear function implies that on average 0.26 MW of opportunity cost is incurred per MW of 6s FCAS provided. The intercept of this linear function is 2.6 MW and this implies that on average there is a fixed cost of 2.6 MW associated with providing the marginal FCAS.
- The value of foregone power is determined by the flat forward contract price, say $35/MW, and the current REC spot price, say $30/MWh, and the probability of producing RECs, 50%. This gives a foregone energy price of $50/MWh.
- The value of the foregone power is adjusted for the fact that 25% of the foregone power of a second unit operating at Gordon could be attributed to winter environmental flows. Very approximately, this is 0.26 MW / MW x (0.8 x 0.75 + 0.2 x 1.0) x $50/MWh = $10.40/MWh. When the calculations are done such that they take account the relative efficiencies of running one Gordon unit plus one John Butters unit versus two Gordon units the calculation gives a more accurate variable cost of foregone generation of approximately $10/MWh of FCAS and a fixed cost of approximately $2.40/MWh, giving a total cost of about $12.40/MWh.

The details of the example calculation are presented below.

Table 1 Model Input Parameters

	John Butters providing FCAS with Gordon	*Gordon alone providing FCAS*
Proportion of the time	20%	80%
Energy Price ($/MWh)	35	35
Proportion of lost water power needed for environmental flows	0%	25%
REC price	30	30
Probability of RECs	50%	50%

In order to supply 80 MW of 6s raise FCAS, either John Butters (36 MW 6s raise) and one Gordon units (50 MW 6s raise) or two Gordon units (87 MW 6s raise) need to be operating. If we assume that John Butters is only running for 20% of the time then to meet an FCAS requirement of 80 MW would require an average of 7.2 MW from John Butters and 72.8 MW from Gordon.

Table 2 Estimated Average MW Provision of 6s Raise FCAS

	John Butters	*Gordon*
John Butters Priority	36.0	44.0
Gordon Priority	0.0	80.0
Weighted average	7.2	72.8

Given the average provision of FCAS it is possible to determine the water power foregone per MW of FCAS service provided under the regimes of using John Butters and Gordon versus Gordon only (Table 3). The average amount of power foregone to supply 1 MW of FCAS is 0.022 MW + 0.237 MW = 0.259 MW. That is, to supply 1 MW FCAS has an opportunity cost of about 0.26 MW of power.

Table 3 Estimated Foregone Generation (MW) per MW of FCAS Provided

	John Butters	*Gordon*
MW of foregone generation per MW 6s raise for each unit	0.24	0.26
MW of forgone generation on average for the portfolio of John Butters and Gordon combined	0.022	0.237

Under the assumptions presented in Table 1, including the estimate that 25% of the provision of 6s raise from Gordon does not incur any additional costs due to the requirements for environmental flows, the estimated opportunity cost for provision of 6s raise FCAS is about $10/MWh. How this figure is determined is outlined in Table 4.

Table 4 Opportunity Cost per MW FCAS ($/MW per hour)

	John Butters	*Gordon*	*Total*
MW foregone per MW FCAS once environmental flows are considered	0.022	0.178	0.199
Price per MWh foregone ($/MWh)	50	50	
Opportunity cost (price) per MW FCAS ($/MWh)	1.09	8.88	9.97

3.3.10 Allocation of Fixed Opportunity Cost

There is always some arbitrariness in allocating fixed costs but some attempt needs to be made otherwise Hydro Tasmania will be systematically under compensated if the linear approximation of FCAS opportunity costs is used. IES suggests that the fixed cost be allocated based on the maximum hedge quantity the generator wishes to contract for (the hedge quantity cap) and the expected total Tasmanian requirements at the times when the generator's liability is near its maximum.

The fixed cost (intercept of the straight line) is approximately 2.6 MW per hour comprising on average 0.5 MW of John Butters and 2.1 MW of Gordon based on John Butters operating 20% of the time. When the impacts of environmental flows are considered and the assumptions in the earlier tables are used, this results in an hourly cost of approximately $103. This in turn gives an annual fixed cost of about $810,000 per annum ($812,050 per annum) assuming that there is a material local requirement 90% of the time. For more details see the table below.

Table 5 Fixed Opportunity Cost Calculation

	John Butters	*Gordon*	*Total*
MW foregone due to fixed losses once environmental flows are considered	0.48	1.58	2.06
Price per MWh foregone ($/MWh)	50	50	
Opportunity cost (price) for fixed losses ($/h)	24.18	78.82	103.00
Annual cost ($)	190,620	621,430	812,050

For a generator requiring a cap of X MW and the generator's maximum exposure occurring when the total Tasmanian liability is expected to be about Y MW, then the generator would pay a contribution to the fixed costs of:

(X / Y) x Total annual fixed cost

For a 30 MW cap and an expected Tasmanian requirement of 130 MW this would be approximately $187,000 per annum ($187,396 per annum).

3.3.11 Example Calculation of Variable and Fixed Cost Components of a Contract

Under the assumptions

- that a generator had an average liability of 10 MW for 6s raise over all time periods when there is a material local requirement;
- that this generator needed to be hedged for up to 30 MW when there were local requirements; and
- material local requirements greater than 40 MW occurred 90% of the time

an approximate annual cost to the generator would be

- fixed cost = $187,000 per annum ($187,396 per annum);
- variable cost = 10 MW x $9.97 / MWh x 8760 h x 90% = $785,840 per annum
- total cost = $973,236 per annum.

4 Submissions on the Draft Report

4.1 Introduction

Three submissions have been made regarding the FCAS Pricing Investigation Draft Report. These are from Hydro Tasmania, Aurora Energy / AETV and LMS Generation / Infratil. IES has also had discussions with each party about the proposed approach and the issues raised in each submission.

Generally the submissions support the proposed approach to regulating FCAS prices. Various disagreements are expressed with respect to the basis of pricing (Aurora Energy / AETV, LMS Generation / Infratil) and the exclusion of certain cost items (Hydro Tasmania). Also LMS expresses concern about the “complexities of the proposed pricing arrangements”.

A summary of the submissions’ areas of agreement and disagreement with the broad design of the proposed FCAS pricing regulation are presented in Table 6. A summary of the submissions with respect to the details of the pricing parameters and the contract terms and conditions are presented in Table 7.

Table 6 Summary of Submissions Regarding the Broad Design of the Proposed Price Regulation

Proposed Approach	Hydro Tasmania	Aurora/AETV	Others (Infratil)
Financial hedge contract	Agree	Agree	Agree
Bundling of the 3 FCAS	Agree	Agree	Agree
Quantity based on actual liability	Agree	Agree	Agree
Reduction in quantity based on self provision	Agree	Agree	Agree
Safety net contract	Agree	Agree	Agree
Six month period for contracts	Agree	Agree	Agree
Commencement of declaration (1/1/2011)	Disagree (propose 31/1/2011)	Agree	Agree
End of declaration (5 years)		Agree	Agree
Standard ISDA contract		Agree	Agree
Materiality of new supply	Size sufficient to supply all non Hydro Tasmania needs		
Costs of inertia not included	Disagree: propose that inertia costs be included		
Cost of regulation not included	Disagree: propose that their regulatory costs be recovered		
Proposed pricing methodology	Agree	Agree	Agree

Table 7 Pricing Parameters and Contract Terms and Conditions

Proposed Approach	Hydro Tasmania	Aurora/AETV	Others (Infratil)
Energy price	Vic peak contract prices	Vic flat prices	Vic peak minus value of cap contract
REC price	AFMA	AFMA, Greenroom or other publication	Agree
Probability of producing RECs	Agree	Disagree	Agree
Amount of foregone generation	Agree	Disagree	
Impact of environmental flows	Agree	Disagree	
No premium for quantity based on liability	Disagree: propose 30% premium		
Allocation of fixed opportunity costs when providing FCAS	Agree with approach but disagree with input parameters	Disagree	
Determination of when there is a local requirement (Basslink import definition)	Suggest criterion of Basslink flow < + 180 MW	Use actual local requirements	
Energy price reference using 1 year forward contract period	Disagree (propose 6 month forward contract prices)		

4.2 Infratil's Submission

Infratil was in general agreement with the approach but disagreed with the use of prices for Victorian peak period contracts as the basis for valuing the foregone energy generation. Infratil argued that the foregone water would correspond to marginal generation. This extra generation would not be used at the highest price periods as water and generation capacity would be allocated to these highest price periods first. Rather, the extra generation would be used for intermediate priced periods. Specifically, the marginal generation of a power station with a capacity factor of say 40% would be getting prices around the 40th percentile of high prices. Infratil suggested using the peak price and subtracting the value of cap contracts to reflect the fact that the marginal generation would not be in the highest price periods.

IES investigated the relationship between the marginal generation and the Victorian spot prices that could be obtained. Gordon's long term capacity factor is approximately 35% and John Butter's is approximately 40%. If the generation from these power stations is optimised to obtain the greatest prices then the first MWh of generation would be allocated to the highest prices then the next MWh to the next and so on. Using this process and assuming perfect foresight, the marginal generation for Gordon should be able to obtain prices around the 35th percentile and John Butters around the 40th percentile. Table 8 shows the historical Victorian 35th and 40th percentiles and the average peak and off peak prices and the average of prices exceeding the percentile prices. From this table it is clear that the marginal generation is much more likely to attain prices around the average price than the peak price. In fact the percentile prices over all the years are generally less than the average price. Thus, IES would recommend using the flat contract price rather than the peak contract price.

Table 8 Victorian Electricity Spot Prices ($/MWh)

Year	35th percentile	40th percentile	Average of top 35%	Average Top 40%	Average Peak Price	Annual Average Price
1999/00	25.50	23.56	44.27	41.79	30.82	26.35
2000/01	37.01	34.93	85.67	79.47	61.01	44.57
2001/02	27.32	26.48	49.91	47.04	38.32	30.97
2002/03	25.48	24.25	47.37	44.56	37.70	27.56
2003/04	24.58	23.30	40.86	38.74	32.44	25.38
2004/05	27.69	26.47	42.73	40.78	35.39	27.62
2005/06	25.48	24.20	59.24	54.94	45.87	32.47
2006/07	44.42	40.41	106.33	98.34	80.39	54.80
2007/08	45.21	43.09	77.79	73.59	62.78	46.79
2008/09	36.64	34.65	76.18	71.11	60.85	41.82
2009/10	26.84	25.28	66.50	61.44	55.00	36.28

4.3 Aurora / AETV Submission

The key areas wherein the Aurora / AETV submission disagrees with the proposed approach are as follows:

- Energy price;
- Probability of producing RECs;
- Amount of foregone generation;
- Impact of environmental flows;
- Allocation of fixed opportunity costs when providing FCAS; and
- Determination of when there is a local requirement.

4.3.1 Energy price

IES agrees with Aurora and Infratil that the peak contract price proposed in the draft report is too high. We suggest using the flat contract price.

4.3.2 Probability of Producing RECs

IES discussed this point with Aurora / AETV and pointed out that in the long term one would expect that in roughly 50% of years the generation of a hydro power station would be above its REC baseline which reflects its average output and the other 50% of the time it would be below. When a hydro generator is above its baseline all of its marginal output would earn RECs. Hence, in the longer term, the foregone generation would be expected to earn RECs 50% of the time.

4.3.3 Amount of Foregone Generation

Aurora / AETV argued that because about 20% of the local supply of 6s raise comes from plant other than Gordon and John Butters, and that this plant is most likely only moved small amounts away from its most efficient dispatch points, the opportunity cost of providing FCAS from this plant would be nearly zero. IES pointed out to Aurora that our calculations were based on the cost of providing the marginal MW of FCAS not the average cost and if this plant had zero opportunity cost it would not be the marginal plant. The reason why we are using the opportunity cost of the marginal plant rather than the average cost is because this price is indicative of the price which would come out of a truly competitive market.

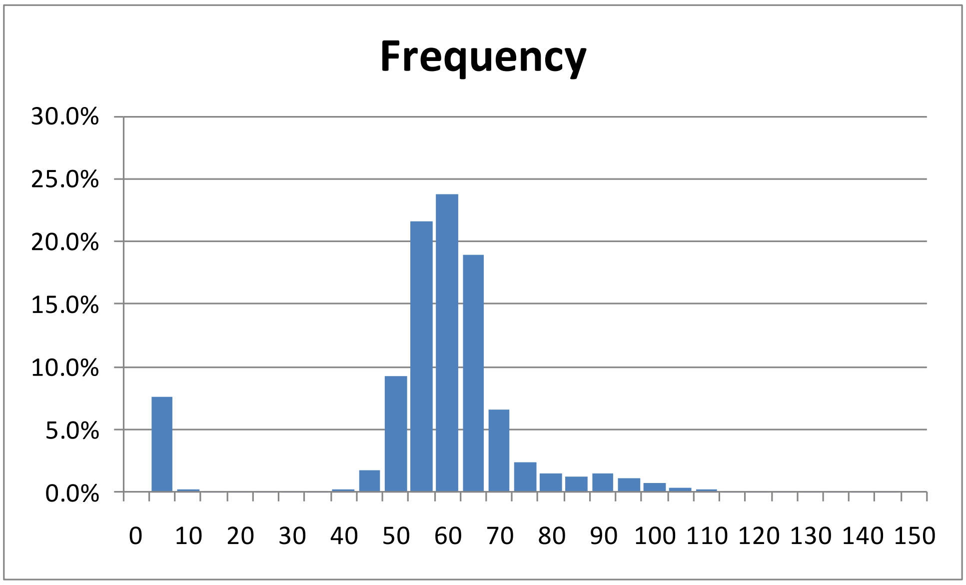
IES has assumed that the marginal MW of FCAS would generally come from a Gordon unit or a John Butters unit. Thus the marginal cost of supplying FCAS would be the marginal cost of providing an extra MW from Gordon or John Butters.

4.3.4 Impact of Environmental Flows

Aurora / AETV argued that any total FCAS requirement less than 50 MW would have no opportunity cost as a Gordon unit would have to be running to meet environmental flows anyway and a single Gordon unit could provide up to 50 MW of FCAS.

IES examined the distribution of 6s FCAS requirements and concluded that most of the time when there is a local requirement it is over 50 MW (see Figure 7), hence it could not be provided by one unit at Gordon alone.

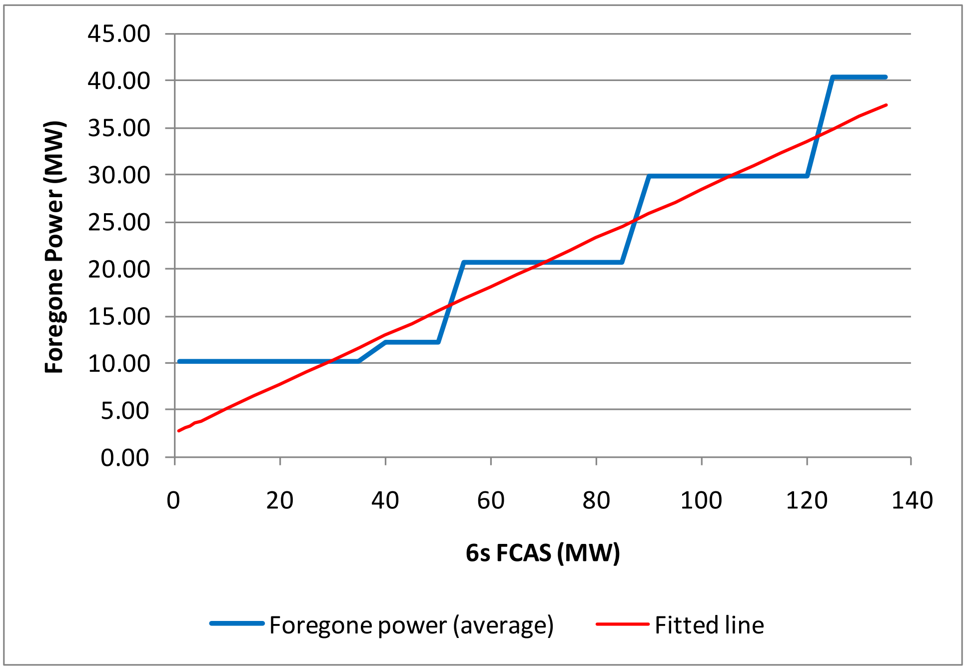
Figure 7 Histogram of Local FCAS Requirements (MW)



4.3.5 Allocation of Fixed Opportunity Costs when providing FCAS

In its submission Aurora questioned the fixed opportunity cost. In its subsequent discussions with Aurora, IES reiterated that the fixed opportunity cost calculation arises as a consequence of the straight line used to approximate the stepped FCAS supply curve having a non zero intercept (Figure 8) and that the fixed cost when there is a local requirement needs to be allocated. If the non zero intercept is not used, then effectively the straight line which is used to approximate the FCAS supply curve is always below the stepped FCAS opportunity cost function.

Figure 8 Average Supply Curve: Foregone Power versus 6s Raise



4.3.6 Size of a Local Requirement

In its submission Aurora argues that when there is a local requirement that is less than 50 MW, Hydro Tasmania's opportunity cost should be zero as this requirement can be met by Gordon generation which is meeting its environmental flows.

In the draft report, the occurrence of a local requirement was considered to be based on whether Basslink is exporting less than 50 MW. However since the MW of local requirements can be obtained directly, it would be better to simply use the presence of a non zero local requirement as the basis of determining whether there is a local requirement.

The ramifications of the two previous points are that any non zero local requirement should be covered by the hedge and any requirement less than say 40 MW should be deemed as having a zero opportunity cost because Hydro Tasmania would automatically meet this requirement as a consequence of satisfying environmental flows for the Gordon Power Station. Accordingly the hedge cost should be based on local requirements that exceed 40 MW.

4.4 Hydro Tasmania Submission

The key areas wherein the Hydro Tasmania submission disagrees with the proposed approach are the following:

- Commencement of declaration;
- Materiality of new supply;

- Costs of Inertia;
- Cost of regulation;
- Source of REC price;
- Duration of forward contract used for pricing;
- Premium for meeting actual liabilities; and
- Determination of local requirement.

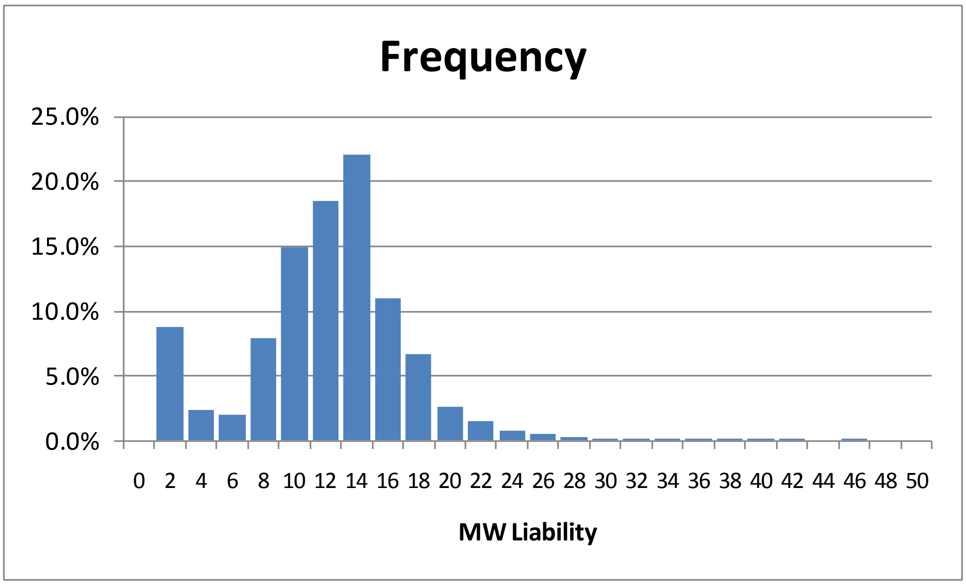
4.4.1 Commencement of Declaration

Hydro Tasmania would like the commencement of the declaration to be 31/1/2011 rather than the 1/1/2011 date that Aurora would prefer.

4.4.2 Materiality of New Supply

Hydro Tasmania suggests that the threshold for a material new supply should be related to the non Hydro Tasmania liabilities. That is, if a new supplier were able to enter the market and provide for all the FCAS requirements of non Hydro Tasmania generators then this would meet the threshold of a material new supplier. IES agrees with this suggestion. Figure 9 presents the historical total liabilities for non Hydro Tasmania generators. If a threshold of 16 MW were set for a material new entrant then 16 MW of capability would cover the total FCAS requirements for non Hydro Tasmania generators about 87% of the time. If this threshold were set at 20 MW then it would cover the total FCAS requirements for non Hydro Tasmania generators about 97% of the time.

Figure 9 Histogram of Non Hydro Tasmania 6s FCAS Liabilities (MW)



4.4.3 Costs of Inertia

The amount of inertia on the Tasmanian system at any time does influence the amount of 6s FCAS required but it is not a straight forward substitute. Further, AEMO does not deem inertia to be a way of providing 6s FCAS. The low inertia levels in Tasmania are due to Basslink and the wind farms being able to inject power into the system and providing little or no inertia.

Hydro Tasmania could propose that inertia be recognised as an ancillary service under the NEM Rules. IES considers that in the event that inertia is recognised as a new ancillary service, the costs for this service will likely be allocated as a network ancillary service or perhaps allocated to low inertial sources of power such as wind farms and Basslink. It is unlikely that inertia costs would be allocated along the cost recovery lines used for raise FCAS services. For these reasons IES considers it inappropriate that Hydro Tasmania recover these costs through the FCAS safety-net contract.

4.4.4 Cost of Regulation

Hydro Tasmania argues that its costs related to the regulation of FCAS pricing should be recovered through the FCAS pricing mechanism. IES strongly disagrees with this proposition.

4.4.5 Source of REC Prices

Hydro Tasmania suggests that it would prefer to use AFMA's reported REC prices rather than NextGen's Green Room prices. IES considers that AFMA is an appropriate source of REC prices.

4.4.6 Duration of Forward Contract Used for Pricing

In the draft report IES suggested using annual Victorian forward contract prices to avoid including substantial seasonal variations associated with high Victorian contract prices for the first quarter of each year. Hydro Tasmania has suggested using 6 month forward contract prices to reflect the contract durations. IES considers this inappropriate in view of the substantial energy storage capacity associated with the FCAS providing generators.

4.4.7 Premium for Meeting Actual Liabilities

Hydro Tasmania has suggested that a premium of 30% above costs should be imposed on the contract prices to reflect that the contracted amounts match the actual 5 minute liabilities. This is based on an analogy to premiums paid for load following contracts in the energy market due to the risks that a generator takes on when selling these contracts. IES considers this analogy not to hold in the context of Tasmanian FCAS provision as, rather than increasing risk, a contract that matches actual liabilities reduces risks for both Hydro Tasmania and the contracting generator.

4.4.8 Determination of Local Requirement

Hydro Tasmania has suggested that the presence of a local requirement be determined by when Basslink exports are less than 180 MW. As discussed earlier, IES prefers the option of using actual local FCAS requirements being non zero as the basis of determining when there is a local requirement.

4.4.9 Fixed Cost Calculation

In the draft report, IES suggested that as part of the pricing methodology, a generator should pay a portion of the fixed opportunity costs based on the ratio of its capped amount and the average or expected total Tasmanian requirement at times when the generator's liability is at a maximum or above or near the cap quantity. That is the generator would pay a contribution to the fixed costs of:

(X / Y) x Total annual fixed opportunity cost

where X MW is the capped amount of the generator's FCAS liability, and

Y MW is the expected total Tasmanian generators' liability when the generator's liability is at a maximum or near or above the capped quantity of X MW.

Hydro Tasmania has argued that the draft report implies that there is a correlation between a generator's maximum exposure and high Tasmanian requirements. The intention is that the divisor, Y, is based on the expected total Tasmanian generation liability at times when the contracting generator's liability is largest. Thus if the largest liability is expected to occur at times of low Tasmanian demands and maximum Basslink imports, then the average of the total Tasmanian liability at these times would be the divisor Y. An alternative approach to the one suggested in the report for the allocation of fixed opportunity costs, is to use the average proportion of the total liability. However, this approach creates no incentive for the contracting party to minimise their capped amount to what is really necessary for managing their risks.

4.5 Changes to Methodology and Parameter Values Based on Submissions

Based on our consideration of the submissions the main changes to our draft recommendations are as follows.

1. The use of the Victorian flat swap price rather than peak swap price as the basis for the opportunity cost valuation of energy.

   This change was based on IES accepting Aurora and Infratil's arguments that the peak price is an overvaluation of the opportunity cost of the foregone energy when supplying 6s FCAS.

2. The use of a binary strike price which will assume a zero value when the FCAS requirement is less than 40MW.

   This is an out working of Aurora's point on environmental flows but IES has lowered the threshold that Aurora suggested from 50 MW to 40 MW for two reasons. The 40 MW threshold for 6s raise FCAS was chosen because this means that a Gordon unit could satisfy the needs for environmental flows for a range of power outputs and suffer zero or minimal opportunity costs. The slightly lower threshold caters for the situations when Gordon is being dispatched to provide material amounts of generation rather than just for the provision of FCAS. The other reason is that a threshold between 10 MW and 40 MW separates the bulk of small local requirements from the bulk of materially large requirements (see Figure 7).

3. Basing consideration of the materiality of new supply on the liability of non Hydro Tasmanian generators rather than the total liability for Tasmania.

   This change is based on IES accepting Hydro Tasmania's argument that a material new supplier occurs when that supplier can largely replace the need for other generators to contract with Hydro Tasmania to manage their FCAS liabilities.

5 Settlements and Parameter Values

The key parameter values required to determine a contract price and settlements are presented in Table 9. This table also presents the suggested source or method of determining these parameter values.

Table 9 Parameter Values

Parameter	Purpose	Value
Generator turbine efficiencies	Calculation of foregone generation	Standing data provided by Hydro Tasmania
Generator FCAS capabilities	Calculation of FCAS provision and foregone generation	Standing data provided by Hydro Tasmania (can also be obtained from NEM FCAS standing data)
Proportion of the time John Butters is supplying FCAS for local Tasmanian requirement	Calculation of FCAS provision and foregone generation	Average of previous 12 months of historical data (can be obtained from NEM dispatch data)
Energy price	Used to value foregone generation	D-Cypha price for 1 year Victorian flat contract for the next calendar or financial year whichever commences sooner.
REC price	Used to value foregone generation	Most recent REC spot price as published by an appropriate source.
Probability of power station generating RECs	Used to value foregone generation	50%
Proportion of foregone generation required for environmental flows	Used to value foregone generation	25% based on existing environmental flow requirements. This would need to be updated if there is a material change to environmental flow requirements.

Parameter	Purpose	Value
Proportion of the time Tasmania has a local FCAS requirement greater than 40 MW	Used to allocate fixed cost component of opportunity costs	Average of previous 12 months of historical data (can be obtained from NEM dispatch data to determine which periods that Tasmania had a local requirement over 40 MW)
Maximum FCAS hedge quantity (cap)	Used for calculating contract price (fixed cost component)	Nominated by purchaser of contract
Actual FCAS liability for dispatch period used in hedging contract	Used for calculating settlement payments	Quantity determined by 6s liability and maximum hedge quantities for other services determined by scaling these amounts
FCAS quantity scalers	Used for calculating settlement payments	Hydro Tasmania has suggested a ratio of 1 MW 6s : 1.75 MW 60s : 2 MW 5 min
FCAS hedged quantity	Used for calculating settlement payments	• Minimum(cap, actual 6s liability – self provision) • Minimum(1.75 x cap, actual 60s liability – self provision) • Minimum(2 x cap, actual 5 min liability – self provision)
Self provision and contracting with an alternative source.	Used for calculating settlement payments	Quantity in Hydro Contract reduced by actual amounts enabled for contingency raise services in NEM dispatch and/or amount hedged by contract with alternative provider.
FCAS hedge price	Used for calculation fixed for floating price payments	• $0/MWh when total local liability is less than 40 MW • Fixed and variable cost calculation when liability is greater than or equal to 40 MW

Comments on interpreting the above table :

1. Where a value is required to be calculated for the previous twelve month period it should be calculated for a calendar or financial year (i.e from 1 January or 1 July) as appropriate.

2. Where a formula refers to "self provision" this is intended to include contracts with alternative providers as well as the direct means of having the service dispatched in the relevant FCAS market.

As discussed earlier, the "safety net" contract would be a bundled contract for all raise contingency services. As such there could be a number of ways that the bundled price could be split up between the individual services. However this is not really a problem. To illustrate how settlements can work assume that the amounts of FCAS that the generator has contracted for are in the ratio of 1.0 MW of 6s : 1.75 MW of 60s : 2.0 MW of 5 min. Assume that the generator has a cap of Qcap MW of 6s raise and an actual 6s liability of Q6s then the settlement for this 5 minute period would be such that the buyer pays Hydro Tasmania:

Fixed cost component per dispatch interval + Q6s x variable cost per MW FCAS

- Q6s x spot price 6s – Q60s x spot price 60s – Q5min x spot price 5min.

If any of the quantities of the services exceeded the scaled cap amounts then the actual quantities would be reduced to the capped amounts.

6 Summary Recommendations

IES recommends

- the general hedge contract serve as a "safety-net" contract providing a high quality hedge with no exclusions, and that generators be encouraged (but not required) to negotiate price discounts in respect of any exclusions and special conditions they are willing to accept;
- the adoption of the pricing methodology set out in this report along with the identified parameters and proposed basis of setting parameter values;
- that the methodology, current values of parameters, standing data and "safety-net" contract documentation be published on Hydro Tasmania's website.