



ELECTRICITY COMMISSION

**Explanatory Paper and Conclusion
on:**

**Mandatory Use of Extended Water Heating Cuts as
an Emergency Measure**

November 2005

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1. Introduction

Overview

- 1.1 The October 2004 *Government Policy Statement on Electricity Governance (GPS)* requires the Electricity Commission (Commission) to use reasonable endeavours to ensure security of supply in a 1 in 60 dry year.
- 1.2 Paragraph 73 of the GPS describes the Commission role in managing water heating cuts during security of supply situations:

“The Commission is expected to ensure contingency arrangements are put in place for the use of ripple control of hot water heating for use as appropriate if conservation campaigns are required, and as a measure to temporarily reduce demand in events such as major and unexpected plant or transmission line outages. The Commission should recommend regulations and rules if required. (The use of ripple control for these purposes should not preclude its use for other purposes outside of security of supply situations).”
- 1.3 In late 2004 the Electricity Commission issued a discussion paper on emergency security of supply provisions. A number of submitters in response to that paper raised doubts about the potential effectiveness of extended water heating cuts as an emergency measure.
- 1.4 The Commission has since published an *Initial Security of Supply Policy* (June 2005) explaining the Commission’s approach to ensuring security of supply. Paragraph 2.10 of that document notes that the process for dealing with emergency security of supply situations will be detailed in an Emergency Response Plan (ERP). Given that the Emergency Response Plan will take some time to prepare, the Commission decided to develop an Interim Emergency Response Plan (Interim ERP) that could be activated should an energy supply contingency arise in the near future. Water heating cuts are included in the Interim ERP as a possible measure.
- 1.5 As a result of the doubts raised by submissions the Commission also decided to further investigate the effectiveness of extended water heating cuts as an emergency measure.
- 1.6 On 18 August 2005, the Commission published a consultation paper titled “Mandatory Use of Extended Water Heating Cuts as an Emergency Measure”. An accompanying analysis titled “Desktop Analysis on the Effectiveness of Extended Water Heating Cuts as an Emergency Measure” (July 2005) was attached as an appendix to the consultation paper.

Draft Conclusions in Consultation Paper

- 1.7 The consultation paper and accompanying analysis put forward the following draft conclusions:
 - Extended water heating cuts are likely to produce less than 2% national electricity savings;

- To achieve this level of national savings, water heating cuts would need to be very extended, of the order of 16 to 18 hours per day nationwide, and the effects would be uneven across society;
- Extended water heating cuts are likely to have negative implications for the instantaneous reserves market and AUFLS;
- Extended water heating cuts could potentially reduce the effectiveness of other savings measures;
- Preference should be given to encouraging voluntary savings in hot water use as part of any national energy savings campaign (noting that some retailers may also cut water heating as a commercial response to high spot prices);
- Despite the limited potential and the acknowledged downsides of using water heating cuts as an emergency measure, there may be value in accessing extended water heating cuts in extreme circumstances, provided that the Commission is convinced, at the time, that they have the potential to help avoid rolling blackouts.

Questions Raised by the Consultation Paper

- 1.8 The Consultation paper invited submissions on the analysis and the draft conclusions. In particular, the consultation paper posed ten questions for submitters:

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| <p>1. Do you agree with the conclusions reached in the Concept technical analysis included in appendix 1 of the consultation paper? Those conclusions were:</p> <ul style="list-style-type: none"> • The potential savings from water heating cuts are likely to be less than 2% of national electricity demand; • Even this modest level of savings is likely to require extended water heating cuts of the order of 12-16 hours per day. |
| <p>2. Do you agree that the potential savings from extended water heating cuts may be significantly reduced by the following factors:</p> <ul style="list-style-type: none"> • consumers are likely to be making voluntary savings in the use of hot water as a result of a call for national savings; • some retailers may cut hot water as a means of managing their exposure to high spot prices; • some distributors may cut hot water as a means of reducing demand on the grid / local network? |
| <p>3. Do you agree that extended water heating cuts may have an adverse impact on the reserves market and/or AUFLS, and that this could reduce security of supply?</p> |
| <p>4. Do you agree that mandatory water heating cuts may dilute the incentives for residential consumers to achieve voluntary energy savings?</p> |

5. Do you consider that the Commission should be concerned about the uneven impact of water heating cuts across households?
6. Do you agree that there are potential safety issues with water heating cuts? Are there other safety issues that should be noted?
7. Do you agree that the long-term impact of water heating cuts on the availability of controlled water heating load is an important consideration in examining the appropriateness of mandatory water heating cuts?
8. Do you agree with the conclusion that, despite the limited potential and the acknowledged downsides of using water heating cuts as an emergency measure, they may have value as a last resort measure in extreme circumstances?
9. Do you agree that, before water heating cuts are used as an emergency measure, the Commission should be convinced, at the time, that the use of water heating cuts will have a material affect on the potential to avoid rolling blackouts?
10. Do you agree with the Commission's overall conclusions?

The Submission Process

- 1.9 The submissions on the consultation paper closed on 7 October 2005. Sixteen submissions were received.
- 1.10 The full submissions are available to view on the Electricity Commission website.
- 1.11 Submissions were received from the participants set out in the following table. These submissions are drawn upon at various points in this paper.

Retailer / Generator	Distributors	Other
Contact Energy	Aurora	Major Electricity Users' Group (MEUG) Parliamentary Commissioner for the Environment (PCE) Transpower
Genesis Energy	Counties Power	
Meridian Energy	Horizon	
Mighty River Power (MRP)	Northpower	
TrustPower	Orion	
	Powerco	
	Vector	
	Waipa Networks	

- 1.12 The Commission has considered the submissions and has made decisions on its approach to extended water heating cuts during a security of supply situation. This document sets out the Commission's decisions and explains the rationale for those decisions.

2. Summary of Submissions

- 2.1 A summary of the submissions has been prepared and is available to download from the Commission's website¹. The key points raised in submissions are discussed in this section.

Key Points relating to the Analysis

- 2.2 **Low energy savings:** The majority of submissions agreed that extended water heating cuts were likely to produce less than 2% national electricity savings² and that a number of factors were likely to reduce that figure further. Examples of the factors that submitters thought would reduce potential savings included pre-existing hot water savings from a voluntary savings campaign, pre-existing water heating cuts introduced by retailers to manage exposure to spot prices, loss of consumer goodwill towards voluntary savings, and customers responding to extended water heating cuts by switching to uncontrolled tariffs.
- 2.3 **Long-term risk:** Many submitters were concerned that extended water heating cuts could encourage consumers to move away from controllable load, thereby reducing the long-term availability and benefits of controllable load.
- 2.4 **Range of views on reserves/AUFLS:** A range of views were received on the extent of any negative impact of extended water heating cuts on the market for instantaneous reserves and the provision of automatic under-frequency load shedding (AUFLS). Some submitted that there would be serious negative effects. Others submitted that the effects would be minor.
- 2.5 **Safety and unequal impact:** Many submissions recognised the unequal impact of water heating cuts across different classes of consumer, and the negative implications for safety. However, several submissions noted that these problems could be worse under the alternative of rolling blackouts, and the unequal impact in itself should not be considered a barrier to implementation.

Alternative Strategies for Water Heating

- 2.6 Some submissions also proposed alternative strategies for using water heating cuts to save energy.
- 2.7 Orion suggested that water heating cuts could be used as a one-off measure to signal to the public the seriousness of the energy situation and the need for increased voluntary savings.
- 2.8 Aurora suggested that extended daily cuts should not continue for more than two weeks because of the negative long term implications for controllable load. Aurora also suggested that nine hour cuts could be introduced at an earlier stage in an energy crisis.

¹ <http://www.electricitycommission.govt.nz/pdfs/submissions/pdfssecurity/water-heat/sub-sum.pdf>

² The Parliamentary Commissioner for the Environment (PCE) and Northpower had a more optimistic view than other submitters of the volume of energy savings that could be achieved.

- 2.9 The Parliamentary Commissioner for the Environment (PCE) suggested that shorter water heating cuts could be used to create an incentive for consumers to install more efficient hot water cylinders (or cylinder wraps). Energy savings could come from this improved efficiency and from some reduction in heat losses from cylinders.
- 2.10 Transpower suggested that the Commission should investigate alternative uses for water heating that could provide more effective contributions to energy conservation without risking the potential negative impacts that water heating cuts could incur. They gave the example of increased use of controllable water heating for instantaneous reserves to enable hydro generation to operate more efficiently (because there would be less need to use hydro power stations to provide instantaneous reserves) and to free thermal capacity to provide energy rather than instantaneous reserves.
- 2.11 Some submitters argued that extended cuts should not be mandatory, but should be left for market participants to implement on a voluntary basis. Concern was also expressed that mandatory water heating cuts could amount to expropriation of an existing property right to sell or use controllable load. It was argued that compensation should be provided to consumers or those who have the commercial right to sell controllable load.

Further Study and Analysis

- 2.12 A number of submissions proposed areas for further study and analysis, at least before mandatory extended water heating cuts were introduced.
- 2.13 Contact proposed further investigation of the adverse effects on the reserves and energy markets.
- 2.14 Transpower suggested investigating alternative uses for water heating that could provide more effective energy conservation.
- 2.15 Aurora proposed a cost-benefit study to compare the short term benefits of extended cuts against long term costs.
- 2.16 Two submissions suggested that water heating cuts had the potential to save substantial volumes of energy, and that further analysis should be carried out before firm conclusions were reached.

Majority View

- 2.17 The majority of submissions agreed that there could be a role for extended water heating cuts as a penultimate measure (before rolling blackouts) *provided that* the Commission was confident that it would help to avoid rolling blackouts. However, there was considerable scepticism about whether extended water heating cuts would help to any significant extent.

3. Commission Conclusions

Conclusion on Effectiveness

- 3.1 The Commission agrees with the conclusion in the discussion paper that extended water heating cuts are likely to produce less than 2% national electricity savings, and probably much less than this.
- 3.2 To achieve even this level of national savings, water heating cuts would need to be very extended, of the order of 16 to 18 hours per day nationwide³, and the effects would be uneven across society.
- 3.3 The Commission also agrees that extended water heating cuts could potentially reduce the effectiveness of other savings measures.
- 3.4 The Commission acknowledges concerns that extended water heating cuts could encourage consumers to move away from controllable load, thereby reducing the long-term availability and benefits of controllable load. However the Commission's conclusions in this paper do not rely on any particular finding about the size or significance of this effect.
- 3.5 While noting the unequal impact of water heating cuts across different classes of consumer, and the negative implications for safety, the Commission agrees with those submissions that noted that such problems could be worse under the alternative of rolling blackouts, and the unequal impact in itself should not be considered a barrier to implementation.
- 3.6 The Commission noted a range of views on the extent of any negative impact of extended water heating cuts on the market for instantaneous reserves and the provision of automatic under-frequency load shedding (AUFLS). Some submitted that there would be serious negative effects. Others submitted that the effects would be minor. The Commission has concluded that there is likely to be some negative impact, but the Commission does not rely on that finding in reaching the overall conclusions in this paper.

Alternative Strategies for Water Heating

- 3.7 The Commission has considered alternative duration outages suggested by some submissions, but has concluded that shorter duration outages are unlikely to be effective as an emergency measure.
- 3.8 Transpower raises the possibility of encouraging greater use of water heating for instantaneous reserves so that hydro generators do not need to provide those reserves during a hydro shortage. This submission relies on the point that hydro generators may be able to operate more efficiently if they do not have to provide

³ Concept Consulting has confirmed that the analysis of cylinder performance indicates that savings from shorter cuts (e.g. 8 hours) would be substantially less than from 12 to 16 hour cuts, because fewer households would run out of hot water. The analysis shows that substantial savings are only possible if a large number of households run out of hot water. Although some savings would be achieved from shorter cuts arising from reduced cylinder heat losses, these savings would be relatively minor.

instantaneous reserves⁴. However, the Commission has concluded that these technical efficiencies are likely to be of marginal significance.

- 3.9 The Commission has some sympathy for the view that market participants should be left to co-ordinate the contribution that controlled water heating could make, as part of the normal market response to an emerging security of supply situation.

Further Study and Analysis

- 3.10 The Commission notes that several submissions have suggested further research, study, and analysis, before final conclusions on the role of water heating cuts are reached. However, the Commission has concluded that further work is unlikely to reveal further information to the extent that its conclusions on the role of water heating cuts would be altered to any material degree.

Conclusions on Water Heating Cuts as an Emergency Measure

- 3.11 The Commission has concluded that preference should be given to encouraging retailers and/or distribution line companies to implement water heating cuts as part of the normal market response to a developing security of supply situation, and to encourage voluntary savings in hot water use as part of any national energy savings campaign.
- 3.12 Despite the limited potential and the acknowledged downsides of using water heating cuts as an emergency measure, the Commission has concluded that there may be value in securing water heating cuts as an emergency measure in extreme circumstances, if the only alternative is likely rolling blackouts.

⁴ For example, some energy is required to drive the compressed air that keeps a turbine spinning so that it can provide tail water depressed reserve.

4. Implementing Extended Water Heating Cuts

Regulations and Rules

- 4.1 The GPS invites the Commission to recommend regulations and rules, if required, to implement water heating cuts. Regulations and rules would have the advantage of providing some certainty about the ability to implement mandatory cuts, and could help address commercial uncertainties about the rights of retailers and distribution line businesses to access water heating ripple control facilities.
- 4.2 However, the preparation of regulations or rules could be a complex process, since they would need to consider the different assets and the different commercial arrangements in place for controllable water heating load in different parts of the country. The Commission would also need to demonstrate a clear benefit from any proposal to regulate for mandatory water heating cuts. The limited benefits identified by the analysis to date suggest that this could prove to be difficult. The Commission also has limited resources to develop industry arrangements, and it is suggested that other work has a higher priority at this stage.
- 4.3 The Commission has therefore decided not to develop recommendations for regulations or rules for mandatory extended water heating cuts

Provisions in Contracts

- 4.4 The main alternative considered by the Commission is to encourage participants to include provisions for extended water heating cuts in contracts for supply, and to call for voluntary action in a security of supply emergency (as long as the Commission is convinced that extended water heating cuts would reduce the probability of rolling blackouts).
- 4.5 In such circumstances, industry participants are likely to cooperate to the extent that they are able (given their particular circumstances and commercial arrangements). In this way, the Commission is likely to capture most of the benefits of extended water heating cuts without creating undue regulatory costs or unduly interfering with commercial arrangements.
- 4.6 The Model Domestic Contract contains clauses providing for controlled load management (including water heating) and the use of those controls to comply with instructions from the Electricity Commission, where called upon to ration electricity in response to an anticipated electricity shortage. To the extent that the Model is adopted by electricity retailers, it therefore appears that mechanisms will exist for retailers to implement extended water heating cuts during a security of supply emergency.

Load Management and metering Technology Project

- 4.7 The Commission also expects that the Load Management and Metering Technology Project will provide additional information about the nature of the controllable load resource, and its different uses and commercial arrangements. This information could provide a useful input into a future review of the most appropriate role for controllable water heating during security of supply situations.

- 4.8 The Commission notes that the Load Management and Metering Technology Project includes, within its terms of reference, a consideration of controllable load (including water heating) and its possible role during security of supply emergencies.
- 4.9 In the meantime, the Commission invites retailers and distribution companies to consider including provisions in domestic retail contracts, and use of system agreements, allowing for extended water heating cuts during a security of supply emergency.