Retail Advisory Group

Research project: Effects of low fixed charges

Note: This paper has been prepared for the purpose of Retail Advisory Group. Content should not be interpreted as representing the views or policy of the Electricity Authority.

Contents

Executive Summary

The Electricity Authority (Authority) requested the RAG to investigate the competition, reliability and efficiency effects of the Electricity (Low Fixed Charge Tariff Option for Domestic Consumers) Regulations 2004 (Regulations), focusing on whether the Regulations inhibit efficient distribution and retail pricing and the efficient operation of the industry. The paper's focus reflects concerns expressed by industry participants and consumer representatives about the Regulations.

The project's findings will be presented to the Minister for consideration. The Authority has no ability to change the Regulations.

Efficiency

This research paper makes three main findings with regard to efficiency, which relate to:

- Distortions to consumer usage of the network;
- Distortions to consumer investment, particularly in solar photovoltaics (PV); and
- Operating inefficiencies, stemming from compliance costs.

First, under the Regulations consumers (in aggregate) face reduced fixed charges and higher variable charges. This increases conservation, as intended by the regulations, but consumers also fail to use electricity even when the value of using it exceeds the cost of producing and delivering it. This is because they face distorted tariffs that do not reflect the costs of the electricity they are using. The net cost of this is estimated to be $23 million per year and includes costs to many electricity consumers who end up paying more for less.

Second, the artificially high unit price of electricity created by the Regulations encourages consumers to invest in solar PV and other substitutes for distributed electricity, such as gas, even when these are relatively expensive compared to distributed electricity. Since solar PV does not generate electricity during the evening demand peak, investments in solar PV do not save any of the distribution network's costs of providing network capacity. But consumers with solar PV can avoid contributing to those costs by reducing their usage at off-peak times. As a result, consumers without PV pay more than their share of these costs, and consumers with PV pay less. Consumers are expected to make investments in solar photovoltaics (PV) in excess of the efficient level if the Regulations remain in place.

A first order or 'first round' estimate of excessive investment associated with the Regulations is $2.2 million to $3.9 billion dollars (discounted present value).[1] This effect is expected to accelerate as falling consumption of grid-based electricity causes prices to increase to cover system costs – which remain largely unchanged. Rising prices then provide additional incentives to invest in alternatives to grid-supply – including more investment in solar photovoltaics. Thus a 'cost spiral' begins. A single step forward in this cost spiral increases the estimated size of excessive investment to between $3.5 billion and $5.4 billion. To put this in context, the total regulated value of Transpower is $4.5

[1] This value range has been estimated using forecasts of uptake of solar PV in four cost scenarios. A key assumption (which may not be entirely realistic) is that tariffs would be at the efficient level in the absence of the Regulations.

billion, so the potential over-investment in solar can be a highly material cost to New Zealand.

The Regulations may inhibit investment in other alternative technology like electric vehicles (EVs), by creating a high variable charge that increases the fuel cost for EVs. However, the effect is likely to be marginal at this stage due to the significant gap between electricity costs and petrol costs.

Third, the Regulations increase operating costs by imposing a range of compliance costs on distributors and retailers that raise the costs of service to consumers. These costs include administration costs from managing duplicated tariffs and from communicating with customers about low fixed charge tariff options (LFC options). These costs are not necessarily inefficient. However, the ambiguity of the Regulations results in inefficient operating costs to the extent participants separately obtain advice on how to comply (advice which would be unnecessary if the Regulations were clearer).

The Regulations do permit some tariff innovation, including time of use and capacity based charges, which could mitigate some of the efficiency (and competition) effects. However, the ability of participants to mitigate the adverse effects is constrained as, for example, the Regulations do not permit fixed charges for network use that are larger than 30 cents per day.

The costs arising from the Regulations could grow rapidly over time, due to the investment effects noted above and also since the low fixed charges required by the Regulations are not inflation-adjusted. So any costs the Regulations create will increase annually with general price inflation.

Competition

This paper finds no empirical evidence that competition is negatively affected by the Regulations, however small retailers report compliance costs arising from the Regulations, as discussed above. These compliance costs are not helpful in terms of promoting competition in the industry.

Reliability

No material effects on reliability were found in the research carried out for this paper.

1 Introduction

1.1 Objective and scope of this report

1.1.1 In its 2014/2015 work programme, the Authority included research into the effects of the Low Fixed Charge (LFC) Regulations as a priority project.

1.1.2 The Authority requested the RAG investigate the competition, reliability and efficiency effects of the Regulations, focusing on whether the Regulations inhibit efficient distribution and retail pricing and the efficient operation of the industry.

1.1.3 Industry participants and consumer representatives have highlighted issues with the Regulations. Their major concern is the adverse effect the Regulations have on the efficient operation of the retail and distribution segments of the electricity market and on retail competition.

1.1.4 This report's main purpose is to report on the findings of research into the effects of the Regulations on:

a) efficiency of retail and distribution pricing

b) operational efficiency

c) competition.

1.1.5 Implications for reliability of supply have been canvassed in preparing the report, but no material effects have been found so the report does not discuss this issue further.

1.2 Role of the Authority in assessing the Regulations

1.2.1 The Authority is carrying out this review under its function to undertake inquiries into any matter relating to the electricity industry.[2] The review is centred on the Authority's statutory objective: 'to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers'.[3]

1.2.2 As outlined in the Memorandum of Understanding with the Ministry of Business, Innovation and Employment (MBIE), MBIE is responsible for administering and amending the Regulations. The Authority is responsible for monitoring compliance, investigating alleged breaches, and if necessary, taking enforcement action in relation to the Regulations.[4] The Authority is not able to implement market facilitation measures or make amendments to the Electricity Industry Participation Code 2010 that override the Regulations.

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2 See 16(1)(g) of the Electricity Industry Act 2010 ('the Act').

3 Section 15 of the Electricity Industry Act, available at: http://www.legislation.govt.nz/act/public/2010/0116/latest/DLM2634339.html.

4 The 2011 Memorandum of Understanding between MBIE and the Authority sets out the respective responsibilities of each agency: a) the Authority is responsible for enforcing compliance with the Regulations. MBIE is to consult the Authority if changes are proposed to the Regulations. The Authority has the primary responsibility for distribution pricing methodology; b) MBIE is responsible for any regulatory activity and processing any exemptions in relation to the Regulations: Memorandum of Understanding between Ministry of Economic Development and the Authority, Appendix 1: http://www.ea.govt.nz/search/?q=memorandum+of+understanding&s=&order=&cf=&ct=&dp=&action_search=Search

1.2.3 The energy conservation objective of the Regulations is outside the scope of the Authority's review.

1.3 Submissions

1.3.1 The RAG's preference is to receive submissions in electronic format (Microsoft Word). It is not necessary to send hard copies of submissions to the RAG or to the Authority, unless it is not possible to do so electronically. Submissions in electronic form should be emailed to submissions@ea.govt.nz with Research project: Effects of low fixed charges in the subject line.

1.3.2 If submitters do not wish to send their submission electronically, they should post one hard copy of their submission to the address below.

Submissions
Electricity Authority
PO Box 10041
Wellington 6143

Or send by facsimile to:

Fax: 0-4-460 8879

1.3.3 Submissions should be received by 4pm on 29th September. Please note that late submissions are unlikely to be considered.

1.3.4 The Authority will acknowledge receipt of all submissions electronically, on behalf of the RAG. Please contact the Submissions' Administrator at the Authority if you do not receive electronic acknowledgement of your submission within two business days.

1.3.5 If possible, submissions should be provided in the format shown in appendix F. Your submission is likely to be made available to the general public on the Authority's website. Submitters should indicate any documents attached in support of the submission, in a covering letter and clearly indicate any information that is provided to the RAG on a confidential basis. However, all information provided is subject to the Official Information Act 1982.

1.4 Background and purpose of the Regulations

1.4.1 The Regulations were introduced in 2004. The objectives of the Regulations are to:

a) ensure retailers offer an LFC tariff (or LFC tariffs) for delivered electricity to domestic consumers at their principal place of residence that will assist low-use consumers and encourage energy conservation

b) require distributors to assist retailers to deliver LFC tariffs.[5]

1.4.2 According to Parliamentary debates, the Regulations were introduced to provide low-use consumers with a tariff option that was "more equitable" for low energy usage and compatible with the Government's energy-efficiency objectives.[6]

[5] See clause 3 of the Regulations, available at: http://www.legislation.govt.nz/regulation/public/2004/0272/latest/DLM283614.html.

1.4.3 At the time the Regulations were introduced, the majority of retailers offered consumers the option of an LFC tariff in accordance with policy guidelines.[7] Competition for retail customers was much more limited than today and the Minister of Energy wanted to ensure that all retailers offered, and all consumers had access to, an LFC tariff.

1.5 Basic requirements of the Regulations

1.5.1 The Regulations establish a pricing mechanism that requires retailers to offer and promote an LFC tariff to all domestic consumers at their principal place of residence. The expectation is that this will increase cost savings to people who conserve energy.

1.5.2 The Regulations require a retailer to ensure that any LFC tariff it makes available to customers includes:

a) a fixed component that is capped at 30 cents per day (excluding GST)[8] and after prompt payment discount (regulation 18)

b) a variable component that is set so that the average consumer[9], as defined in the Regulations, pays no more per year on the LFC tariff than on any alternative tariff.[10]

1.5.3 The retailer can increase the variable component of an LFC tariff to offset the lower fixed component. However, the retailer can only increase the variable component by an amount that means the average consumer under the Regulations pays no more per year on either the LFC tariff or on any alternative tariff.

1.5.4 The Regulations also require a distributor to ensure that any supply arrangement it has with a retailer for residential premises includes a fixed component that is capped at no more than 15 cents per day (excluding GST).[11] Such a supply arrangement also requires that the variable charge is set so the average consumer pays no more per year for the fixed charge and variable charges than on any alternative distributor tariff option.[12]

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6 See Hansard, Hon Darren Hughes – Deputy Leader of the House on behalf of the Minister of Energy (19 March 2008), available at: http://www.parliament.nz/en-nz/pb/debates/debates/speeches/48HansS_20080319_00001656/hughes-darren-electricity-disconnection-and-low-fixed; to the extent that low use consumers are low income consumers, low fixed charges 'can also assist those on low incomes to save power' (Cabinet Economic Development Committee, 2004).

7 In December 2000 the then "Government Policy Statement (GPS): further Development of New Zealand's Electricity Industry" (now rescinded) noted amongst other things, that "The Government expects all retailers to offer at least one tariff to domestic consumers with a fixed charge of no more than 10 per cent of the bill of the average".

8 See Regulations, regulation 8.

9 Regulation 4(1) of the regulations stipulates "average consumer means, - (a) in relation to a consumer whose home is in the Lower South region, a person who purchases or uses 9 000 kWh of electricity per year in respect of that home; or (b) in relation to a consumer whose home is elsewhere in New Zealand, a person who purchases or uses 8 000 kWh of electricity per year in respect of that home".

10 See Regulations, regulation 9.

11 See Regulations, regulation 14, available at: http://www.legislation.govt.nz/regulation/public/2004/0272/latest/DLM283614.html.

12 See Regulations, regulation 15.

1.6 Key issues addressed in the report

1.6.1 The key issues covered in this report include:

a) the Regulations' requirements on retailers and distributors

b) the magnitude of the Regulations' compliance costs faced by distributors and retailers and passed on to consumers

c) the extent of cross-subsidisation between consumers caused by the Regulations

d) the potential scale of any pricing inefficiency (e.g. cost recovery limits) arising from the Regulations

e) any investment distortions arising from the Regulations (e.g. in solar photovoltaics).

1.7 Research approach

1.7.1 The information presented in this report is based on:

a) interviews with a cross-section of retailers and distributors on their experiences with the Regulations

b) analysis of how distributors implement the Regulations based on distributors' information disclosures

c) a high-level review of existing literature and background documents on the Regulations, including a review of existing pricing principles

d) analysis of the uptake of the LFC tariff using experimental data the Authority has collated from retailer data disclosures

e) analysis of the cost structures of distribution and retailing based on:

i) the model used by the Commerce Commission to assess the profitability of Electricity Distribution Businesses (distributors)[13]

ii) the NZIER retail cost index[14]

f) model-based evaluation of the uptake of solar photovoltaics with and without LFC tariffs under 4 scenarios for future prices of grid-supplied electricity relative to solar photovoltaics.

1.8 Outline of the report

1.8.1 The report is ordered according to the scope of effect of the Regulations. The initial discussion focusses on the Regulations themselves. Section 2 sets out the requirements of the Regulations. Section 3 then considers the flexibility that distributors and retailers have in setting charges that comply with the Regulations.

[13] 'Financial-model-EDB-DPP-2015-2020.xlsx' available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/default-price-quality-path-from-2015/

[14] Information about the index is available at: http://www.emi.ea.govt.nz/Datasets/Browse?directory=%2F20140720_NZIER_synthetic_retail_price&parentDirectory=%2FDatasets%2FSupplementary_information%2F2014.

1.8.2 Section 4 examines the Regulations' implications for retailers' and distributors' compliance costs, which are ultimately passed on to consumers.

1.8.3 Sections 5 and 6 consider the wider effects of the Regulations in terms of how retailers and consumers are able to price their services. Section 5 specifically considers what efficient distribution and retail pricing should look like in-principle and how the Regulations prevent efficient pricing practices. This sets the scene for section 6 that assesses the practical implications of efficient pricing limits caused by the Regulations. Section 6 outlines four specific examples of inefficient pricing arising from the Regulations.

1.8.4 Section 7 assesses the effects of the Regulations on consumer investment behaviour and finds that there are potentially large distortions to investment through advantages that the Regulations create for consumers who make investments to help reduce electricity consumption such as by installing solar photovoltaic systems.

1.8.5 Section 8 examines in-principle effects of the Regulations on competition and notes that there is no empirical evidence of negative competition effects. This absence of negative competition effects is not evidence that the Regulations *promote* competition.

1.8.6 Section 9 makes concluding observations about the balance of effects of the Regulations.

2 Requirements of the Low Fixed Charge Regulations

2.1.1 The analysis in this section focuses on the Regulations' requirements regarding the design of an LFC tariff.

2.2 Key requirements of the low fixed charges

2.2.1 The key requirements the Regulations prescribe for the LFC tariff are:

a) the maximum fixed charge that distributors can charge is 15 cents per day

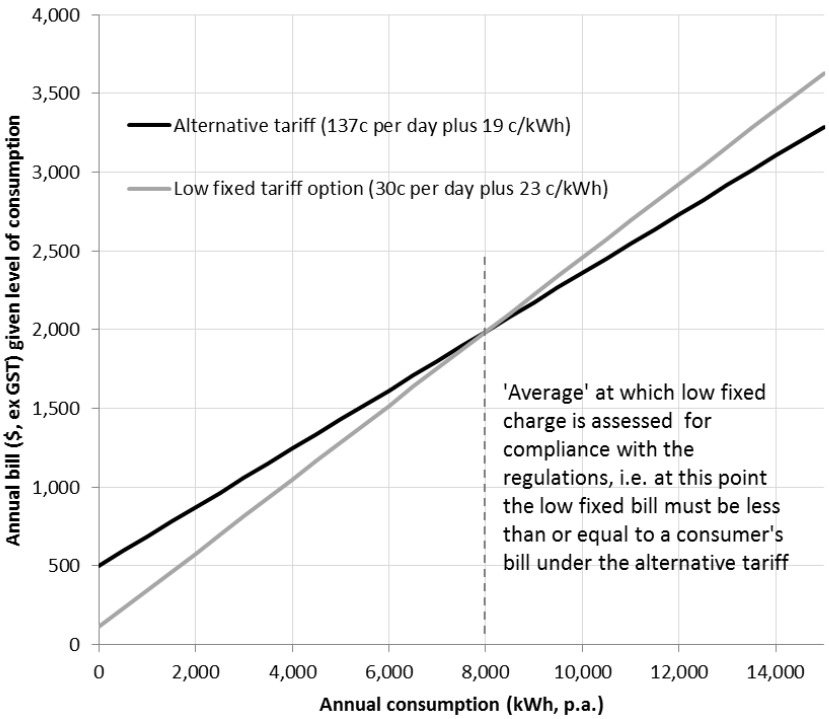
b) the maximum fixed charge that retailers can charge is 30 cents per day (including the fixed daily charge by the distributor in paragraph a) above and any other fixed charges [e.g. relay and metering costs])[15]

c) the variable component of an LFC tariff must be set so that the average consumer pays no more in total per year for the fixed and variable components of an LFC tariff than on any alternative tariff option

d) the variable charge must not be tiered or stepped according to the amount of electricity consumed.[16]

2.2.2 Figure 1 below illustrates how an LFC tariff must intersect with an alternative tariff in terms of pricing: at the point of annual consumption for the average consumer.

Figure 1: How an LFC tariff intersects with an alternative tariff



[15] See regulation 14(1)(c) of the Regulations.

[16] See regulations 10(2)(a) and 16(1)(a) of the Regulations.

2.3 Regulations set out fixed values defining an "average consumer"

2.3.1 The Regulations define an "average consumer" as

a) a person who purchases or uses 8,000 kWh of electricity per year for their home;[17] or

b) a person who purchases or uses 9,000 kWh of electricity per year for their home, if the consumer's home is south of Arthur's Pass (referred to as 'Lower South region' in the Regulations).[18]

2.4 The tariff charges must benefit below-average consumers

2.4.1 The variable component of a retailer's LFC tariff must be set so that the average consumer pays no more in total per year for the fixed charge and the variable charge(s) than on any alternative tariff option.[19]

2.5 Options for separate charges by distributors and retailers

2.5.1 LFC tariffs may be either:

a) a "bundled" option under which the retailer charges the consumer directly for the electricity supplied to the home; or

b) a "split-charging" option under which distributors and retailers charge consumers separately for the services and electricity they supply.[20]

2.6 Retailers required to promote the LFC tariff and notify Authority of changes to an LFC tariff

2.6.1 The Regulations also require retailers to promote LFC tariffs to each consumer at least once every 12 months.[21] Retailers must advertise an LFC tariff at the same time and in the same manner as it advertises an alternative tariff.[22]

2.7 Retailers and distributors must notify Authority of changes to an LFC tariff

2.7.1 The Regulations also require retailers and distributors to notify the Authority and provide it with specific information[23] regarding any new LFC tariff, or any change to an existing LFC tariff, 15 working days before the date the new tariff or change takes effect.[24] Amongst other things, the specific information the retailer or distributor must provide includes:

a) calculations showing how the LFC tariff complies with the Regulations

b) a schedule of tariff options that the retailer or distributor makes available to homes in its supply area.[25]

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17 Under regulation 4(1) of the Regulations, 'home' is defined as the domestic premises (as defined in the Electricity Act 1992) that are the principal place of residence of a domestic consumer.

18 See regulation 4(1) of the Regulations.

19 See regulations 8 and 9 respectively of the Regulations.

20 See regulation 7 of the Regulations.

21 See regulation 12 of the Regulations.

22 See regulation 11 of the Regulations.

23 See regulation 23 of the Regulations.

24 See regulation 22 of the Regulations.

25 See regulation 23 of the Regulations.

Q1.	What comments do you have on the above description of the requirements of the Regulations?

3 Flexibility provided by the Regulations

3.1.1 The Regulations are prescriptive in part but allow some flexibility for retailers and distributors in terms of pricing practices.

3.2 Distributors implement the Regulations in a variety of ways

3.2.1 Variation in the way distributors implement the Regulations provides some insight on the degree of flexibility that the Regulations allow.

3.2.2 Analysis of distributors' charges shows that distributors have adopted four broad types of tariff structure to comply with the Regulations, including:

a) a fixed charge of 15 cents per day and a variable rate, in cents per kWh, with no differentiation between LFC tariffs and non-LFC tariffs (approximately 240,000 ICPs covered by this type of tariff)[26]

b) one general approach to tariffs (approximately 1,100,000 ICPs covered by this tariff) with each tariff composed of a fixed charge in cents per day and a variable charge in cents per kWh, but the tariff is split between:

i) 'low-user' tariffs with a fixed charge of 15 cents per day for 'low-users' plus variable rates, in cents per kWh, with charges varying by season, time of day and whether demand can be controlled

ii) 'standard user' tariffs with the same structure as the low user tariff but with higher fixed charges than the 'low-user' tariffs and lower variable charges than the 'low-user' tariffs

c) the same as for 3.2.2 (b) but variable charges are based on a measure of peak demand, such as the peak demand charge used by The Lines Company Limited (see 3.4.4 below) (approximately 50,000 ICPs covered by this type of tariff)

d) charges that are not tailored to consumers' ICPs, rather charging retailers at the grid exit point, ('wholesale pricing' under regulation 17 of the Regulations) with a fixed charge of zero (Orion Limited and PowerCo – Western Region – controlled) or 15 cents per day (PowerCo – Western Region –uncontrolled and OtagoNet Joint Venture) (approximately 240,000 ICPs across these types).

3.3 Flexibility on the form of fixed charges

3.3.1 The Regulations define both the charging basis and the maximum amount for the fixed charge component of an LFC tariff. The Regulations allow for only one fixed charge in the LFC tariff. However, the Regulations allow:

a) a retailer and a distributor to recoup fees for special services[27]

[26] All distributors also vary their charges according to other attributes of demand such as season, time of day and whether demand can be controlled by the distributor.

b) a distributor to recoup fees for any fee payable for:

i. providing or reading any meter that the distributor owns

ii. providing any relay that the distributor owns.[28]

3.3.2 Consequently, while the Regulations prescribe a maximum amount for the fixed charge component of an LFC tariff, a distributor or retailer may recoup its costs provided such costs come within the definitions of 'special services',[29] or for distributors, fees payable for metering or relays under Regulation 14(1)(c).

3.3.3 The Regulations prescribe a limit of 15 cents per day for the fixed charge for distributors, but do not set a formula for allocating variable costs between the retailer and distributor.[30]

3.4 Flexibility regarding the form of variable charges

3.4.1 The Regulations allow for multiple variable charges and charges on different measures of demand such as "setting different variable charges for controlled or uncontrolled load, or for electricity consumption at different times of the day or year".[31]

3.4.2 The Regulations do place some limitations on the form of multiple variable charges. Rates used for variable charges cannot be tiered or stepped according to the amount of electricity consumed.[32] This ensures that retailers and distributors cannot claw back the cost savings to low-use consumers provided for under the Regulations. However, it does not prevent a retailer or a distributor from setting different variable charges for controlled and uncontrolled load, or for electricity consumption at different times of the day or year.[33]

3.4.3 There is also some flexibility in how the definition of "average consumer" is applied for the purposes of determining whether a variable charge complies with the Regulations. When a peak demand or capacity charge is used, distributors and retailers have some flexibility in determining what the average peak demand is, and how that aligns with the definition of "average consumer" in the Regulations.

3.4.4 For instance, in implementing a peak (kW) demand tariff, The Lines Company (TLC) has taken the approach of estimating the average peak demand of the average consumer under the Regulations. There are few (if any) consumers on the TLC network who consume precisely the 8,000 kWh defined in the Regulations as average for TLC's network area. TLC uses a range of consumers between 7,000 and 9,000 kWh to construct the average consumer's kW demand. Once the

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27 See regulation 8(d) of the Regulations.

28 See regulation 14(1)(c) of the Regulations.

29 See regulation 4(1) of the Regulations.

30 The regulations only allow the retailer to charge 30 cents *less* what the distributor has charged in total as fixed charges. Where split charging applies (where distributors charge consumers directly) retailers may not be able to charge any fixed charge. Further, the Regulations do specify the kinds of charges which distributors may use to recover charges associated with delivered electricity (see regulation 14(1)(c)).

31 See regulation 10(3) of the Regulations for retailers and regulation 16(2)(a) of the Regulations for distributors.

32 See regulation 10(2)(a) of the Regulations for retailers and regulation 16(2)(a) of the Regulations for distributors.

33 See regulation 10(3) of the Regulations for retailers and regulation 16(2)(a) of the Regulations for distributors .

average consumer's kW demand is found, TLC uses it as the benchmark for determining compliance against the Regulations – particularly regulation 15(1). TLC's approach suggests that there is scope under the Regulations for innovation with LFC tariffs.

3.4.5 The Regulations expressly contemplate some variation in the measurement of average consumption even if it is limited to default ratios for splitting controlled and uncontrolled load. If the retailer or distributor has used a different assumption as to the consumption of the average consumer from that prescribed in the Regulations, they must supply the Authority with a detailed explanation and data to support the use of the different assumption.[34]

3.5 Regulations do not constrain charges on distributed generation

3.5.1 The Regulations do not specifically address distributed generation, such as domestic use of solar photovoltaics. Requirements on retailers and distributors relate to charges for 'delivered electricity' to the home. The scope of the definition of 'delivered electricity' in the Regulations specifically includes 'electricity supply, line function services, customer service, meter provision and meter reading services and excludes 'special services'. 'Special services' are services that a retailer or a distributor provides to a domestic consumer in addition to those services in the standard delivered electricity package. This suggests that charging for the connection of distributed generation is outside the scope of the Regulations.[35]

3.5.2 The Regulations do not affect a distributor's or a retailer's ability to charge for services related to connection or injection from solar photovoltaics. Distributed generation is governed by Part 6 of the Code. Under the pricing principles in Schedule 6.4 of Part 6 of the Code, distributors can charge for any actual or estimated incremental costs – fixed or variable – incurred as a result of providing connection services.[36]

Q2. What comments do you have on the above discussion of the flexibility provided by the Regulations?

[34] See regulation 23(d) of the Regulations.

[35] See the definition of 'special services' in regulation 4 of the Regulations.

[36] See Part 6 of the Code, available at: https://www.ea.govt.nz/code-and-compliance/the-code/part-6-connection-of-distributed-generation/.

4 Compliance costs

4.1 Summary

4.1.1 The costs of complying with the Regulations include:

a) the costs of verifying whether a home is eligible for the LFC tariff (i.e. if a connection is a primary place of residence)

b) menu costs from having to duplicate tariffs – to provide a low fixed charge alternative to every tariff

c) costs of coordination between retailers and distributors to ensure the combined effects of charges do not contravene the regulations[37]

d) costs of communicating with consumers (at least) each year and promoting the LFC tariff[38]

e) costs to retailers of having to liaise with distributors and retail customers when distributors question the status of retail customers

f) costs of applying for exemptions under the Regulations (e.g. for remote areas).[39]

4.1.2 These compliance costs are not inefficient in and of themselves. Assessing the efficiency of these costs requires assessing the effectiveness of the Regulations in meeting their objective. If some of these costs could be avoided without compromising the objective of the Regulations then this would make current compliance costs inefficient.

4.1.3 Assessing the objectives of the Regulations is beyond the scope of this report.

4.2 Example of a compliance cost for distributors: cost of verifying principal place of residence

4.2.1 We estimate that the cost to distributors of verifying consumer eligibility for an LFC tariff at 50 cents per ICP per year. We make this estimate on an assessment of the steps taken by one particular network operator (Eastland Network) to determine customer eligibility. This assessment is outlined in Table 1.

4.2.2 We understand Eastland Network sent out 3,500 letters in the last three years to consumers with multiple ICPs and with consumption profiles. Under the Regulations,[40] a consumer is only eligible for an LFC tariff in respect of its principal place of residence. Eastland Network's letters informed consumers with multiple

[37] This only applies where distributors charge customers directly (so-called 'split charging').

[38] One retailer which notifies people by post say this cost $1 per customer. Migration to email notification will significantly reduce this cost.

[39] Exemptions under the Regulations are granted to individuals on a case-by-case basis. This means that if a distributor obtains an exemption from the Regulations, this does not automatically apply to the retailer. The retailer has to apply separately for an exemption. There were 12 time-limited exemptions in force under the Regulations as at August 2014.

[40] See the definition of 'home' in regulation 4 of the Regulations.

ICPs that the ICP the letter was sent to was not the consumer's principal place of residence,[41] so the consumer did not qualify for the LFC tariff.

4.2.3 Of the approximate 3,500 letters sent, apparently:[42]

a) around 1,750 (50%) customers responded by telephone accepting that they did not qualify for an LFC tariff

b) a small number responded aggressively (less than 20)

c) around 500 contacted the distributor with sound reasons about why they were eligible for the LFC tariff

d) the remaining letter recipients provided no response.

4.2.4 The costs from this letter initiative mostly comprised correspondence and associated staff costs. The only other cost that arose was a notional cost for legal opinions on how the Regulations need to be applied.

Table 1. Example of distributor 'primary residence' verification costs
Single year cost estimate for Eastland Network, nominal dollars

Cost item	Value	Units
No. of letters.	1,167	no.
Postage/letter	0.4	$
Materials/letter	0.1	$
FTE_hrs/letter	5	mins
Follow up calls made as share of letters	0.5	share
FTE_mins/call	15	mins
Avoidable mins/call	15	mins
Cost of time per hour[43]	26.78	$/hour
Material cost	583	$
Time cost	4,392	$
Customers (domestic ICPs)	20,139	$
Legal opinion	5,000	$
Total cost	9,975	$
Verification cost/customer	0.50	$/ICP

4.3 Example of a compliance cost for retailers: cost of verifying principal place of residence

4.3.1 Retailers also face costs related to verifying whether consumers are eligible for an LFC tariff. One retailer reports employing a full-time staff member to assess (for

41 Personal Communication, Bruce Easton, Eastland Network, 15 January 2015.

42 Ibid.

43 Average Hourly Earnings, Statistics New Zealand Income Survey, June 2014.

consumers with multiple ICPs) which of the consumer's LFC tariff. For this retailer, a conservative assessment of such staff costs is $1 per ICP.[44]

4.3.2 One retailer who notifies consumers by post informed the RAG that it costs $1 per customer (another retailer's estimate is 70 cents per customer). Changing to email notification will significantly reduce this cost. However, another retailer who notifies customers by both mail and email notes that there is still an administrative overhead attached to arranging the email notification. The retailer concerned claims this cost 15 to 20 cents per customer. This is a cost which we expect would decline as a retailer's customer base increases.

4.3.3 These compliance costs are, in general, common across the industry and largely unavoidable. This implies that they are, ultimately, borne by consumers.

Q3. Do you consider that the analysis in this section produces a reasonable estimate of the compliance costs stemming from the Regulations?

Q4. Are there any significant compliance costs of the Regulations other than those identified in this section?

[44] The cost of an FTE used for this calculation is average hourly earnings in New Zealand in December 2014 ($28.8), a 40 hour working week and a 48 week year. It is conservative because it excludes other avoidable costs of employment.

5 In-principle impacts on efficiency of pricing

5.1.1 This section considers what efficient distribution and retail pricing should look like in-principle and how it might operate in the absence of the Regulations.

5.1.2 The analysis is conceptual rather than empirical. It is based on established economic principles regarding efficient network pricing. It also draws on long-standing distribution pricing principles[45] and reflects on the decisions already made by the Authority on decision-making and economic frameworks.[46] This provides the basis for the empirical analyses provided in section 6 below.

5.1.3 The principles for efficient network pricing set out here are not fully achievable at the present time given existing technology and institutional arrangements. However, these principles are standards which can be used to guide the assessment in this section, in light of the Authority's statutory objective.

5.2 Efficient distribution tariffs and the Regulations

Include cost-reflective components for more efficient pricing

5.2.1 Efficient pricing of distribution services generally serves two purposes:[47]

a) signal the costs of meeting demand (cost-reflective tariffs)

b) ensure investors can recover the cost of their investments (revenue recovery).

5.2.2 Cost-reflective tariffs reduce 'free-riding' and promote long-term benefits to consumers. Free-riding occurs when the cost of a service to some consumers is (partly) paid by other consumers. This practice is inefficient if it leads to consumers curtailing their consumption for no good reason. To avoid free-riding, prices need to reflect the demands and costs that the consumer's electricity use places on the network.

Cost-reflective tariffs should be connected to drivers of investment

5.2.3 Costs of investment should be allocated to activities that create those costs.[48] For distribution networks one driver of investment is consumption of electricity at times of peak congestion on the network.[49] Distributors design their networks to accommodate these peaks as well as to meet the location decisions of their customers. Where appropriate, charges can reflect this by, for example, using

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45 The report draws on 'Distribution Pricing Principles and Information Guidelines' prepared by the Electricity Commission (February 2010) as it reflects established practice and principles that generally seek to ensure efficient pricing. This is, however, without prejudice to the Authority's ongoing review of distribution pricing.

46 Electricity Authority (2013) "Decision-making and economic framework for distribution pricing methodology: Decisions and reasons paper", 4 March 2013.

47 For a theoretical discussion, see Willig, R. (1978) "Pareto-superior Non-linear Outlay Schedules," *Bell Journal of Economics*, vol. 9, no. 1, pp. 56-69. For a wider summary of the literature as it relates to capital intensive network monopolies see Joskow, P. (2007) "Regulation of Natural Monopolies." *Handbook of Law and Economics*, vol. 2, no. 2, pp. 1227-1348.

48 The actual implementation of this sort of cost-reflective pricing (marginal cost pricing) is not straightforward. There is considerable debate over exactly how it is best implemented. It is outside the scope of this report.

49 Other principal drivers of investment are the location of consumers on the network, consumers' security and reliability requirements and the age and condition of the network which drives maintenance and replacement expenditure requirements.

peak-demand charges which are proportional to a consumer's share of demand at peak. For networks facing no or negative peak demand growth, cost-reflective tariffs would have much higher proportions of fixed charges to cover the costs of the network.

5.3 Revenue recovery should avoid causing consumers to reduce their consumption

5.3.1 Revenue recovery is a different objective from cost-reflective price signalling. The basic principle for recovering revenue is that it should be done in a way that causes as small a reduction in demand as possible.[50] That is, if we assume that consumers benefit from consuming electricity, then a charge which reduces demand by 1 MW and brings in $100,000 of revenue will always be preferable to a charge that reduces demand by 2MW and brings in $100,000.

5.3.2 It is usually inefficient, therefore, to recover revenue using charges that are linked to demand, such as charges on the basis of cents per kWh of electricity consumed. These kinds of charges cause consumers to reduce consumption and thus make them worse off. This assumes, of course, that there is an alternative way to recover revenue that will not cause consumers to reduce demand.

5.3.3 Generally, the most efficient approach to pricing is splitting charges into a variable charge linked to activities that create costs, as discussed above in 5.2.3, and a fixed charge to recover remaining revenue.[51] Fixed charges that do not vary with demand provide no incentive to reduce electricity consumption and this is appropriate where the underlying costs are fixed.

5.3.4 This observation, that charging based on use is generally inefficient when costs are fixed, could in some circumstances apply to peak capacity charges as well as to charges based on kWh of electricity consumed. This would depend on the circumstances of the individual distribution network. Tariffs which include peak demand charges can promote more efficient consumption and investment decisions by signalling the costs of consuming during peak periods but if there is excess capacity on a network or if peak charges are very large relative to costs of expanding capacity, then consumer response could be inefficient.

5.4 Distribution pricing principles and the Regulations

5.4.1 The benefits of efficient pricing are reflected in the Authority's Distribution Pricing Principles (Pricing Principles). The Pricing Principles also reflect a degree of pragmatism in dealing with the practical difficulties of long-run marginal cost pricing.

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[50] This insight has been studied in great depth and is well-established as a guiding principle in tax and regulatory policy. In the case of taxation, the literature stretches back to Ramsey, F. (1927). 'A contribution to the theory of taxation', *Economic Journal*, vol. 37, no. pp.47-61. The regulatory literature stretches back to Boiteux, M. (1956). 'Sur la gestion des monopoles publics astreints à l'équilibre budgétaire', *Econometrica*, vol. 24, pp.22-40. Published in English as: On the management of public monopolies subject to budgetary constraints, *Journal of Economic Theory*, vol.3, pp. 219-40, 1971. Prices based on this tradition are thus referred to as Ramsey-Boiteux pricing.

[51] In-principle, tariffs should be higher for those consumers whose consumption changes the least in response to price changes. It is difficult to identify these consumers in practice.

5.4.2 The Pricing Principles seek to encourage use of the existing network while also signalling to users the costs of investment in the network to provide additional capacity (particularly for peak demand).

5.4.3 A key Pricing Principle for distributor charges is as follows:

a) Prices are to signal the economic costs of service provision, by:

i) being subsidy free (equal to or greater than incremental costs, and less than or equal to standalone costs), except where subsidies arise from compliance with legislation and/or regulation;

ii) having regard, to the extent practicable, to the level of available service capacity, and

iii) signalling to the extent practicable, the impact of additional usage on future investment costs.

5.4.4 This Pricing Principle suggests distributors' variable charges should encourage use of existing network assets whilst also signalling to users the cost of meeting system peak demand.

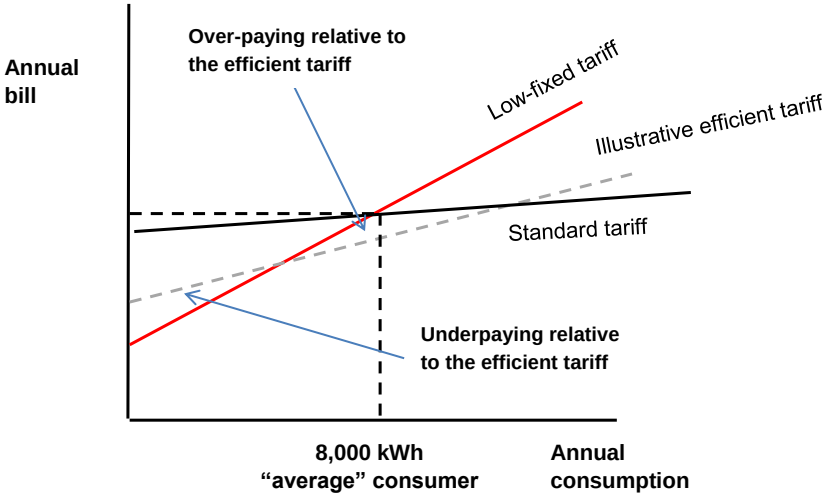
5.4.5 By introducing cross-subsidies and reducing the extent to which prices can reflect available service capacity, the Regulations are inconsistent with this Pricing Principle.

5.4.6 This cross-subsidisation dynamic is illustrated below in Figure 2. The diagram depicts tariffs that split costs to consumers across a fixed component (the 'intercept' on the left axis) and a demand-based charge (captured by the slope of the lines).

5.4.7 In Figure 2, the fixed charge is set at a prescribed level so that variable charges will, on average, be higher than they otherwise would be. By comparison, the standard tariff has a fixed charge that is higher than the efficient level and a smaller variable charge.

5.4.8 Cross-subsidies promote inefficient consumption patterns. On one hand, some consumers do not face the actual costs of their consumption, which is likely to promote excessive consumption of electricity. On the other hand, other consumers will face artificially high prices. High prices cause these consumers to use less electricity than they otherwise would, or else have less money to spend on other things (or to save).

Figure 2: Cross-subsidy between LFC tariffs and standard user tariffs[52]



5.5 Distribution pricing decision-making and economic framework

5.5.1 In addition to its Distribution Pricing Principles, the Authority has also laid out a decision-making and economic framework for assessing distribution prices. The Authority's (2013) "Decision-making and economic framework for distribution pricing methodology"[53] established general criteria for assessing the efficiency of distribution pricing methods that include a hierarchy for preferred pricing approaches, in order of preference:

1. market charges or market-like charges (including long run marginal cost pricing which is a market-like pricing approach)
2. exacerbators-pay charges
3. beneficiaries-pay charges
4. alternative charging options.

5.5.2 The Authority also noted:

> *In applying the hierarchy the Authority will seek to ensure that distribution pricing arrangements lead to efficient and practicable outcomes, and enable distributors to recover their maximum allowable revenue. The Authority recognises that distribution costs may be recovered through a*

[52] The Regulations refer to 'alternative' tariffs (see regulation 4(1)) but retailers generally label them 'standard' tariffs (terminology also reflected in the example to regulation 5).

[53] Electricity Authority (2013) "Decision-making and economic framework for distribution pricing methodology: Decisions and reasons paper", 4 March 2013.

combination of two or more charging approaches set out in the hierarchy. [emphasis added]

5.5.3 The Regulations prescribe charges based on a pricing approach that is at best fourth in this hierarchy and is inefficient even within that class of pricing:

> *31 The Authority considers that an alternative charging option may be needed when a market-based approach or exacerbators-pay and beneficiaries-pay approaches are not efficient, practicable or do not recover the full costs of distribution services. The Authority considers that the key principles for identifying an alternative charging option that is efficient are to:*
>
> > *(a) minimise, to the extent practicable, distortions from the efficient level in use of the network resulting from the imposition of the charge*
> >
> > *(b) minimise, to the extent practicable, any distortion in network-related investment from the efficient level resulting from the imposition of the charge*
> >
> > *(c) ensure the costs of providing the distribution network are recovered, consistent with the requirements of the Commerce Commission under Part 4 of the Commerce Act 1986.*
>
> *32 An example of an alternative charging option is to use a low-rate, broad-based charge to recover the costs of maintaining, upgrading and extending the distribution network from the largest number of parties. This approach is commonly referred to as "postage stamp" pricing.*

5.5.4 By these standards the prescribed LFC tariffs are not efficient because they distort network usage by shifting costs onto those who would otherwise make greater use of the network.

5.5.5 Contrary to paragraph 31(c) of "Decision-making and economic framework for distribution pricing methodology", the LFC tariff may cause distributors to fail to recover costs consistent with requirements under Part 4 of the Commerce Act 1986.[54]

5.5.6 The constraint on revenue recovery comes about through the fact that regulated price paths are a weighted average of prices. If demand declines on higher priced tariffs and consumers move to the LFC tariff, then there will potentially be a step change in revenue. Distributors cannot adapt prices to deal with this, at least within a regulatory control period, without breaching price paths.

5.5.7 However, we have not found a practical example in which this has been a problem that is directly related to the Regulations. We therefore cannot assess how material this effect is.

[54] This is not an opinion regarding the law or its application, but an observation about how the arithmetic of price path compliance operates in conjunction with the Regulations.

5.6 Efficient retail pricing

5.6.1 Principles for efficient retail pricing are similar to those for distribution pricing except that energy charges and retail margins are best determined by market interaction and competitive disciplines.

5.6.2 An additional issue of relevance in terms of long-term benefit to consumers is that retail pricing becomes much more efficient when time-of-use metering is possible (Joskow and Tirole, 2006).[55] In general, advanced metering systems are increasing the possibilities for time-of-use metering and penetration of these meters is now more than 50% in the New Zealand market. Therefore we should expect scope for more efficient retail tariffs in the future.

5.6.3 The reason that retail pricing is more efficient when time-of-use metering is possible is because it allows prices to reflect the fact that the value of electricity varies significantly over the course of a day and through the year. If prices vary to signal this changing value, through time-of-use metering, then people have the option to pay for what they want rather than what others want. On average, prices will be lower than without time-of-use metering because suppliers can be more accurate in the way they set prices to recover revenue. In other words, consumers as a group get to consume more electricity at lower prices.

5.6.4 The Regulations' requirements for particular pricing structures will inhibit moves to more efficient pricing. For example, time-of-use pricing should encourage consumers to consume more electricity off-peak. The incentive to shift demand should come through lower variable consumption charges off-peak. Under the Regulations, retailers are constrained in how low they can let variable charges go. This is because they need to use variable charges to recover transmission and distribution costs. In a nutshell, retailers need to charge consumers more than the additional cost of supply. As a result, people consume less than they would if proper cost-reflective, time-of-use pricing was allowed.

5.6.5 The Regulations also limit retailers' ability to pass fixed third-party charges, such as meter leasing costs, through to customers via fixed charges. These costs have to be passed through as part of a charge linked to consumption (such as in a cent per kWh charge). This further increases variable prices above the additional costs of supplying the consumer.

5.6.6 Recovering a fixed cost, such as meter charges, via a consumption charge is also imprecise. Some consumers will inevitably be under-charged and some will be over-charged.

5.6.7 These limitations on time-of-use tariffs are likely to be a particular problem for retailers who have business models structured around offering highly transparent cost-reflective time-of-use pricing.

5.6.8 The Regulations appear predicated on the notion that variable retail charges cause conservation of electricity and this is evidently positive. In fact, conservation is only beneficial to consumers over the long term if it is in response to cost-

[55] Joskow P. and J. Tirole (2006) 'Retail electricity competition', *RAND Journal of Economics*, vol. 37, no. 4, pp. 799-815.

reflective pricing and reflects consumers' willingness to pay. If not, conservation reflects a loss of the benefits consumers would otherwise get from increased consumption, such as from having warmer homes (this is elaborated further, by way of example, at the end of section 6.3). High variable charges can also have negative consequences for consumers who are budget-constrained, because it incentivises excessive monitoring of how much electricity is being used – above what is warranted by the cost of the energy being used – and, for risk averse people, it reduces the amount of electricity they use.[56]

5.7 Potential consumer confusion

5.7.1 Consumers may be confused by the complexities within the Regulations. Some retailers have suggested:

a) because the Regulations are communicated as the 'low fixed charge' some consumers are led to believe this is the least expensive option for them, even if it is not

b) consumers are confused by some of the terminology under the Regulations (e.g. 8,000kWh) and what this means for them in practice in terms of tariff choice

c) consumers only compare the daily fixed charge for the standard charge rather than the total annual energy bill and so they consequently select an LFC tariff when they would pay less on a standard plan.

5.7.2 If customers make inefficient decisions they will pay the consequence of a higher bill for their electricity and be worse off. This can happen if customers do not understand the tariffs and subscribe to the LFC tariff though their consumption is higher than average consumer under the Regulations.

5.8 Imperfect pass-through means principles are only a guide

5.8.1 As outlined above, the Regulations prescribe charging approaches that could, in-principle, be improved upon when compared to either conventional economic principles for network pricing or the Authority's Distribution Pricing Principles.

5.8.2 This in-principle assessment of the Regulations has one important caveat. In practice, there are limits for distributors in terms of both how they charge (particularly due to the Regulations), as well as how their charges are passed on to end-users. This is because retailers (rather than distributors) determine the final pricing structures to end users through their direct relationship with consumers. This means that there is limited pass-through of price signals from distributors to retailers to consumers. This in turn limits the extent to which prices faced by consumers are cost-reflective in practice.

5.8.3 Thus, while the LFC tariff under the Regulations is an in-principle source of inefficiency because prices are not cost-reflective, a question remains about the

[56] Research here and overseas indicate that when people have more certainty about their bills and a greater ability to manage their expenditure ahead of time – such as via prepaid meters – they tend to consume and spend more on electricity. See, for example, Jack, K. and G. Smith (2015) 'Pay as You Go: Prepaid Metering and Electricity Expenditures in South Africa' *American Economic Review: Papers and Proceedings*, vol 105, no.5, pp. 237-241.

extent of this inefficiency in practice. It is an open question, whether or not retailers would pass through more cost-reflective distribution charges in a way that allows consumers to see an approximation to 'their' incremental share of costs, rather than just a smeared pro-rata, consumption-based distribution charge.

5.8.4 It is clear that the proliferation of variable charges, caused by regulated fixed price maximums for low users, impedes efficient pricing. This means that, as technology (such as smart meters) allows increasingly better cost-reflective pricing, the Regulations will likely inhibit associated improvements in efficiency and lowering of costs to consumers.

Q5.	What comments do you have on the in-principle impacts on efficiency of pricing identified above?

6 Evidence of inefficient pricing

6.1 Distributors' low fixed charges are very low

6.1.1 The discussion above noted that retail and distribution pricing should include cost-reflective components and fixed charges for any remaining revenue requirements (sections 5.2 and 5.5). This raises questions about whether the levels of fixed charges under the Regulations are inefficiently low in practice.[57]

6.1.2 Analysis of distributors' costs suggests that regulated fixed charges are many times smaller than efficient fixed charges should be. This is shown below in Table 2 which presents lower and upper bounds on average efficient fixed charges per ICP per day.[58]

Table 2. Fixed costs of distribution are many times larger than low fixed charges

Dollars. Present Value, 2015. Estimated orders of magnitude based on Commerce Commission modelling[59]

	Allowable revenue[60]	Long Run Marginal Cost	Residual component	Implied lower bound on average fixed charge per ICP per day	Implied upper bound on average fixed charge per ICP per day
Alpine	163,099,020	54,727,425	108,371,595	1.57	2.37
Aurora	247,691,737	92,954,881	154,736,856	0.85	1.36
Centralines	48,814,569	14,917,496	33,897,073	1.97	2.83
Eastland	103,952,687	54,074,012	49,878,675	0.91	1.89
Electricity Ashburton	144,179,693	87,804,101	56,375,592	1.41	3.61
Electricity Invercargill	58,957,105	26,630,283	32,326,822	0.85	1.54
Horizon Energy	95,547,211	40,109,026	55,438,185	1.03	1.77
OtagoNet	108,078,052	50,542,312	57,535,740	1.73	3.25
Powerco	1,087,074,297	519,284,847	567,789,451	0.81	1.56
The Lines Company	148,967,866	55,531,814	93,436,053	1.82	2.90

[57] In practice, if the fixed cost imposed by the Regulations was a reasonable approximation to the fixed cost faced by network owners, then the fixed charge prescribed by the Regulations might well be reasonable.

[58] We have used the Commerce Commission's determination of Building Block Allowable Revenue as a benchmark for the present value of revenue recoverable over the next 5 years. We estimate long run marginal cost based on average incremental costs (net present value of capital and operating expenditure with the discount rate equal to a weighted average cost of capital of 7.19% as defined by the Commerce Commission in its model). We then deduct long run incremental costs to determine the residual to be allocated across consumers in as least distortive a manner as possible.

[59] 'Financial-model-EDB-DPP-2015-2020.xlsx' available at http://www.comcom.govt.nz/regulated-industries/electricity/electricity-default-price-quality-path/default-price-quality-path-from-2015/.

[60] This is the full amount applying to all regulated services and covers residential, commercial, and industrial consumers. Accordingly, the per-ICP values are based on an assumption that all ICPs are charged a pro-rata share of revenue.

Top Energy	168,714,387	97,349,840	71,364,547	1.08	2.54
Unison	436,524,631	208,232,743	228,291,888	0.94	1.79
Vector	1,749,930,119	779,978,116	969,952,004	0.77	1.39
Wellington Electricity	432,008,258	155,535,551	276,472,707	0.74	1.16

6.1.3 The first column in Table 2 is the amount of revenue that each distributor is allowed to recover for the next five years. This revenue is made up of an estimate of future costs of serving demand (Long Run Marginal Cost[61]) plus a residual requirement to ensure investors can recover the costs of their past investments (Residual Component). The size of the Residual Component gives a first order estimate of the size of costs to be recovered through fixed charges per connection (ICP), as shown in the far right column.

6.1.4 Average residual costs are estimated to be between 74 cents and $1.97 per day depending on the network.[62] Note that this figure excludes transmission charges. Interconnection charges would add approximately 50 cents per day if they were allocated on a per-ICP basis. This raises candidate fixed charges to more than $1 per day – well beyond the 30 cents fixed by the Regulations (and 15 cents for distributors).[63]

6.1.5 The lower bound share of distribution revenue that we estimate should be raised from fixed charges is 55%, on average. The upper bound on fixed charges – the far right column in Table 2 – allocates all allowable revenue (100%) to a fixed charge per ICP per day. The actual average share of revenue recovered from fixed charges is 22%. This apparent inefficiency may not be entirely due to the Regulations. There may be other contributing factors including errors. Nonetheless the Regulations are a major contributor to this apparent inefficiency given the size of the fixed charges set by the Regulations and the fact that more than 50% of residential consumers are on LFC tariffs.

6.1.6 The upper bound on fixed charges is included here to reflect the fact that a large amount of distribution asset investment may not vary with peak demand or energy use. This includes, for example, conductors (cables), poles and replacement expenditure that does not vary with demand. This means that it will not necessarily be efficient to recover all investment costs with a charge that varies by network use – regardless of whether the charges are based on peak demand or a variable kWh charge. This would depend on the circumstances of the individual distribution network. An extreme case then for retail pricing of distribution services – the upper bound – would be one where all investment was in assets such as poles and cables. In this case all lines and transmission charges would be fixed and the

[61] Present value of forecast capex plus increase in Opex as a share of demand. We use ICPs and forecast constant price revenue growth to measure demand. This use of Long Run Marginal Cost is for illustrative purposes, and should not be taken as an endorsement of the use of Long Run Marginal Cost as part of a charging methodology.

[62] Networks in Tasman, Nelson and Canterbury (Orion) are excluded due to difficulties reconciling data.

[63] This figure does not include all transmission charges, since connection charges are excluded. If these were included, estimated fixed charges would be higher again.

only variable charge in domestic consumers' retail bills would be for the generation of electricity.

6.2 Retailers' low fixed charges are very low

6.2.1 Extending our analysis of distributor fixed costs to include retail charges we find that, as a lower bound, the proportion of a consumer's bill that we would expect to be based on fixed charges to be around 46% of the average (7,000 kWh) consumer's bill at $824 per annum or $2.30 per day – quite some distance from the current level of 30 cents per day under the Regulations.[64] This is based on the principles of efficient pricing established in sections 5.2 and 5.5 above.

6.2.2 The results of our analysis are outlined in Table 3. The first column shows how large fixed charges would be, per day, if all fixed costs of supply were recovered with fixed charges. This includes estimates of:

a) fixed costs of distribution

b) fixed costs of transmission

c) retailer overheads

d) metering costs.

6.2.3 Estimates of the variable component of costs are based on typical wholesale energy costs by network area and the variable (cost-reflective price signal) components of transmission and distribution prices.

6.2.4 The results in Table 3 also show significant variation amongst distribution areas in terms of the efficient portion of costs that should be apportioned to fixed costs. This suggests that a single regulated low fixed rate for all of New Zealand is inefficient as it does not account for different costs of services across the country.

6.2.5 Two sets of estimates are provided: a lower bound based on the lower bound estimates for fixed distribution charges in Table 2; and an upper bound based on only marginal costs of energy supplied.[65] The gap between these two estimates, in terms of shares of bills that are fixed, is largest for more sparsely populated areas where distribution typically makes up a larger share of residential electricity bills.

6.2.6 For the lower bound estimates the analysis is also based on estimates of:

[64] This is the average of the annual bills for a consumer with consumption of 7,000 kWh p.a. for each of the notional tariffs in Table 3. This average differs from the 'average consumer' defined in the Regulations. The number for 'average consumer' defined in the Regulations is not a calculation but a fixed number with unclear provenance. The consumption averages for the average consumer under the Regulations (8,000 kWh or 9,000 kWh for consumers in the Lower South region) are not very accurate. By our estimation, 73% of all domestic ICPs consume less than 8,000 kWh p.a., and in the North Island this value is as high as 4 in 5 ICPs.

[65] In practical terms this is not an upper bound for fixed charges because retailers are free to offer fixed charge tariffs for energy consumed, if they choose. However, 'all-you-can-eat' tariffs would be a radical departure from current retail practice and, if widely applied, would not be very efficient (see Borenstein, S. and S. Holland (2005) 'On the efficiency of Competitive Electricity Markets with Time-Invariant Retail Prices', *The Rand Journal of Economics,* vol. 36, no.3, pp.469-493).

a) fixed retail costs from NZIER's cost index, including:[66]
   i) retail overheads (70 cents per ICP per day)
   ii) metering charges (17 cents per ICP per day)
b) fixed transmission costs based on information on residential transmission charges from the Commerce Commission collated information disclosures and Transpower New Zealand Limited's (Transpower) data on charges by distributor, assuming that fixed transmission costs are the same proportion of transmission charges as they are for distribution costs
c) estimates of variable costs based on:
   i) marginal costs of energy supplied (average around 8 c/kWh based on forward market energy prices, using data in NZIER's cost index)
   ii) network charges not covered by fixed charges, apportioning these by kWh as a first approximation.

Table 3. Shares of fixed charges in retail prices are very low under the Regulations

Dollars in 2015. Retail prices. Excludes GST and EA Levy. Cost shares based on 7,000 kWh consumption p.a.

	Lower bound estimate of fixed charges without regulations			**Upper bound estimate of fixed charges without regulations**			**With regulations**
	Notional fixed costs, $ per ICP per day	Notional variable cost cents per kWh	Share of bill which is fixed	Notional fixed costs, $ per ICP per day	Notional variable cost cents per kWh	Share of bill which is fixed	Share of costs in fixed charges under the Regulations
Alpine	2.63	9.7	41%	2.8	8.5	64%	6%
Aurora	1.96	9.5	48%	2.2	8.2	59%	7%
Centralines	3.35	11.2	39%	3.9	8.1	72%	5%
Eastland	2.00	10.2	50%	2.4	7.9	61%	6%
Electricity Ashburton	2.37	9.8	44%	2.6	8.7	61%	6%
Electricity Invercargill	1.72	8.6	49%	1.8	8.0	54%	8%
Horizon Energy	2.00	9.0	46%	2.2	8.1	58%	7%
OtagoNet	2.73	10.3	42%	2.9	9.2	62%	6%
Powerco	1.99	10.3	50%	2.4	8.3	60%	6%
The Lines Company	2.85	10.4	41%	3.3	8.3	67%	5%
Top Energy	2.09	10.4	49%	2.6	7.7	64%	5%
Unison	2.03	9.5	47%	2.3	8.2	59%	7%
Vector	1.90	10.0	50%	2.2	8.4	58%	7%
Wellington Electricity	2.01	10.3	50%	2.3	8.6	59%	7%

66 ftp://ftp.emi.ea.govt.nz/Datasets/Supplementary_information/2014/20140720_NZIER_synthetic_retail_price/NZIER_synthetic_retail_price.pdf.

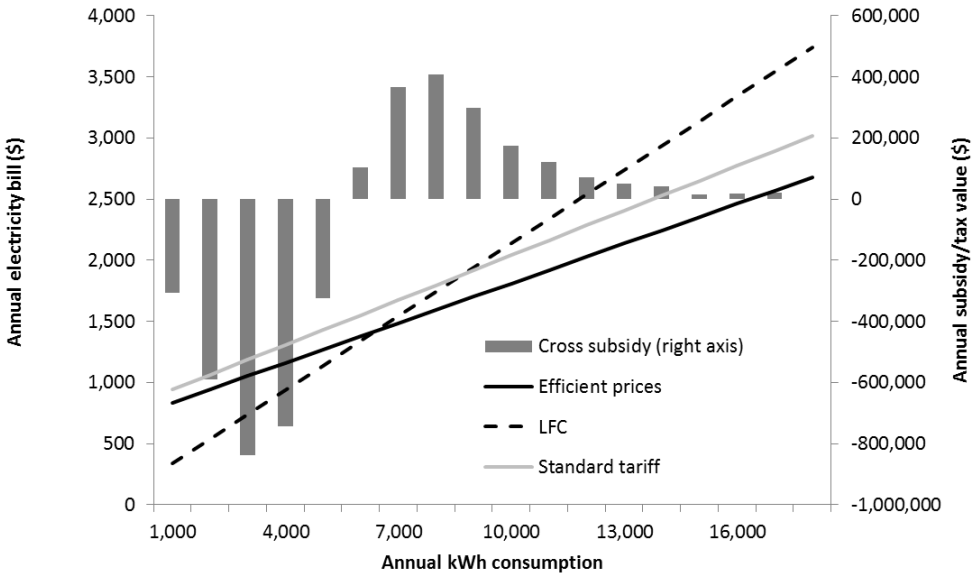
6.3 Cross-subsidisation: high-use households pay more than the cost of service – example of tariffs in Taranaki

6.3.1 We have estimated the extent to which the Regulations lead to cross-subsidisation by comparing a sampled retail tariff for a low user on an LFC tariff in the Taranaki region (38 cents fixed per day, exclusive of prompt payment discount, and 20 cents per kWh) with the notional efficient retail tariff structures for Powerco's network area shown in Table 3 (lower bound with a fixed charge of $1.99 and a variable charge of 10.3 cents and an upper bound with a fixed charge of $2.40 and a variable charge of 8.3 cents).[67]

6.3.2 This example also includes a standard tariff based on the level of tariff required to keep profits the same under an efficient tariff or under the combined low fixed and standard tariff.[68] This tariff is $2.20 per day and 11.7 cents per kWh.

6.3.3 The results of the analysis using the lower bound for fixed tariffs as a share of overall bill are shown in Figure 3 and Table 4. Figure 3 shows that the standard tariff has a similar slope to the efficient tariff but that the annual bill of someone on the standard tariff is higher than the notional efficient tariff.

Figure 3. Magnitude of cross-subsidies: illustrative example from the Taranaki region



[67] Note that the notional efficient tariff is only efficient with respect to the average cost. The sampled retail tariff was taken from an LFC tariff listed on the *Powerswitch* website. It is indicative only and is not intended to fully reflect the wide variety of retail tariffs available in Taranaki from a range of retailers. Retailers employ thousands of tariffs reflecting a range of market conditions, changes in conditions over time and customer circumstances.

[68] To do this we assume that each consumer has chosen the tariff that best suits their consumption. This is only done for the purposes of calibrating the standard tariff. The results all reflect the actual split between customers on LFC tariffs and those customers not on LFC tariffs – irrespective of which tariff they ought to be on from a cost-minimising perspective.

6.3.4 The values shown in Figure 3 are the 'economic' value of the subsidy in the sense that it is the difference between cost-reflective and notionally efficient (lower bound) prices and the prices required under the Regulations. The majority of this cross-subsidy occurs at the point of 'average consumer' as defined by the regulations (at 8,000 kWh).

6.3.5 This calculation of cross-subsidy ignores inefficient cost increases that have arisen for reasons not directly related to LFC tariffs. This includes ignoring the nearly 20% of consumers who consume less than 6,000 kilowatt-hours per annum and are on the standard tariff despite being better off on the LFC tariff.[69]

6.3.6 The overall implication of this analysis is that consumers, in aggregate, pay more for less under the Regulations than under the notional efficient tariff. If we assume that consumers all have the same responsiveness to price (a long run elasticity of -0.1 in this example[70]) then consumption would be 1.8% higher under the notional efficient tariff – with the lower variable charge – than under the standard and LFC tariffs.

Table 4. Example of the magnitudes of cross-subsidy from the Regulations

Annual consumption	Annual bill on LFC	Annual bill on standard tariff	Subsidy per customer per year p.a. to LFC	Annual bill with 'efficient' tariffs	% of customers on LFC	% of customers not on LFC
1,000	339	935	-457	829	1%	8%
2,000	539	1,053	-361	933	3%	2%
3,000	739	1,170	-264	1,036	7%	3%
4,000	939	1,287	-168	1,140	9%	3%
5,000	1,139	1,405	-71	1,243	10%	3%
6,000	1,339	1,522	25	1,347	8%	3%
7,000	1,539	1,639	122	1,450	6%	3%
8,000	1,739	1,757	219	1,554	4%	4%
9,000	1,939	1,874	315	1,657	2%	4%
10,000	2,139	1,991	412	1,760	1%	3%

[69] The preliminary data collated by the Authority is based on LFC tariff penetration by mesh-block. This data is not perfectly accurate as it includes ICPs that are not the consumers' principal place of residences. Nonetheless, the number of residential properties that are not principal place of residences are so few that this preliminary data provides a good indication of the general proportion of households on the LFC tariff.

[70] The elasticity used in this example is deliberately low in magnitude, because this is not intended to take into account investment-related demand responses, which is covered in section 7.

11,000	2,339	2,109	508	1,864	0%	2%
12,000	2,539	2,226	605	1,967	0%	2%
13,000	2,739	2,344	701	2,071	0%	1%
14,000	2,939	2,461	798	2,174	0%	1%
15,000	3,139	2,578	895	2,278	0%	1%

6.3.7 The quantity of foregone consumption due to the low fixed charge is in the order of 7,500 MWh. This amounts to a cost of $774,000 p.a., when priced at the marginal 'notionally efficient' variable price (10 cents per kWh). The cost per consumer connection is around $16 per year on average. The true welfare costs are likely to be larger than this due to wider impacts over time (considered further in section 7).

6.3.8 Generalising these results across New Zealand this suggests an annual cost from reduced consumption in the order of $23 million per year.[71]

6.3.9 This measure of the impact of the Regulations is not a welfare measure. Welfare analysis would ideally value this reduced consumption in terms of what people would be willing to give up to avoid the costs imposed by the regulations or the value of additional income needed to ensure people are compensated for the costs imposed by the regulations.[72] It is ambiguous whether a welfare analysis would imply a larger or a smaller cost.

6.3.10 A welfare analysis has not been carried out as part of this research project because it would require detailed analysis of the value of electricity to different kinds of households which risks taking this study beyond its stated scope of analysing market and pricing efficiency and competition and reliability effects.

6.3.11 A detailed welfare analysis might be side-stepped in other analyses of regulation but cannot be avoided in an analysis of the consumer welfare effects of the Regulations because of the transfers occurring between households. While it could be assumed that these transfers do not matter – in net – empirical research indicates that they do.[73]

6.3.12 Under our upper bound estimate of efficient fixed charges foregone consumption, due to the low fixed charge, increases to 10,000 MWh – 25% more than the reduction under the lower bound estimate. However, for consistency, the reduction is valued at the correspondingly lower variable charge (commensurate with the

[71] This is simply the $16 average cost multiplied by 1.4 million households in New Zealand.

[72] Or, simplistically, it might value changes in consumer surplus.

[73] Studies on household-specific consumption indicate that sensitivity to price changes does not follow expenditure, or even necessarily income, in a simple linear fashion, but rather, vary across groups and sub-groups. This is a finding from a study cited evaluating the impacts of carbon taxation on welfare (Creedy, J. and C. (2006). "Carbon taxation, prices and welfare in New Zealand," Ecological Economics, Elsevier, vol. 57(3), pp 333-345, May). To the best of our knowledge, research into equivalent dynamics for electricity consumption and pricing has not been carried out. The findings from the carbon taxation paper are, however, supported by similar work on issues such as indirect taxation. See e.g. John Creedy, 2004. "The Effects on New Zealand Households of an Increase in the Petrol Excise Tax," Treasury Working Paper Series 04/01, New Zealand Treasury.

higher fixed charge) of 8.3 cents per kWh. This lower value per kWh implies that cost of reduced consumption in the lower bound estimate rises by only 13%, to $26 million per year.

6.3.13 Overall, these results do not rest on assumptions about notionally efficient tariffs. The magnitude of effects are somewhat sensitive to assumptions that distributors would adopt 'notionally efficient tariffs – 'but-for' the Regulations – but the results are mainly due the fact that the regulations mandate a particular tariff structure with very low fixed charges.

6.3.14 Distributors could nonetheless be expected to adopt much higher fixed charges in their tariffs, if they were allowed, because there is less risk to revenue.[74] In contrast, revenue from variable charges or peak demand charges is subject to unpredictable shifts due to weather, for example.[75]

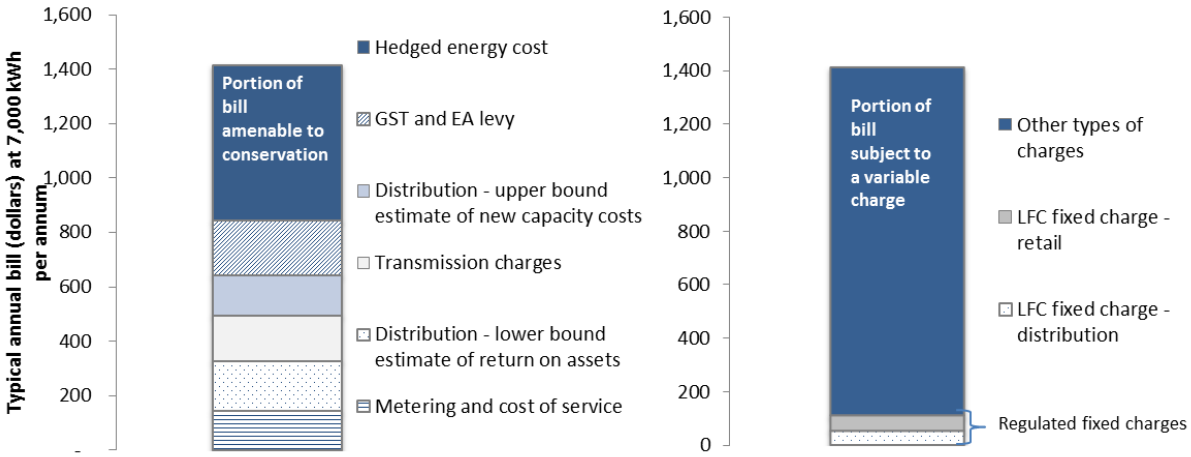
6.3.15 The main direct effect of the Regulations – that very low fixed charges shift system costs disproportionately onto higher-consumption households – is summarised in Figure 4 and Figure 5.

6.3.16 Figure 4 compares some of the constituent costs of a typical residential electricity bill alongside the tariff structure required under the Regulations. Around a third of the bill, the top portion in the chart, is energy costs. In the diagram costs are – roughly – ordered from more to less demand-related. At the very bottom are lower bound estimates of fixed distribution costs and meter costs. These costs do not change at all when demand changes.

Figure 4: Comparison of a retail bill and the structure of an LFC tariff

[74] One exception to this is the additional revenue that, under the current regulatory regime, a distributor might gain from variable energy charges if demand growth is higher than what was anticipated by a regulator when setting the distributors allowable revenue and price path. We ignore this because it requires a very strong assumption that the regulator will be wrong and because the current environment of flat to negative demand growth makes it unreasonable to assume that, presently, distributors would prefer variable charges.

[75] Revenue risk is not the only factor in distribution pricing and factors such as institutional inertia or public relations might attenuate the speed of a shift to higher fixed charges (if allowed). That said, the scope of this research project is not to consider what would occur if there was a change to the regulations but rather to analyse the effects of the regulations. This purpose demands a more abstract counterfactual: what might have happened if the Regulations did not exist?



6.3.17 The right panel of Figure 4 shows the very limited scope there is for retail tariffs to incorporate fixed charges and consequently variable tariffs have to be a large part of electricity bills. Indeed one might refer to the Regulations as the 'high variable charge regulations', when explaining their effects.

6.3.18 The Regulated requirement to offer a low fixed charge then causes an unavoidable tilting of tariffs in favour of low users. Higher variable tariffs cause consumers to use less electricity but higher users pay more while using less. This is illustrated in Figure 5 using the results of the analysis of the effects of the Regulations on a sampled retail tariff in the Taranaki region (lower bound estimate of effects as outlined in Table 4).[76]

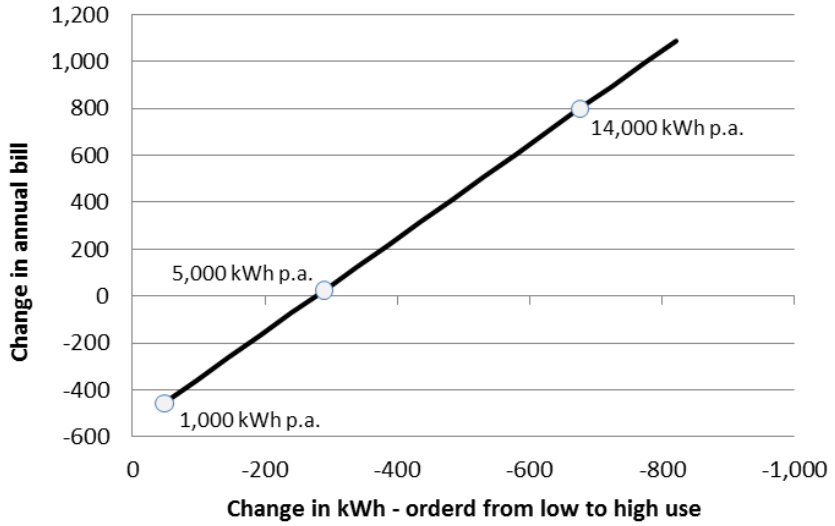
6.3.19 These results are predicated on the assumption that people respond to marginal kWh charges. If instead people respond to average charges or the size of their monthly bill then low-users would have increased consumption as a result of the regulations and would be using more while paying less.[77] The result for high users would remain that they would be paying more and using less.

6.3.20 These results have not considered the implications of peak demand charges. This is because peak demand charges are not in widespread use for residential consumers. As discussed above (5.2.7) peak demand charges can provide a useful price signal about excess capacity and costs of new capacity in a way that kWh charges do not. If they are used to charge for costs that are not incremental, however, then they too will unnecessarily distort household consumption decisions. This would depend on the circumstances of the individual distribution network.

[76] Further investigation of the Regulations could consider the balance of impacts across higher-use and lower-use households in terms of welfare impacts. This could include the extent to which high bills and reduced electricity consumption are causing poor health and unnecessary increases in public health costs. This is outside the scope of this research project.

[77] Recent research in California provides strong evidence that consumers do respond to average prices and that this undermines the effectiveness of high variable charges in encouraging conservation (Ito, K. (2014). "Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing", *American Economic Review*, vol. 104, no.2, pp.537-563).

Figure 5: High users pay more for less



6.4 Some evidence consumers are confused

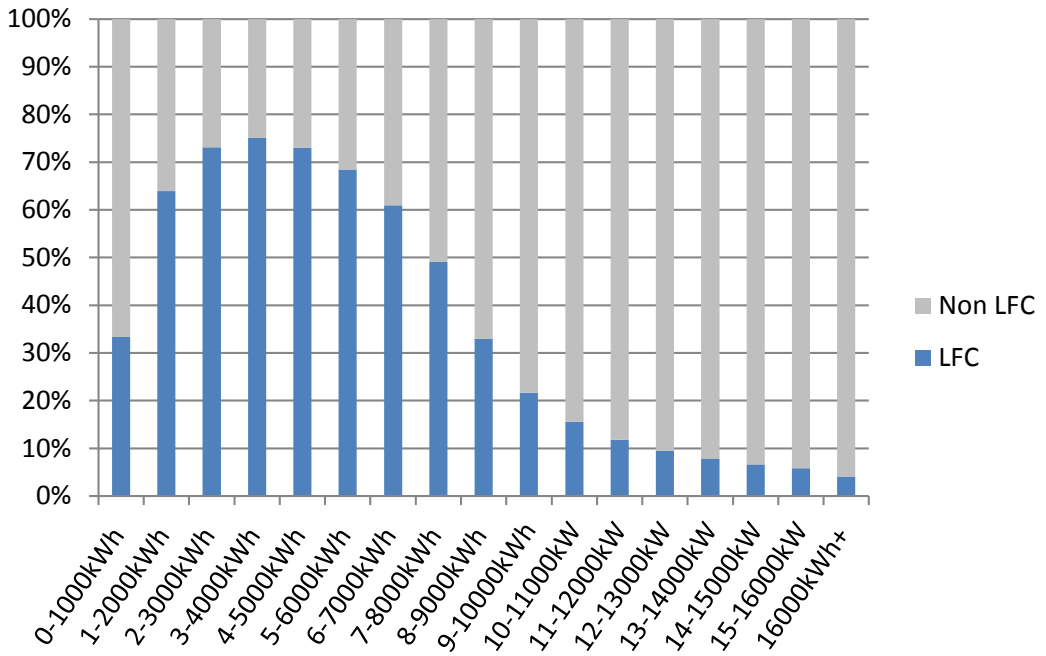
6.4.1 There is some evidence that the Regulations are not working as efficiently as they might due to the fact that some consumers are not on LFC tariffs and would be better off on an LFC tariff. Others are on a LFC tariff and their consumption is higher than the consumption threshold thus they are worse off as a consequence. This is reflected in Figure 6 which shows a long tail of high-use consumers on an LFC tariff. The Regulations have the effect that households which consume more than the defined 'average consumer' (8,000 kWh per year in the North Island and 9,000 kWh per year in the South) will not be better off on an LFC tariff and those who consume less than the average will not be better off on a standard tariff.

6.4.2 Preliminary data on uptake of LFC tariffs suggest that approximately 1 in 20 consumers is on a LFC tariff when this is not in their best interests.[78] Similarly 1 in 3 low-use consumers is not on an LFC tariff when, in principle, they would be better off on an LFC tariff. All told, an estimated 450,000 households, out of total of 1.6 million connections, are not on the tariff best suited to their consumption profile.

Figure 6. Share of ICPs on the LFC tariff and other tariffs[79]

[78] Retailer data disclosed to the Authority for the year to December 2014 indicates 6% of consumers were on an LFC tariff when their bill would be lower on a standard tariff.

[79] Authority's experimental data on the number of residential ICPs by tariff type according to retail disclosure data for the year to December 2014.



Q6.	What comments do you have on the level of distributors' and/or retailers' fixed charges discussed above?
Q7.	What comments do you have on the analysis of cross-subsidies set out in this section?

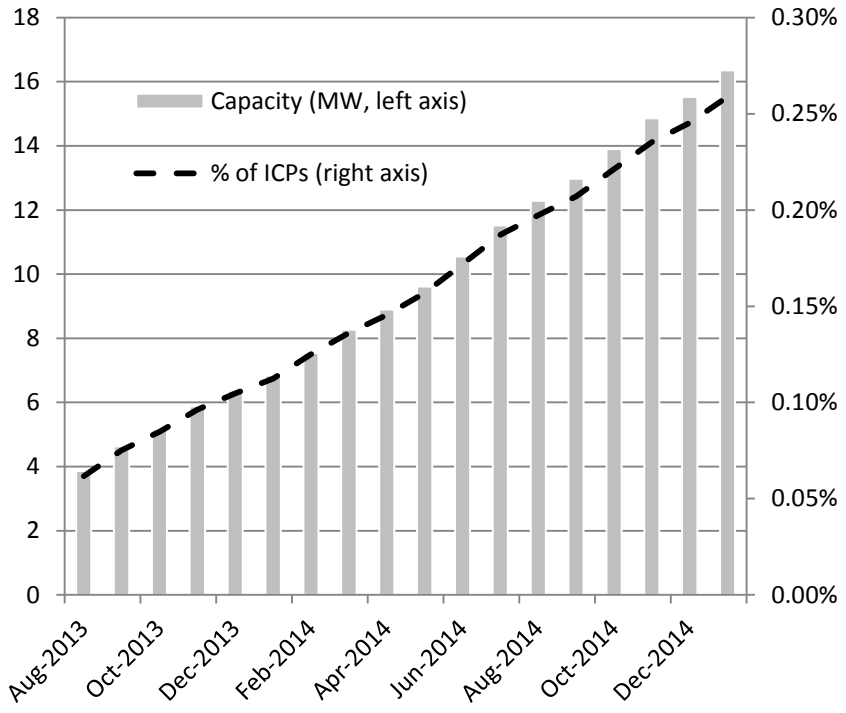
7 Effects of the Regulations on household investment decisions

7.1 Subsidies for distributed generation and solar photovoltaics

7.1.1 The growth in distributed generation poses a particular concern to the long-term efficiency of the Regulations because it is an avenue for inefficient investment and avoidance of network charges. Consumers receive price signals, due to the Regulations, to reduce their use of reticulated electricity because it reduces their responsibility for network charges irrespective of whether or not the steps they take to reduce consumption also reduce their use of capacity provided by networks that reticulate electricity. Currently, the cross-subsidy that arises from this is minor. However, these effects will only increase as more and more consumers install solar photovoltaics and the avoided charge is passed on to other consumers.

7.1.2 Presently, the concern over inefficiency of distributed generation caused by the Regulations is most evident in the case of solar photovoltaics. The use of solar photovoltaics remains small but it has accelerated in recent years as the cost of solar photovoltaics technology declines (see Figure 7).

Figure 7. Recent rise in solar photovoltaics in the residential sector[80]



7.1.3 When a consumer installs solar photovoltaics and reduces consumption from the local distribution network (approximately 800 to 1,700 kWh p.a.), the effect of the LFC tariff is that the consumer will reduce its responsibility for network charges.

[80] Electricity Authority EMI *Installed Distributed Generation Trends* report available at http://www.emi.ea.govt.nz.

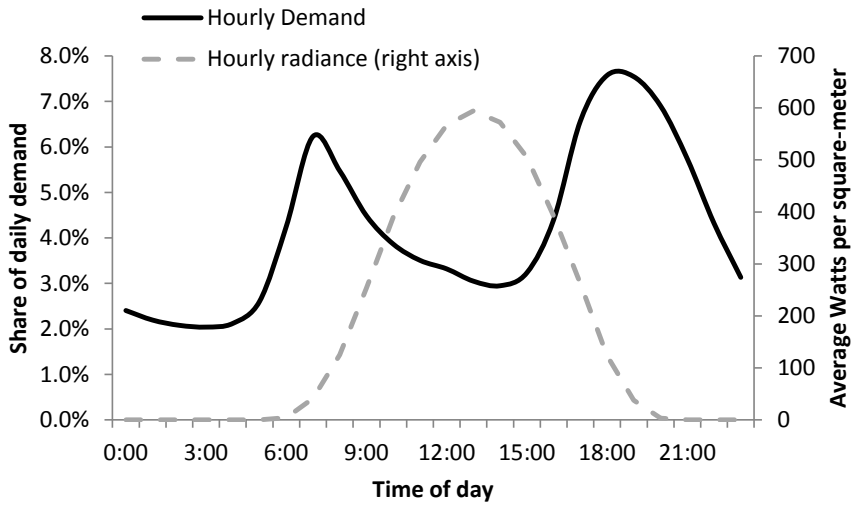
This appears to be a saving, but this is not the case if demand for capacity or peak energy demand does not decline along with a reduction in annual consumption. If solar photovoltaics owners continue to make full use of network capacity at peak times then the LFC tariff acts as a subsidy to solar photovoltaics installation and costs increase for consumers who are not on the LFC tariff.

7.1.4 In general, it is likely most owners of solar photovoltaics will continue to demand distribution services at peak times (6am/pm – 9am/pm).[81] This is a consequence of domestic seasonal and daily demand peaks falling at times when solar radiance is low. This is shown in Figure 8.

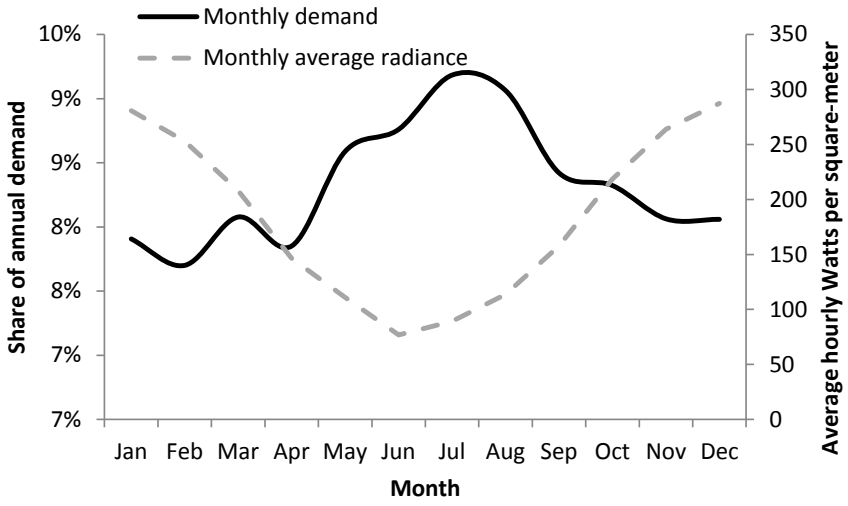
7.1.5 The top panel of Figure 8 shows that solar radiance, which powers solar photovoltaics, declines to close to zero when household demand is at its daily peak. This figure is an average of daily demands across the year. In terms of annual winter peaks, there is unlikely to be any solar power generation. Indeed the winter months – when peak demand is at its highest – sees significant reductions in solar radiance and hence solar power generation. This means that owners of solar photovoltaics save on off-peak energy costs but place no less of a demand on capacity requirements of the electricity network.

Figure 8. Mismatch between solar energy production and peak domestic demands

Radiance data for Auckland and a household demand profile on a peak demand day



[81] The assessment here is independent of any assessment of the benefits of battery storage for smoothing-out the peak demands that domestic consumers make on reticulated electricity supply systems.



7.1.6 Subsidies to solar photovoltaics created by the Regulations are not trivial. The earlier example of how a cross-subsidy in Taranaki works implies a subsidy of between $750 and $4,800 for each 1,000 kWh reduction in consumption below 5,000 kWh – the point at which consumers start to benefit from reduced electricity bills, due to the Regulations, according to the analysis in section 6.3. The lower a customer's initial consumption – whether through dual fuel use, low needs or conservation – the greater the incentive to further reduce consumption by installing solar photovoltaics.[82] The subsidy effects of the Regulations will thus work to encourage investment that may not be economic. This is inefficient because it means consumers end up paying more for electricity than they otherwise would.

7.1.7 The extent of the subsidy for solar photovoltaics is presently small overall given that solar photovoltaics makes up less than half a percent of residential ICPs. At the same time, uptake of solar photovoltaics has been rapid in recent years with a quadrupling of output from installed solar photovoltaics in the past 18 months. This suggests that the implicit subsidy for solar photovoltaics could yet become an important source of inefficient investment.

7.2 Expected impact of LFC tariff on investment in solar photovoltaics

7.2.1 The LFC tariff increases the financial pay-off to consumers with domestic solar photovoltaics. This should accelerate investment in solar photovoltaics above what it would be without the Regulations.

7.2.2 A first order or 'first round' effect of the Regulations on the size of the future investment cost associated with the Regulations is estimated to be between $2.2 billion and $3.9 billion dollars (discounted present value). This excludes consequent flow-on effects that can more than double these costs. Potential flow-on effects are discussed further below. In practice, a 'first round effect' may not actually be distinguished from other effects because events are unlikely to occur in

[82] This is the present value over 25 years (the assumed life of the solar photovoltaic system) of annual subsidies ranging from $71 per annum at 5,000 kWh of consumption through to $457 per annum at 1,000 kWh of consumption. The assumed discount rate is 8%.

a neatly sequenced fashion. The reason they are separated here is to distil and better explain different but interacting effects.

7.2.3 This assessment is based on an evaluation of the uptake of solar photovoltaics with and without LFC tariffs and under four scenarios for future prices of grid-supplied electricity relative to electricity from solar photovoltaics. These scenarios are summarised in Figure 9 below.

7.2.4 Under all scenarios, the economics of solar photovoltaics is expected to improve with the cost of investing in solar photovoltaics declining by either 2.5% p.a. or 7% p.a. The slower rate of decline (2.5%) reflects the International Energy Agency (IEA) expectation that costs of solar photovoltaics will be 40% lower in 2035.[83] The faster rate of decline (7% p.a.) reflects a view from Citigroup that photovoltaics module costs will fall to US $250 per kW by 2020.[84] These equate to costs of installation of between $1,750 (low cost) and $2,500 (high cost).

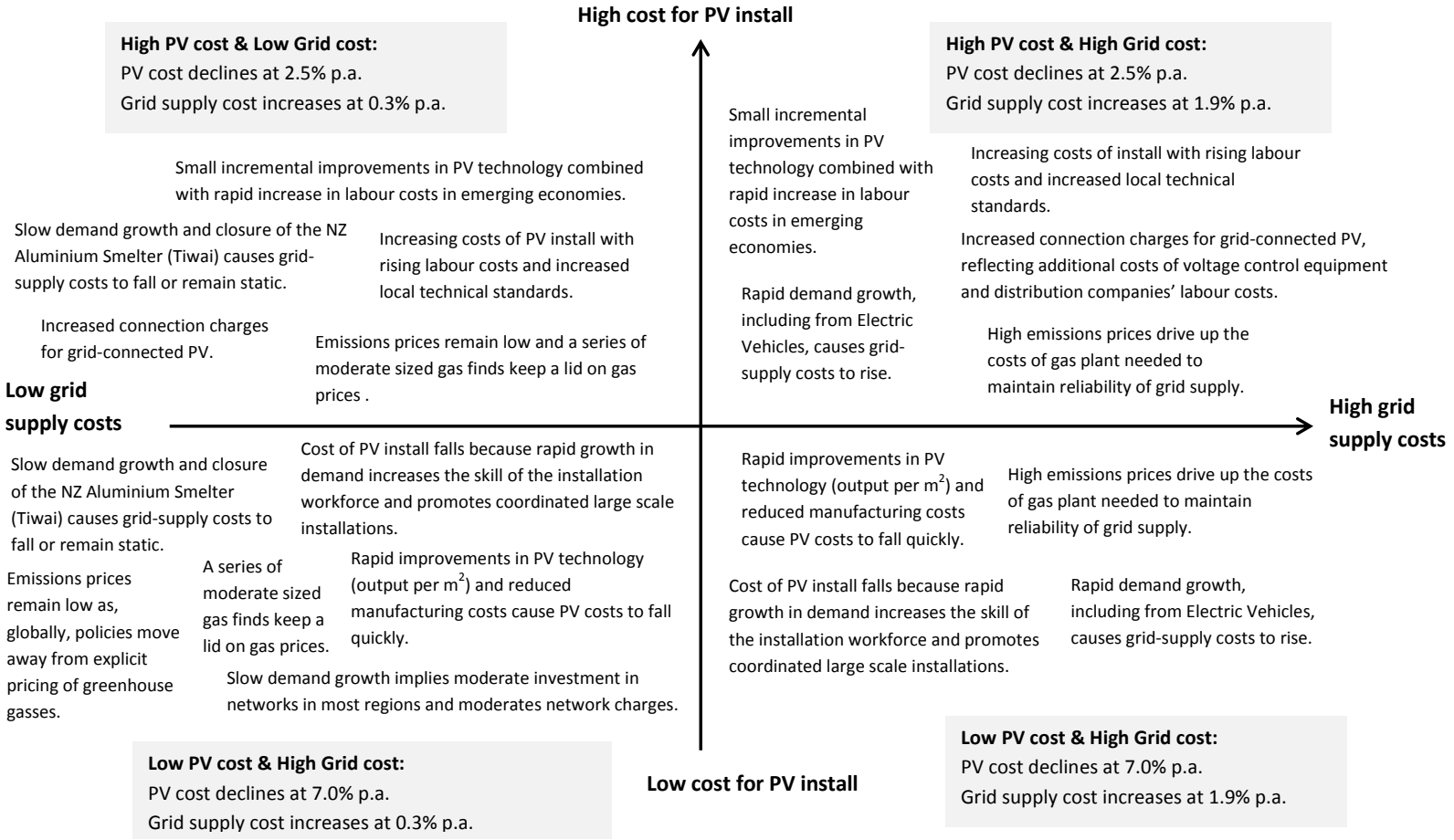
7.2.5 Grid supply costs are assumed to increase in all scenarios but in a low grid-supply cost scenario, costs increase 0.3% p.a., and in a high growth scenario, these costs increase by 1.9% p.a. These scenarios are based on the two most extreme paths for the wholesale electricity price indicator in MBIE's (2015) draft *Electricity Demand and Generation Scenarios*.[85] A full list of assumptions is provided in Appendix A.

[83] This expectation has been adopted by MBIE (2015) in its draft *Electricity Demand and Generation Scenarios* published on 2 April (http://www.med.govt.nz/sectors-industries/energy/energy-modelling/modelling/electricity-demand-and-generation-scenarios/draft-edgs-2015).

[84] This is at the extreme end of publically available scenarios for solar photovoltaics module costs. By comparison the US Department of Energy has programmes targeting a reduction in solar photovoltaics costs amounting to $500 per kW. These are exclusive of installation costs including labour and other equipment such as inverters. Non-module costs are between 2 and 3 times module costs. In our low cost (7% decline) scenario we assume the final cost of installing solar photovoltaics is twice the module cost.

[85] The high cost growth scenario (1.9%) reflects average annual growth in long run energy costs from MBIE's 'Global low carbon emissions scenario'. The low cost growth scenario (0.3) reflects average annual growth in long run energy costs from MBIE's 'High gas availability' scenarios.

Figure 9: Scenarios for relative costs of solar photovoltaics versus grid supply



7.2.6 Currently, solar photovoltaics provides a small net positive return on investment in most parts of New Zealand, but the Regulations raise these returns on average by 1.5 percentage points which equates to an increase in returns of 50% to 100%.

7.2.7 These rates of return results are shown in Table 5. This shows the 'internal rate of return' on installing a 3 kW solar photovoltaics module today in five regions or 'zones' of New Zealand (Upper North Island (UNI), Central North Island (CNI), Lower North Island (LNI), Upper South Island (USI) and Lower South Island (LSI)).[86] A solar photovoltaics installation is assumed to cost $10,950 per unit in all regions, but output and revenue from selling surplus generation varies by region. The gains to be made from avoiding the payment for grid-supplied electricity also vary according to regional tariffs and whether consumers are on standard tariffs or LFC tariffs. The results in Table 5 reflect average tariffs (by LFC tariffs and standard tariffs), average electricity consumption, average time of use of electricity and average hourly sun radiance by region.

Table 5: Rates of return on installing solar photovoltaics, by grid cost scenario and with and without LFC tariff

Type of user and tariff	Zone	Low cost grid supply	High cost grid supply
LFC tariff – low user	UNI	2.8%	4.6%
	CNI	2.8%	4.6%
	LNI	1.7%	3.5%
	USI	1.9%	3.8%
	LSI	1.3%	3.2%
Standard tariff – standard user	UNI	4.8%	6.6%
	CNI	5.1%	6.8%
	LNI	3.6%	5.4%
	USI	2.7%	4.5%
	LSI	2.0%	3.9%
No LFC tariff - low user	UNI	-0.1%	1.8%
	CNI	-0.2%	1.7%
	LNI	-1.2%	0.7%
	USI	-0.6%	1.3%
	LSI	-1.5%	0.5%
No LFC tariff - standard user	UNI	1.1%	3.0%
	CNI	0.8%	2.7%
	LNI	-0.1%	1.8%
	USI	0.5%	2.4%
	LSI	-0.5%	1.4%
Change due to LFC tariff - low user	UNI	3.0%	2.9%
	CNI	3.0%	2.9%
	LNI	2.9%	2.8%
	USI	2.6%	2.5%
	LSI	2.8%	2.7%
Change due to LFC tariff - standard user	UNI	3.7%	3.6%
	CNI	4.3%	4.2%

[86] These regions are the 'zones' defined in the Network Supply Point (NSP) table produced by the Electricity Authority and published in the reports section of the Authority's data portal at http://www.emi.ea.govt.nz.

LNI	3.7%	3.6%
USI	2.2%	2.2%
LSI	2.5%	2.4%

7.2.8 There is no difference between the low cost and high cost photovoltaics scenarios because the results reflect returns on an investment made today and people investing today will not benefit from future cost reductions that are reflected in the solar photovoltaic cost scenarios. A table of results showing the impact of varying costs of solar photovoltaics on investment returns 10 years from now is provided in Appendix B.

7.2.9 The rates of return in Table 5 can be readily compared to rates of return for other investments. Under current tariff structures and with high growth in grid-supply costs, a solar photovoltaics installation in the Upper North Island will provide a better return than current 4% term deposit rates or the historical average term deposit rate 6% (6 month term, RBNZ). [87]

7.2.10 The 'No LFC' scenarios in Table 5 assume that in the absence of the Regulations, fixed charges would be 46% of retail bills as discussed above in paragraph 6.2.1 of this report. Consumers' bills are assumed to be the same overall and variable tariffs adjusted to ensure this is the case.

7.2.11 Rates of return to solar photovoltaics are expected to improve over time as installation costs decline. An example of this is shown in Figure 10. This shows that the LFC tariff increases returns to solar photovoltaics over time and so there is expected to be increasing rates of solar photovoltaic uptake over time.

7.2.12 To assess the implications of this increase, we assume that the decision to invest in solar photovoltaics is a function of rates of return. The relationship between rates of return and investment is shown in Figure 11. The shape of this relationship is calibrated to actual penetration rates to date (e.g. average 2.9% rates of return to solar photovoltaics in the Upper North Island and 0.3% penetration as at end 2014). This continuous relationship captures the fact that people decide to install solar photovoltaics for reasons other than financial rates of return (see Appendix C for the precise values used to fit these relationships).[88]

[87] This rough comparison does not take account of tax. Returns from a solar photovoltaics installation would look even better by comparison If returns from the term deposits used here were considered on a post-tax basis.

[88] The model is a simplification and focusses on averages to understand scope of potential effects. Inevitably it misses some of the factors which affect investment in solar photovoltaics. For example, the analysis does not take into account potential constraints on uptake such as the number of apartment-dwellers and tenants (who may be unable to install solar panels), or factors such as roof pitch and shading which may prevent installation on certain buildings. The modelling used here also ignores the scope for consumers to invest in different sized installations or to purchase back-up generators to facilitate disconnection from local distribution networks altogether.

Figure 10. Inreasing rates of return to solar photovoltaics over time

Example from Low photovoltaics cost – High Grid cost scenario

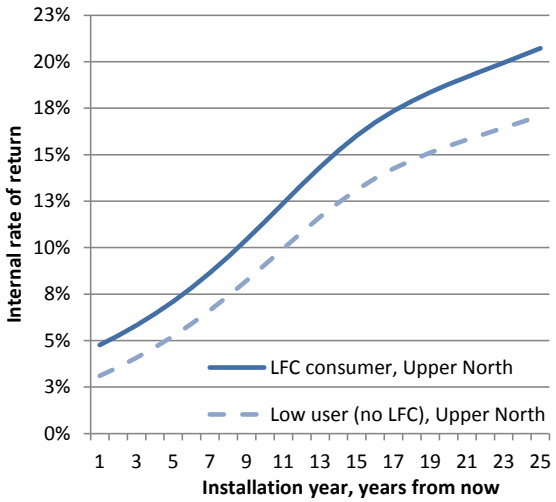
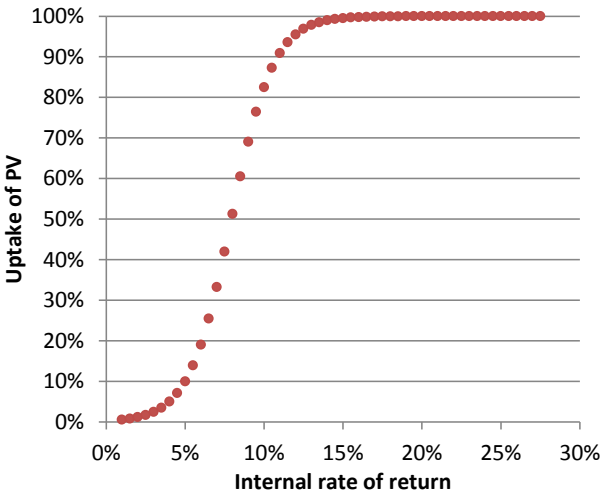


Figure 11. Effect of rates of return on uptake

Calibrated to existing penetration



7.2.13 Rates of uptake vary widely based on expectations of future grid costs, future costs of solar photovoltaics and hence rates of return. Average uptake of solar photovoltaics in the next 10 years with the LFC tariff is estimated to range from 20% of ICPs nationwide - in the high photovoltaics cost and low grid cost scenario – and 90% with rapid photovoltaics cost-declines and high costs of grid supply.

7.2.14 In these scenarios the Regulations are a major cause of the increased uptake of solar photovoltaics. This can be seen in Table 6 where half of uptake in the high uptake scenario (up to 60% in 10 years in the Lower North Island) is due to benefits from reduced retail bills associated with the Regulations – as opposed to relative economics of supply from solar photovoltaics versus grid supply.

Table 6: Solar photovoltaics uptake in 10 years' time by cost scenario and with and without the LFC tariff

		Low cost photovoltaics, Low cost Grid	Low cost photovoltaics, High cost Grid	High cost photovoltaics, Low cost Grid	High cost photovoltaics, High cost grid
LFC	UNI	38%	92%	11%	66%
	CNI	33%	90%	9%	61%
	LNI	9%	64%	2%	26%
	USI	27%	87%	8%	55%
	LSI	16%	77%	4%	40%
Standard	UNI	81%	99%	42%	93%
	CNI	83%	99%	44%	93%
	LNI	41%	93%	12%	68%
	USI	45%	94%	15%	72%

	LSI	28%	87%	8%	56%
No LFC - low user	UNI	4%	37%	1%	12%
	CNI	3%	32%	1%	10%
	LNI	1%	10%	0%	3%
	USI	3%	35%	1%	12%
	LSI	1%	19%	0%	6%
No LFC - standard user	UNI	11%	68%	3%	31%
	CNI	7%	57%	2%	22%
	LNI	2%	25%	1%	7%
	USI	9%	62%	3%	27%
	LSI	4%	37%	1%	13%
Change due to LFC - low user	UNI	34%	54%	10%	54%
	CNI	30%	58%	9%	51%
	LNI	9%	54%	2%	23%
	USI	24%	52%	7%	44%
	LSI	15%	58%	4%	34%
Change due to LFC - standard user	UNI	70%	31%	39%	62%
	CNI	76%	42%	42%	71%
	LNI	39%	68%	11%	60%
	USI	36%	31%	12%	45%
	LSI	24%	50%	7%	44%

7.2.15 Based on these different investment paths (with and without the LFC tariff), and assuming that solar photovoltaics installations have a useful life of 25 years, the present value cost of the investment distortion created by the Regulations ranges between $2.2 billion and $3.9 billion dollars (discounted present value, assuming a 8% discount rate).[89] The overall assessment of costs by area and scenario is summarised in Table 7.[90]

Table 7: Summary of value of LFC tariff-induced investment in solar photovoltaics ($ billion, present value)

Area	Low cost photovoltaics, Low cost grid	Low cost photovoltaics, High cost grid	High cost photovoltaics, Low cost grid	High cost photovoltaics, High cost grid	Average across scenarios
UNI	1,469	860	994	1,097	1,105
CNI	970	567	652	727	729
LNI	627	660	199	801	572
USI	512	384	253	461	403
LSI	279	252	91	302	231

89 This reflects the number of solar photovoltaics installations the Regulations have brought about multiplied by the capital cost at time of investment, less the discounted cost of the same investment when it would otherwise have been put in place.

90 Note that the first year of investment path has been excluded from these cost estimates as the high grid cost and low photovoltaics cost scenario sees an infeasibly large jump in solar photovoltaics installations in the first year of the analysis (a four-fold increase). This suggests that expectations are, in reality, for smaller relative price differences between grid supply and solar photovoltaics costs than are captured in the low photovoltaics cost and high grid supply cost scenarios. Thus the first year's jump in installations was ignored in favour of focussing on differences in investment time paths so as not to overstate investment costs.

Total	3,858	2,725	2,190	3,388	3,040

7.2.16 The estimated effects are only a first set of effects. At the same time that investment in solar photovoltaics is accelerated, grid-based consumption declines and this reduces the base over which revenue needs to be recovered to cover system costs (distribution and transmission). Table 8 sets out the average percentage changes in variable tariffs needed to ensure system costs are recovered under each of the above scenarios.

Table 8: Average variable tariff change to ensure system costs are recovered

Area	Low cost photovoltaics, Low cost Grid	High cost photovoltaics, Low cost Grid	Low cost photovoltaics, High cost Grid	High cost photovoltaics, High cost Grid	Average across scenarios
			Year 5		
UNI	3%	2%	12%	9%	7%
CNI	3%	2%	11%	8%	6%
LNI	1%	0%	4%	2%	2%
USI	1%	1%	6%	4%	3%
LSI	1%	0%	3%	2%	2%
			Year 10		
UNI	14%	5%	26%	20%	16%
CNI	12%	5%	24%	18%	15%
LNI	4%	1%	17%	9%	8%
USI	6%	2%	19%	12%	10%
LSI	4%	1%	17%	9%	8%
			Year 15		
UNI	22%	9%	26%	24%	20%
CNI	20%	8%	24%	22%	19%
LNI	13%	3%	23%	17%	14%
USI	15%	4%	20%	18%	14%
LSI	12%	2%	21%	17%	13%
			Year 20		
UNI	22%	10%	24%	24%	20%
CNI	20%	9%	22%	22%	18%
LNI	15%	3%	21%	19%	15%
USI	16%	5%	19%	18%	15%
LSI	15%	3%	20%	18%	14%

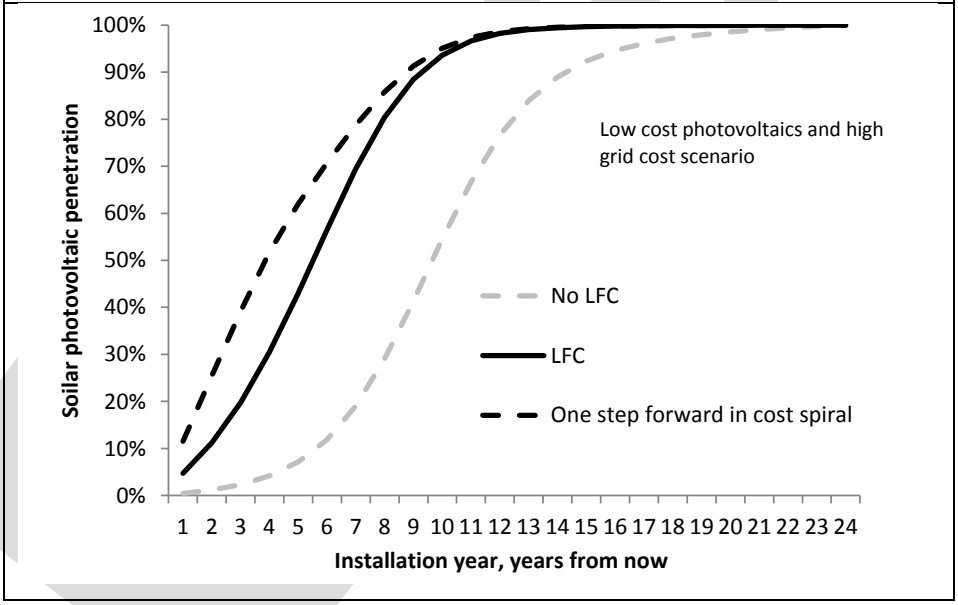
7.2.17 Rising variable charges would provide additional incentives to invest in alternatives to grid-supplied electricity, including solar photovoltaics. This, in turn, would further reduce the amount of grid-based electricity consumption and, in the absence of higher fixed charges (due to the regulations), variable charges would rise further.

7.2.18 Rather than speculate about the end result to this dynamic of spiralling costs and increasing investment in grid-supply alternatives, we consider one step forward in the cost spiral. This avoids making judgements about the sustainability of spiralling costs and focusses mainly on the sensitivity of the investment inefficiency to spiralling costs. This then provides an illustration of the speed with which the investment inefficiencies can 'get away on you'.

7.2.19 Applying the tariff increases summarised in Table 8 to our four scenarios causes estimated investment costs to increase significantly (see example impact in Figure 12). Under the scenario with high solar photovoltaic costs and low grid supply costs the value of investment brought forward by the Regulations rises from $2.2 billion to $3.9 billion. The highest cost scenario, with high grid supply costs and low solar photovoltaic costs, rises from $3.5 billion to $5.4 billion. This is only one step forward in the cost spiral so it understates the overall potential effect.

7.2.20 In addition to inefficient solar investment, the tariff changes shown in Table 8 would also cause reductions in electricity consumption because of reduced household purchasing power. This, in turn, would cause further tariff increases and further reductions in consumption. The cost that this imposes on consumers has not been valued. To do so would require evaluating the cost spiral to potential end points and making judgements about how the regulatory system and politicians would respond to such a cost spiral.

Figure 12: Example of impact of spiralling costs on accelerating investment in solar photovoltaics

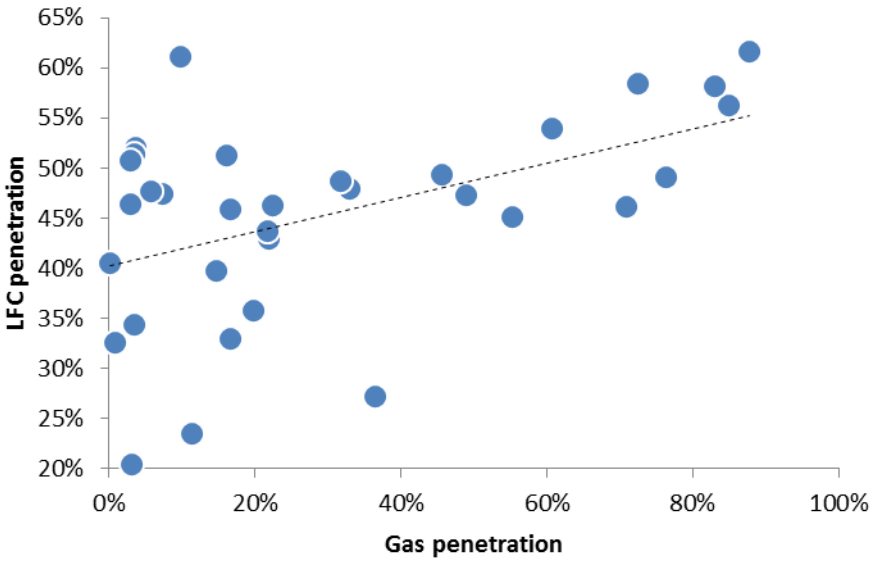


7.2.21 Other kinds of investments and behaviour changes that could be promoted by a cost spiral include increased use of gas. A correlation between gas use and low fixed charges already exists in the North Island. Figure 13 below provides evidence of this with an association between penetration of a LFC option and gas penetration. As the penetration of gas connections increases, there are observed

increases in LFC penetration. The relationship runs in two directions of course, with use of gas increasing the likelihood of a household being on an LFC tariff and the availability of an LFC tariff option increasing the payoff to investing in or using more gas.

Figure 13. Dual fuel use increases low fixed charge tariff penetration

Observations are Territorial Local Authorities. Gas penetration is ratio of (all) gas ICPs to domestic electricity ICPs. Low fixed user penetration is ratio of ICPs on LFC tariffs to total number of ICPs.



7.3 Ambiguous effects for electric vehicles

7.3.1 For other grid-connected new technologies and consumer investments, the effects of the LFC tariff are more uncertain. Buyers of electric vehicles and plug-in hybrids will, for example, face higher variable costs for electricity than they otherwise would (as discussed in sections 5 and 6). This will make cost savings (relative to conventional vehicles) lower than they otherwise would be. These effects are not likely to be material in the short-term though, as the gap between conventional and electric powered vehicles (in terms of running costs) is very large.

Q8.	Do you agree that the Regulations are likely to lead to inefficient household investment decisions?
Q9.	Are there any significant investment effects of the Regulations other than those identified in this section?

8 Effects on retail competition

8.1.1 The Regulations' potential detrimental effects on retail competition arise from the Regulations increasing:

a) compliance costs

b) the adoption of inefficient pricing practices

c) barriers to market entry that stem from constraints on tariff innovation and inefficient consumer decision-making caused by confusion on the part of consumers and inefficient consumer switching.

These effects potentially increase costs for retailers and distributors, which raises barriers to entry and in turn confers benefits on incumbent retailers. A sample of the views of retailers on these matters is provided in Appendix E.

8.1.2 Charges that are inconsistent with the cost of providing services to consumers result in the extraction of a price premium from consumers with homes that are ineligible for the LFC tariff. The price premium can undermine competition by forcing retailers to exit market locations that are unprofitable for the provision of retail service as consumers choose the LFC tariff.

8.1.3 Compliance costs that retailers are unable to recover fully under the LFC tariff could become a burden on non-LFC tariff consumers, retailers and distributors. If those costs are high without any opportunity for distribution across a sizable commercial customer base that offers opportunities for decreasing costs to scale, fewer retailers will be able to operate in the market. With the exit of retailers from areas troubled by this outcome, competition in the market will be compromised.

8.1.4 Related to the issue of compliance costs are barriers to market entry if tariff and service innovations are constrained by the Regulations.

8.1.5 Table 8 below provides a summary assessment of the extent to which the Regulations raise costs or inhibit innovation. Table 8 also includes a preliminary assessment of whether, taken together, these effects are likely to have a large or small impact on competition.

8.1.6 As Table 8 shows, our overall assessment is that no single aspect of the Regulations is likely to have a large effect on competition. However, there are a number of areas in which the Regulations may create profits for incumbents in the market and corresponding barriers to market entry and expansion for new retailers by increasing operational costs and inhibiting innovation.

8.1.7 Assuming that small retailers can engineer their offerings to attract more profitable customers, any costs created by cross-subsidies will tend to be more of a problem for larger firms and incumbents than for smaller retailers. A crude example of a small retailer engineering their offerings in this manner would be for a small retailer to offer a standard tariff with a higher daily fixed charge and lower variable charge than most competitors. This makes the cost of the annual bill from the small retailer competitive for high volume users. It also allows the small retailer to create an LFC tariff that has a higher variable charge than its competitors. The difficulty

for the small retailer in this example is that the small retailer is competing in a reduced segment of the market.

8.1.8 Inefficiencies will also arise for retailers (particularly a new entrant retailer) with a disproportionately high number of customers on LFC tariffs. Because the Regulations create cross-subsidisation, a customer portfolio that is overweight with consumers on the LFC tariff and underweight with non-LFC tariff consumers, will not have well balanced opportunities for cost reallocation away from consumers on the LFC tariff. A retailer with this sort of customer portfolio will be less profitable than a retailer with a more competitive, balanced portfolio. The cost and complexity of maintaining a balanced portfolio may therefore be a barrier to entry or expansion for new retailers.

Table 8. Qualitative assessment of negative effects on retailer competition

Compliance costs	**Cost increasing**	**Hinders innovation**	**Deters entry**	**Nature of impact**	**Magnitude**
Verification of eligibility	✓		✓	Threat of entry lowered	Small
Menu costs	✓	✓	✓	Declining in scale	Small
Coordination costs (coordination with distributors)	✓			No return to scale	Small
Cost of communicating with consumers	✓			No return to scale	Small
Cost of determining compliance	✓		✓	Declining in scale	Small
Inefficient pricing					
Complicates distribution pricing and promotes bundling	✓	✓		No return to scale	Small
Cross-subsidies	✓	✓		Increasing in scale	Small
Constraints on tariff and service innovation					
15 day period	✓	✓	✓	Threat of entry lowered	Small
Marginal costs of an additional tariff	✓	✓		No return to scale	Negligible
Limitations on pass-through		✓	✓	No return to scale	Moderate

Consumer confusion

Unnecessary switching	✓			No return to scale	Small

8.2 No empirical evidence of reduced competitive pressure

8.2.1 From interviews with retailers, the RAG understands that consumers on standard tariffs (not low users) are more profitable for retailers than consumers on LFC tariffs. On its own, this suggests that regions dominated by consumers on LFC tariffs will have lower retailer competition.

8.2.2 Statistical analysis suggests that areas with large numbers of consumers on LFC tariffs tend to have more competition, not less. This contradicts the view that LFC tariffs reduce competition, and suggests that characteristics associated with consumers on LFC tariffs counteract any potentially undesirable aspects of how LFC tariffs are structured.

8.2.3 Having analysed potential predictors of LFC tariff penetration, the evidence shows that, on balance, retailers are motivated to compete by factors other than whether or not a consumer catchment has a high proportion of consumers on LFC tariffs. The results of this analysis are summarised in Appendix D.

8.2.4 Our model of LFC tariff penetration shows that increased numbers of consumers on LFC tariffs are associated with:

a) more retailers competing
b) higher household incomes
c) smaller households
d) low volumes of consumption
e) availability of gas
f) increased deprivation, according to Otago University's deprivation index.

8.2.5 This all means that the Regulations have a less noticeable effect on competition than on efficiency of investment and pricing.

Q10. What are your views on the effects of the Regulations on retail competition?

9 Conclusions

9.1.1 Overall, the Regulations have a number of marked effects on the electricity industry and on consumers:

a) compliance costs related to the Regulations cost the industry, and ultimately consumers

b) prices are less cost-reflective than they should be because the Regulations introduce cross-subsidies and an over-reliance on variable charges

c) although some consumers benefit from low prices, in aggregate, consumers face prices that are higher than they would be without the Regulations and the cost of this is approximately $23 million per year

d) the promotion requirements under the Regulations do not appear to be working efficiently as preliminary data suggests 1 in 3 consumers are paying more than they should by either being on the LFC tariff or not being on the LFC tariff

e) the Regulations provide an incentive to install solar photovoltaics of between $700 and $4,490 per annum, and this can encourage investment that is not economic, while raising prices to other consumers

f) a first order or 'first round' estimate of excessive investment associated with the Regulations is $2.2 billion to $3.9 billion dollars (discounted present value)

g) increased investment in solar photovoltaics and falling consumption of grid-based electricity is likely to cause prices to rise. A single step forward in this cost spiral increases the estimated size of excessive investment in solar photovoltaics to between $3.5 billion and $5.4 billion.

9.1.2 There is no empirical evidence that competition is negatively affected by the Regulations, but small retailers do report compliance costs associated with the Regulations. This suggests that the Regulations are not positive in terms of promoting competition.

9.1.3 The Regulations do, however, provide some flexibility that can mitigate some of these effects. A switch to capacity and peak-based charging in the distribution sector could improve the cost-reflectiveness of prices without recourse to increased fixed charges. This would, however, have limited overall effect because of the extent to which such a large share of the costs of electricity network capacity are fixed and unrelated to use – whether peak demand use or energy consumption.

9.1.4 There is very little that can be done to mitigate the other negative efficiency effects of the Regulations. The most pronounced example of this is the current cap on the fixed charge of an LFC tariff under the Regulations. There is strong evidence that the maximum fixed charge permitted under the Regulations is too low.

Q11.	Are there any significant effects of the Regulations which have not been identified in this paper?

Appendix A. Assumptions underpinning solar photovoltaics investment analysis

Variable	Assumption
Size of solar system (kW)	3.0
Annual deterioration in efficiency	1%
Life of solar system	25 years[91]
Buy-back rate (% of variable retail tariff/kWh)	25%
Solar photovoltaics install cost ($/kW):	
Current	3,650
Low cost scenario, 2020	1,750
High cost scenario, 2020	2,500
Solar photovoltaics operating and maintenance cost ($/kW p.a.)	$50
Solar photovoltaics generation potential (kWh p.a.):	
UNI	4,032
CNI	4,016
LNI	3,550
USI	3,261
LSI	3,000

Current average tariff rates			Hypothetical tariffs, no LFC[92]	
Fixed charges, cents per day			*Fixed charges, cents per day*	
	LFC tariff	Standard tariff		
34	186	UNI	230	230
34	187	CNI	230	230
34	184	LNI	230	230
34	187	USI	230	230
34	181	LSI	230	230
Off-peak tariff, cents per kWh			*Off-peak tariff, cents per kWh*	
	LFC tariff	Standard tariff		
UNI	23	17	UNI	15
CNI	23	17	CNI	15
LNI	23	17	LNI	14
USI	23	17	USI	16
LSI	23	16	LSI	15
Peak tariff, cents per kWh			*Peak tariff, cents per kWh*	
	LFC tariff	Standard tariff		
UNI	29	22	UNI	19
CNI	29	22	CNI	19
LNI	29	21	LNI	19
USI	29	22	USI	21
LSI	28	21	LSI	20

[91] Includes life of converter, for simplicity, though the life of the inverter may be somewhat shorter than for other equipment such as solar panels.

[92] To isolate the effects of the Regulations only limited changes are made to average tariffs when constructing hypothetical tariffs. The tariffs are calibrated to ensure that retail revenue does not change, holding consumption volumes constant. Ratios between peak and off-peak charges are also held constant.

Annual consumption by tariff type and area		
kWh	LFC tariff	Standard tariff
UNI	5,106	8,407
CNI	5,038	7,692
LNI	5,017	8,121
USI	5,999	8,835
LSI	5,946	8,655

Appendix B Scenarios for internal rates of return on solar photovoltaic installations in 10 years

Rates of return on installing solar photovoltaics, by cost scenario and with and without LFC tariff 10 years from now

Type of user and tariff	Area	Low cost photovoltaics, Low cost Grid	Low cost photovoltaics, High cost Grid	High cost photovoltaics, Low cost Grid	High cost photovoltaics, High cost grid
LFC tariff	UNI	7.3%	11.2%	5.2%	8.9%
	CNI	7.3%	11.1%	5.2%	8.8%
	LNI	5.9%	9.7%	4.0%	7.5%
	USI	6.3%	10.1%	4.3%	7.9%
	LSI	5.6%	9.3%	3.7%	7.2%
Standard tariff	UNI	10.0%	14.0%	7.6%	11.4%
	CNI	10.3%	14.4%	7.9%	11.7%
	LNI	8.4%	12.4%	6.2%	9.9%
	USI	7.3%	11.2%	5.3%	8.9%
	LSI	6.5%	10.3%	4.5%	8.1%
No LFC tariff - low user	UNI	3.6%	7.3%	1.8%	5.4%
	CNI	3.5%	7.2%	1.8%	5.3%
	LNI	2.3%	6.0%	0.7%	4.2%
	USI	3.1%	6.8%	1.4%	4.9%
	LSI	2.1%	5.8%	0.5%	4.0%
No LFC tariff - standard user	UNI	5.3%	9.0%	3.4%	6.9%
	CNI	4.8%	8.6%	3.0%	6.5%
	LNI	3.8%	7.5%	2.0%	5.5%
	USI	4.5%	8.3%	2.7%	6.3%
	LSI	3.3%	7.0%	1.6%	5.1%
Change due to LFC tariff - low user	UNI	3.8%	3.9%	3.4%	3.5%
	CNI	3.8%	3.9%	3.4%	3.5%
	LNI	3.6%	3.7%	3.3%	3.3%
	USI	3.2%	3.3%	2.9%	3.0%
	LSI	3.4%	3.5%	3.1%	3.2%
Change due to LFC tariff - standard user	UNI	4.7%	5.0%	4.2%	4.4%
	CNI	5.5%	5.9%	4.9%	5.2%
	LNI	4.7%	4.9%	4.2%	4.4%
	USI	2.8%	2.9%	2.5%	2.6%
	LSI	3.1%	3.3%	2.8%	2.9%

Appendix C Relationship between rates of return and rates of solar photovoltaics installation

Relationships between rates of return (irr) and rates of solar photovoltaics installation, $p(PV|IRR)$, are based on the following equation:

$$p(PV|IRR) = \frac{e^{\alpha.\beta.irr}}{1 + e^{\alpha.\beta.irr}}$$

The values for α and β are calibrated so that this function is approximately matched to observed rates of uptake of solar photovoltaics. The results of this calibration are summarised in the table below.

	UNI	CNI	LNI	USI	LSI
Current capacity (MW)	5.33	2.96	1.51	3.86	1.78
p(PV=1)*100	0.26	0.22	0.12	0.36	0.28
Current p(PV=1)	0.003	0.002	0.001	0.004	0.003
Average estimate IRR	0.03	0.03	0.02	0.01	0.01
alpha	-6	-6.15	-6.7	-5.7	-5.8
beta	75	75	75	75	75
Fitted value	0.003	0.002	0.001	0.003	0.003
Error	0.000	0.000	0.000	0.000	0.000
% error	1%	1%	3%	8%	6%

Estimates of the uptake of solar photovoltaics ignore any growth in the number of ICPs. The assumed number of residential ICPs per area and by tariff type is provided below. This data is based on the Authority's experimental data on the number of residential ICPs by tariff type according to retail disclosure data.

ICPs	LFC tariff	Standard	Total
UNI	300,996	283,492	584,488
LNI	326,458	376,929	703,387
USI	109,497	187,812	297,309
LSI	44,892	94,623	139,515
Total	781,843	942,856	1,724,699

Appendix D Models predicting LFC tariff penetration

Results of analysis of characteristics associated with LFC tariff penetration and relationship to competition

Generalised Linear Model predicting share of consumers on LFC tariff in North Island by meshblock[93]

Based on Gamma Distribution with Logit Link Function[94], 29234 observations, 2014 retail consumption data and 2013 census demographics

Variable	Coefficient	Std. Error	P-value
LOG(HOUSEHOLD MEDIAN INCOME)	0.03	0.01	3.85
LOG(HOUSEHOLD DENSITY, PER KM^2)	0.08	0.00	63.36
LOG(DEPRIVATION INDEX)	0.03	0.01	5.56
LOG(AVG_KWH)	-1.72	0.02	-92.81
GAS AVAILABILITY FLAG (0,1)	0.11	0.01	12.35
C	19.19	0.20	96.32
LOG(PEOPLE PER HOUSEHOLD)	-0.14	0.01	-10.12
LOG(HHI INDEX)	-0.59	0.01	-45.56

Generalised Linear Model predicting share of consumers on LFC tariff in South Island by meshblock

Based on Gamma Distribution with Logit Link Function, 9921 observations, 2014 retail consumption data and 2013 census demographics

Variable	Coefficient	Std. Error	P-value
LOG(HOUSEHOLD MEDIAN INCOME)	-0.11	0.02	-6.14
LOG(HOUSEHOLD DENSITY, PER KM^2)	0.07	0.00	36.18
LOG(DEPRIVATION INDEX)	0.09	0.01	9.47
LOG(AVG_KWH)	-1.30	0.03	-39.43
Constant	16.13	0.39	41.09
LOG(PEOPLE PER HOUSEHOLD)	-0.17	0.03	-5.86
LOG(HHI INDEX)	-0.51	0.02	-20.87

[93] Data is the Authority's experimental data on the number of residential ICPs by tariff type according to retail disclosure data.

[94] Visual inspection of the distribution of LFC tariff penetration statistics (i.e. the ratio of permanent residence ICPs with LFC tariffs to total permanent residence ICPs) suggests a flexible functional form such as Gamma. Other models fitted included binomial proportion and normal densities with probit and logit link functions. The Gamma function provided the best model fit according to the Akaike Information Criterion.

Appendix E Retailer feedback on the effects of the Regulations

Retailers were interviewed for their views on the effects of the Regulations on compliance costs and competition. A group of four retailers was interviewed in late February 2015 to inform the preparation of the draft paper and another group of five retailers was interviewed in late April 2015.

Retailers were asked about the processes they followed to advise customers about the LFC, costs of complying with LFC and effects of the Regulations on retailer competition.

Themes from the interviews were:

a) Retailers regard the annual LFC advice as ineffective in encouraging customers to compare and switch between LFC and standard tariffs. Many customers either do not understand how to compare the two tariff plans or are not motivated by the potential difference in costs.

b) LFC annual advice costs per customer were similar across retailers and were generally estimated to be lower than other LFC compliance costs (which were difficult to quantify). These other costs included resolution of LFC eligibility disputes with lines companies, menu costs, and increased time explaining tariff plans to customers.

c) LFC requirements stifle retailer price plan innovation such as “all you can eat” or “stepped charges”.

d) The Regulations do not materially affect decisions on where to compete by large national retailers. However the mix of LFC and standard customers in an area was a consideration in the competition strategy adopted by new entrant retailers.

LFC notice varies from “two options” to “we have switched you to the best plan for you”

Retailers differ in their approach to advising customers on LFC versus standard tariffs depending on their view of whether or not they can or should rely on the information they have on customers’ consumption over the past year as a guide to future consumption. The difference in processes does not appear to be related to the size of the retailer. Advice processes include:

a) An explanation of the LFC and standard tariff plans with the suggestion that the customer consider the LFC if their usage is below the threshold level.

b) A recommendation of the tariff the customer should be on (sometimes with an estimate of the savings that the customer could achieve by moving to the LFC tariff) and a suggestion that they contact the retailer to arrange the switch.

c) Advice to the customer that they have been switched to the LFC tariff but can opt to reverse the change and an estimate of the annual savings from the switch.

All retailers interviewed:

a) Reported very low levels of customer response to annual LFC advice.

b) Commented on the uncertainty and risk of using consumption data for the last year to estimate the customer benefit of a change in the tariff due to both high rates of customer churn and changes in customer usage patterns.

Several retailers also commented that the seasonality of power bills were a factor in deciding when to provide the LFC advice.

Estimates of the cost per customer of the LFC advice ranged from $1 to $2 for a letter and $0.1 to $0.5 for e-mail advice. The proportion of e-mail versus letter delivery of LFC advice ranged from 30% of customers to nearly 100% percent of customers receiving e-mail advice. The difference depends on how customers choose to receive their bill. In addition to a cost per letter several retailers also commented that there were material set-up costs to prepare and merge customer data for a mail-out and to make the communication as simple as possible for the customer.

Some retailers sent out all their advice over one to two months while others spread the advice process over the year. The choice of approach did not seem to be related to retailer size.

Customers generally do not respond to the annual LFC notice

All retailers commented that customer response rates to LFC advice were very low and that a large proportion of their customers found it difficult to compare LFC and standard rates. Those retailers that switched customers automatically reported very low rates of customer requests to reverse the switching decision made by the retailer.

Most retailers commented that many of their customers compare price plans on the basis of the fixed charge and also interpret the term “low fixed charge” as lowest total cost plan. Several retailers said that customers were looking for certainty and simplicity in the comparison of tariffs and that this was difficult to deliver when discussing plans that had a fixed and variable charge with total costs influenced by seasonal factors and customer appliance purchase decisions.

Retailer estimates of the minimum level of saving in annual electricity costs that would be needed to encourage customers to switch ranged from $120 to $150 plus a $200 sign-on bonus.

Other LFC compliance costs exceed mail-out costs but are hard to quantify

All retailers had difficulty in quantifying the LFC compliance costs in addition to the cost of the annual LFC notice to customers because these costs were embedded in core business processes.

Nearly all retailers commented that the following costs were material:

a) Resolution of LFC eligibility disputes between customers and lines companies due to both the senior level of resource involved in resolving the dispute and the temporary cost of under-recovery of lines company fixed charges.

b) Menu costs – the administration, systems and call centre overhead required to offer an LFC option for each standard tariff as well as the increased complexity of conversations with customers.

The 15 working day notification for a change to an LFC tariff was seen as hindering rapid response to competitors and a compliance risk by most retailers. (The compliance risk was due to process errors not being discovered until after the price change was made.)

Some retailers also commented on the cost of legal and communications advice required to make LFC options intelligible for customers.

The Regulations hinder price plan innovation but little effect on where retailers compete

All retailers argued that the LFC stifles innovation and competition by discouraging retailers from offering pricing plans where most of the cost is based on fixed charge for example “all you can eat”, “fixed charge with an excess usage fee” or “stepped charges”.

Suggested changes to the LFC

All retailers suggested that the Regulations should be abolished as they created a cross-subsidy from standard to LFC customers, imposed unnecessary compliance costs on retailers and were not achieving either an energy efficiency promotion objective or assisting low income users.

If the Regulations were retained retailers suggested the following changes (provided they could be made without increasing the complexity of the Regulations:

a) Remove the annual notice requirement

b) Remove the 15 day notification period for LFC tariff changes and other non-specified LFC compliance reporting to the EA.

c) Increase the fixed daily charge and lower the electricity usage threshold for the LFC tariff to reflect increases in fixed costs and reductions in use since the Regulations were issued.

Appendix F Format for submissions

Question No.	Question	Response
Q1.	What comments do you have on the above description of the requirements of the Regulations?	
Q2.	What comments do you have on the above discussion of the flexibility provided by the Regulations?	
Q3.	Do you consider that the analysis in this section produces a reasonable estimate of the compliance costs stemming from the Regulations?	
Q4.	Are there any significant compliance costs of the Regulations other than those identified in this section?	
Q5.	What comments do you have on the in-principle impacts on efficiency of pricing identified above?	
Q6.	What comments do you have on the level of distributors' and/or retailers' fixed charges discussed in this section?	
Q7.	What comments do you have on the analysis of cross-subsidies set out in this section?	
Q8.	Do you agree that the Regulations are likely to lead to inefficient household investment decisions?	
Q9.	Are there any significant investment effects of the Regulations other than those identified in this section?	
Q10.	What are your views on the effects of the Regulations on retail competition?	
Q11.	Are there any significant effects of the Regulations which have not been identified in this paper?	