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?	