

The Real Numbers:

A Detailed Look at Residential Solar PV Return On Investment, Payback, and Overall Value to Consumers

21 Case Studies from across New Zealand



Kristy Hoare and Iain Jerrett

SEANZ (Sustainable Energy Association New Zealand)

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SEANZ



Purpose of This Study

Existing in New Zealand's sphere of public knowledge is considerable mis-information creating many uncertainties around expected power production of solar systems, monetary savings, and the financial benefits that people gain from having solar power installed on roof tops throughout the country.

This study, conducted by SEANZ, aims to dispel any belief that solar power systems are not financially worth while for New Zealanders. The study also endeavoured to discover if there are other non-financial benefits that could be gained from installing solar to help us understand whether New Zealanders invest in solar strictly for financial gain, or if other motivations are present.

We analysed data from solar power systems installed on New Zealand homes which had been in operation for 12 months or more. Using real performance data from these solar power systems helps to present irrefutable evidence of the value of solar power.

While there are many online tools and publications that have tried to establish estimates of energy produced and money saved via solar power systems in our country, this is the first study conducted in New Zealand to publish factual evidence on solar power systems performance and savings on electricity costs.



Data Collection

We attempted to collect data from a wide range of solar power system owners; from different regions (to make the study representative of all of New Zealand) and also making sure there was a wide range of solar installation companies the participants choose to purchase their system from (to remove any biases that could be caused by one solar installation company). We had two methods to recruit participants. First we invited all 85 solar installer members of SEANZ to voluntarily select customers we could get case studies from. The second method was to use the database of My Solar Quotes (MSQ) Ltd to contact New Zealand home owners who stated in a previous study conducted by MSQ that they had decided to go ahead and buy a solar power system. 313 people from the MSQ database were asked to participate via email. MSQ is owned by Kristy Hoare (a SEANZ director). My Solar Quotes is an online platform which helps anyone in New Zealand to quickly collect 3 quotes from solar installers all around New Zealand. 21 complete case studies were obtained (4 from SEANZ members, 16 from MSQ's database). No monetary incentives were used to recruit participants..

Each participant had to fit a certain criteria to be involved in the study (see Appendix A). We asked each participant (often with the help of their solar installation company) for their solar power system setup details, one year of system performance data, energy bills and other related information (see Appendix B).



Conclusion

A wide range of results were uncovered in this study, which highlights the many variables that are taken into consideration when figuring out the financial benefits of owning a solar power system. But in every scenario the return on investment figure was higher than the average bank interest rate of 2.5%, therefore a worthwhile investment from everyone who participated (the lowest being 5.42% ROI).

The main three key factors that affected the financial results included;

The upfront cost of the solar power system

- Because of the wide range in prices, participants that shopped around gained better financial results.

The self-consumption rate

- Those who installed timers and utilised their solar power during the day off-set expensive electricity costs

High electricity prices

- People with high electricity prices benefitted more.

For some participants installing solar power it was largely a financial choice, but even those participants recognised that there were several other benefits of going solar. The main benefits participants highlighted other than financial included environmental conservation and energy independence.

Case Study - The Hill's in Tauranga



The Hill's 3.12kW System in Tauranga
"We are using something that is free and available through the day"

The Real Numbers

One years worth of performance data

First year savings	\$1,013.31
Simple return on investment after one year	9.49%
Actual one year solar production	4,203.8 kWh
Self-consumption rate	58%

Future Estimates*

*See assumptions page

Payback period	10.03 years
25 years savings	\$28,929.10

Solar panels: 10 x 290W panels. Inverter: 3.3kW String Inverter. Total cost: \$10,675.

Electricity price: \$0.35. Solar export price: \$0.08. Installation date: May 2018.

Since installing a solar power system last year, the Hills seem to be pretty chuffed with their solar system, stating "having put solar in we are happy with it, and are pleased to be a solar power system owners. The whole process from the start, to having it installed, was easy and efficient."

Like many solar power system owners, the family noticed that one of the main benefits of installing a solar power system (aside from the financial benefits), is that "we are using something that is free and available through the day."

When most of us think about reducing power bill costs, we tend to try and limit our power consumption habits - not the Hill Family, they mentioned that they are happy with the savings they are making, without having to cut down on using electrical household appliances. When running heat pumps in winter, and air conditioners in summer, the Hill family don't worry as much as they used to. However they do point out that in order to save money on power bills they try to use larger appliances during daytime hours when solar is being produced.



Case Study - The Wright's in Taranaki



The Wright's 2.4kW Solar Power System
"It's nice to see more people going solar"

The Real Numbers

One years worth of performance data

First year savings	\$654.10
Simple return on investment after one year	6.59%
Actual one year solar production	3,329 kWh
Self-consumption rate	51%

Future Estimates*

*See assumptions page

Payback period	14.2 years
25 years savings	\$18,474.90

Solar panels: 8 x 300W panels. Inverter: 3kW string inverter with optimisers. Total cost: \$9,924. Electricity price: \$0.31. Solar export price: \$0.08 . Installation date: April 2018.

Family's like the Wright household are proving to friends and associates that solar power really is as beneficial as it sounds, recently saying "I am a teacher and a couple of parents at the school have decided to install a (solar power) system since we have, it's nice to see more people going solar - and it's nice knowing that it's reducing the (power) bill."

The family don't need to be as cautious using power (as they had in the past using grid power), commenting that at times they now have the freedom to use more power.

The Wright family also changed some of their power consumption patterns, such as using their solar power when it is created (when possible), as opposed to exporting it to the grid. They use timers on their washing machine, dishwasher and also the hot water cylinder.

In terms of their system performance, they say it's meeting their expectations.

Case Study - The Gunston's on the Kapiti Coast



The Gunston's 2.1kWp System in the Kapiti Coast
"At last one feels slightly more in control of one's energy destiny"

The Real Numbers

One years worth of performance data

First year savings	\$607.65
Simple return on investment after one year	6.49%
Actual one year solar production	2,873.2 kWh
Self-consumption rate	42%

Future Estimates*

*See assumptions page

Payback period	14.62 years
25 years savings	\$16,849.98

Solar panels: 7 x 300W panels. Inverter: 3kW string inverter. Total cost: \$9,361.

Electricity price: \$0.35. Solar export price: \$0.11. Installation date: March 2018.

The Gunston household installed solar power to save money on power and for sustainability reasons, saying a key benefit for them is that it "provides a means of communication about energy sustainability with my community."

The household doesn't use any timers, but they aim to match their power demand to the solar power they have generated. They also have an iQ system installed on their hot water system.

The owners are very happy with the system so far, mentioning "at last, one feels slightly more in control of one's energy destiny." They are also eagerly anticipating the day when they have a battery storage system installed.

Case Study - The Johnson's in Whangarei



The Johnson's 4.26kW System in Whangarei
"Solar power has helped reduce the cost of power for all of us"

The Real Numbers

One years worth of performance data

First year savings	\$1,044.85
Simple return on investment after one year	7.54%
Actual one year solar production	5,688 kWh
Self-consumption rate	46%

Future Estimates*

*See assumptions page

Payback period	12.56 years
25 years savings	\$29,318.86

Solar panels: 15 x 285W panels. Inverter: 5kW string inverter. Total cost: \$13,849.
Electricity price: \$0.31. Solar export price: \$0.08. Installation date: February 2018.

A solar power system could make a huge difference to Whangarei's sun drenched homes, especially with grid power prices being very expensive in the region - and this was no exception to the Johnson household. The owner said "At first, I didn't think I could afford solar - but now that I have solar panels I have seen such a big difference in my power bill. My bill use to be over \$500 a month, and now it's just over \$100. There is a one bedroom flat on the property where my mum and dad live and the solar power has helped reduce the cost of power for all of us."

The grid-connected solar power system has allowed the home to have more independence from the grid, however, the owners stated "I would like to be completely independent from the energy companies, and my aim is to get a battery at some stage to make use of all the solar power we generate. Seeing the difference the solar panels have made means I have goals for the future; to become more energy independent."



Case Study - The Andrew's in The Coromandel



The Andrew's 5.13kW System in The Coromandel
"We are doing our bit helping the environment"

The Real Numbers

One years worth of performance data

First year savings	\$1,717.07
Simple return on investment after one year	15.62%
Actual one year solar production	7,898.8 kWh
Self-consumption rate	62%

Future Estimates*

*See assumptions page

Payback period	6.22 years
25 years savings	\$49,054.28

Solar panels: 18 x 285W panels. Inverter: 5kW string inverter. Total cost: \$10,990.

Electricity price: \$0.30. Solar export price: \$0.08. Installation date: February 2018.

Finding a competitive price for a 5kW system, combined with a high self solar power self consumption rate, the Andrew household has managed to get a great financial return on their solar power system - with an impressive 15.62% return on investment.

The owners mentioned that the benefits weren't only financial; they feel "a sense of self-satisfaction, happy in the knowledge that they are creating a clean and green source of energy", and that they are "doing their bit in helping reduce New Zealand's carbon footprint - thereby helping maintain a healthy environment."

The Andrew's considered getting a larger system but batteries would have been needed, so they decided not to have batteries installed as the cost was just too high at the time.

Case Study - The Clark's in The Coromandel



The Clark's 3.3kW System in the Coromandel
"The performance of the system has met our expectations"

The Real Numbers

One years worth of performance data

First year savings	\$905
Simple return on investment after one year	8.95%
Actual one year solar production	3,841 kWh
Self-consumption rate	42%

Future Estimates*

*See assumptions page

Payback period	10.69 years
25 years savings	\$25,362.57

Solar panels: 12 x 274W panels. Inverter: 12 x micro-inverters. Total cost: \$9,580.

Electricity price: \$0.26. Solar export price: \$0.12 . Installation date: February 2018.

The Clark household in the sunny coromandel are "happy with the solar power system, the performance of the system has met our expectations'.

The home owner said "it's surprising to me that we end up exporting a fair amount of power", which is 58% of the solar power they produce, which is quite a large portion. But at least they have a decent export rate from their chosen electricity retailer, "12 cents /kwh for the power we export which isn't bad." Most other electricity retailers only offer 8 cents /kWh.

Since installing the solar power system the owners have noticed the "feel good" factor from going solar, "we get all the green benefits, plus it's another way of reducing our costs."

The Clark's point out their concern that "more people are going to have electric cars, we have to get the power from somewhere. I think we should be encouraging people all over nz to install them."



Case Study - The Griffith's in Auckland



The Griffith's 4.8kW Solar Power System
"Thrilled to date with the system"

The Real Numbers

One years worth of performance data

One year savings	\$1,531.41
Simple return on investment after one year	10.4%
Actual one year solar production	6,097 kWh
Self-consumption rate	81.5%

Future Estimates*

*See assumptions page

Payback period	8.9 years
25 years savings	\$48,999.62

Solar panels: 16 x 300W panels. Inverter: 5kW inverter.

Electricity price: \$0.29. Solar export price: \$0.08. Installation date: November 2017

It has been over a year since Harrisons Energy installed a solar power system for the Griffith's home in Auckland. The Griffith's have reported back saying they are "thrilled to date with the system." The home experiences power cuts, so they will be adding a solar battery storage system at a later date.

During the quoting stage, the family informed Harrisons that a brand new pool was to be completed six months after the solar power system was to be installed. Harrisons factored in the expected increase in power demand when figuring out what system size they needed. In the first few months of the solar power system being installed, 60% of the power the solar system generated was exported to the grid. Since the pool heat pump was installed, the Griffith's now use 81.5% of the solar power and export only 18.5% to the grid. As solar power is more valuable if used in the household and not exported, **they achieve a great return on investment at 10.4%.**



Case Study - The Elstone's in The Hawkes Bay



The Elstone's 7.08kW System in The Hawkes Bay
"We are retiring in a few years and want to get our power-bills down"

The Real Numbers

One years worth of performance data

First year savings	\$1,552.30
Simple return on investment after one year	7.06%
Actual one year solar production	9,240 kWh
Self-consumption rate	46%

Future Estimates*

*See assumptions page

Payback period	13.16 years
25 years savings	\$45,357.92

Solar panels: 24 x 295W panels. Inverter: 10kW 3 phase inverter. Total cost: \$21,999.01.

Electricity price: \$0.27. Solar export price: \$0.08. Installation date: November 2017.

Using more that 21,000kWh a year, the Elstone property is one hefty power consumer! A large, 7.08kW system with 24 panels has made a positive difference as to how the family is powered at home, and the savings made from expensive grid power bills are substantial.

The Elstone's believed by that installing solar power they could reduce their costs going into retirement, saying "We are retiring in a few years and want to get our power-bills down... and as we see it, (grid) power is never going to get any cheaper."

When they decided to go solar, it wasn't just an investment decision - there are many benefits, the owners say "Pay-back period is not necessarily the thing to focus on, it's what the system will do for you in the future too."

Case Study - The Herbert's in Waikato



The Herbert's 3.42kW System in Waikato
"Feeling good that you are generating solar power and using less power from the grid"

The Real Numbers

One years worth of performance data

First year savings	\$780.16
Simple return on investment after one year	8.14%
Actual one year solar production	4,255 kWh
Self-consumption rate	54%

Future Estimates*

*See assumptions page

Payback period	11.63 years
25 years savings	\$22,137.13

Solar panels: 12 x 285W panels. Inverter: 5kW string inverter. Total cost: \$9,580.
Electricity price: \$0.28. Solar export price: \$0.07 . Installation date: November 2017.

The Herbert household has enjoyed notable savings since installing their solar power system, "Since installing solar power our first power bill was \$75, it's normally \$230, our power bill has never gone over \$200 since!"

We monitored their solar power system for a year, noting they had consumed 54% of their solar power, and 46% of the solar had been exported to the grid. To achieve solid solar power self-consumption rates they use appliances like the dishwasher, washing machine and drying machine during the day, rather than at night. They use a wetback in winter to help keep their power bills low.

The Herberts say that they are "feeling good, generating solar power and using less power from the grid."



Case Study - The Clifton's in Tasman



The Clifton's 4kW Solar Power System

"A better return than having money in the bank"

The Real Numbers

One years worth of performance data

First year savings	\$945.42
Simple return on investment after one year	7.27%
Actual one year solar production	5805 kWh
Self-consumption rate	59.6%

Future Estimates*

*See assumptions page

Payback period	12.94 years
25 years savings	\$27,282.36

Solar panels: 15 x 270W panels. Inverter: 15 x micro-inverters.

Electricity price: \$0.23. Solar export price: \$0.07. Installation date: November 2017.

Having installed a 15 panel, 4kW solar power system with micro inverters in late 2017, the Clifton's have so far been impressed with the results.

The owners mentioned the green aspects of the system were beneficial too, stating "it's good to be a little self sufficient, helping to reduce the carbon dioxide load in the atmosphere - making a small carbon offset is important to us."

The Clifton's installed their solar power system along with a Power Reducer (which was included in the cost of the entire system). This device automatically diverts any surplus solar power to the hot water cylinder, which helps to maximise power self-consumption.

They also discussed the financial benefits, which had been delivering above expectations, "It was a simple financial exercise, a better return than having money in the bank". In reflection, the Tasman household are very happy with the performance of their system and the installation process.

Case Study - The Lorimer's in The Coromandel



The Lorimer's 3.12kW System in the Coromandel
"We feel we are helping the planet"

The Real Numbers

One years worth of performance data

First year savings	\$1,227.98
Simple return on investment after one year	10.68%
Actual one year solar production	6,760.5 kWh
Self-consumption rate	24%

Future Estimates*

*See assumptions page

Payback period	9.22 years
25 years savings	\$32,314.70

Solar panels: 18 x 285W panels. Inverter: 5kW string inverter. Total cost: \$11,500.
Electricity price: \$0.32. Solar export price: \$0.14 . Installation date: October 2017.

Based in the Coromandel, the Lorimer's solar power system has meant so much more than just the financial gain, as they recently mentioned "it actually feels really good to be a solar owner, even though the payback might be quite lengthy, we feel we are helping the planet!!"

The family are also considering installing a battery at some stage "not for the financial payback-but because it would provide all our electrical requirements for the future, and quite honestly is the right thing to do."

The Lorimer's are slightly frustrated that there aren't more kiwis having solar installed, and "wish the government would come to the party - we are sure the long payback and low return for selling into the grid puts many people off going solar. We are watching new houses being erected ... and none of the new houses are solar ready. It defies logic." They had a small hiccup with the system, they say "(the) inverter unit was tripping out and not being able to rejoin the grid." This ended up being replaced by the original solar installation company (as it was under the 10 year guarantee), and it is now running fine.



Case Study - The Silverman's in Waimakairi



The Silverman's 3.14kW System in Waimakairi
"Love being independent"

The Real Numbers

One years worth of performance data

First year savings	\$781.97
Simple return on investment after one year	9.35%
Actual one year solar production	4,035.6 kWh
Self-consumption rate	52.7%

Future Estimates*

*See assumptions page

Payback period	10.21 years
25 years savings	\$22,109.32

Solar panels: 11 x 285W panels. Inverter: 5kW string inverter. Total cost: \$8,360.
Electricity price: \$0.30. Solar export price: \$0.08 . Installation date: August 2017.

Other than saving hundreds of dollars each year on power bills, the Silverman household are experiencing the many benefits of installing solar power. They "love being independent" and feel they are "lessening the burden on power companies/Government in providing power".

The Silvermans say another benefit is that it is "clean and green - no emissions, or pollutants."

The home owners have done as much as they can to use their solar power wisely, making use of all their solar power means they aren't exporting excess power to the grid. They have a timer on the hot water cylinder, so it conveniently only comes on during the day. They also have timers on 3 small freezers in the garage, and the dishwasher is set to turn on at 10am most mornings.

The home owners were anticipating the power bills to be under \$100 a month, which has yet to transpire, the solar power system however is producing as much power as expected.



Case Study - The McNae's in Auckland



The McNae's 5kW System in Auckland
"The biggest benefits is that it heats our hot tub"

The Real Numbers

One years worth of performance data

First year savings	\$1,536.24
Simple return on investment after one year	11.38%
Actual one year solar production	6,817 kWh
Self-consumption rate	63%

Future Estimates*

*See assumptions page

Payback period	8.43 years
25 years savings	\$43,955.12

Solar panels: 17 x 295W. Inverter: 5kW string inverter. Total cost: \$13,495.

Electricity price: \$0.31. Solar export price: \$0.08. Installation date: August 2017.

The McNae family negotiated a good price for their solar power system, which in turn has helped them achieve a good return on investment of 11.38%.

The family have had a lot to enjoy since installing solar power; the ability to use appliances more often than they normally would being one such benefit (without the fear of receiving a large power bill at the end of the month). They also had this to say, "The biggest benefit is that it heats our hot tub, and we get to use that a lot especially during winter, it's a guilt free pleasure. The hot tub is on the deck, and looks straight out on the Tamaki river. We also use air conditioning during the summer months, to cool the place down, taking advantage of the high solar power generation during the day - otherwise we wouldn't use the air conditioning as much." Their hot tub and hot water cylinder is on a timer, ensuring they use as much solar power that they can, rather than drawing expensive power from the grid.

The solar power system has helped to halve their power charges, which they believe is really significant. Solar power for them is the gift that keeps on giving, finishing up with "I personally feel like we are saving dollars all the time. It's a good feeling knowing that the water is heated and appliances are powered by solar."

Case Study - The Williams' in Tauranga



The Williams' 2.36kW Solar Power System
"It shows we are doing our bit"

The Real Numbers

One years worth of performance data

First year savings	\$724.62
Simple return on investment after one year	9.73%
Actual one year solar production	3,441 kWh
Self-consumption rate	54%

Future Estimates*

*See assumptions page

Payback period	9.82 years
25 years savings	\$20,560.40

Solar panels: 8 x 295W panels. Inverter: 5kW Inverter. Total cost: \$9,361.

Electricity price: \$0.32. . Installation date: July 2017.

The Williams wanted a solar power system that would optimise their return on investment, their chosen solar installation company recommended an 8 panel system to maximise their electricity savings.

The couple use an automatic timer to charge their hot water cylinder between 1pm to 4pm. They reduced their hot water element size from 3 kW to 2 kW to meet the solar generation output. "As 2 retirees we use appliances during the day when we are generating electricity." The means appliances like the washing machine and dishwasher goes on during the day. They have focused on energy efficiency resulting in a 400w constant base load from fridge, freezer and appliances on pilot.

When asked how it feels to be a solar power system owner and they responded "it shows we are doing our bit." They track their solar power system performance through an online app which they then downloaded to an excel spreadsheet for detailed tracking and reporting. They like to keep a close eye on their investment.



Case Study - The Tolich's in Auckland



The Tolich's 5.13kW System in Auckland
"I'm pretty sure my wife likes it too"

The Real Numbers

One years worth of performance data

First year savings	\$1,738.88
Simple return on investment after one year	15.81%
Actual one year solar production	7,195 kWh
Self-consumption rate	67.4%

Future Estimates*

*See assumptions page

Payback period	6.15 years
25 years savings	\$49,946.93

Solar panels: 18 x 285W panels. Inverter: 5kW String Inverter. Total cost: \$11,000.

Electricity price: \$0.32. Solar export price: \$0.08. Installation date: July 2017.

Mr Tolich prefers to "view solar power as an investment", and with a return of 15.81%, it's looking favourable. He also mentioned how he likes the monetary savings and told us that "I'm pretty sure my wife likes it too". The financial rewards have far exceeded all other benefits of the solar power system, the Tolich's stated. Through generating their own electricity, the Tolich's can now consume as much electricity as they wish, and are less concerned about conserving energy in their home.

Along with getting the solar power system both a pool pump and a heat pump were installed, all at the same time. The heat pump runs on a timer between 2 pm to 3.30 pm (in winter) to increase their solar self-consumption. Mr Tolich manually turns the pool heat pump on and off when the sun is shining (when he is at home), so as to capture more solar generation.

Although the solar power system is saving money on electricity bills, the owners were still surprised to see how much less solar power is generated in winter, mentioning that they didn't appreciate winters lower solar generation versus the sun rich summer months.



Case Study - The Yates' in Auckland



The Yates' 2.7kW System in Auckland

"It's nice to have some of our power for free"

The Real Numbers

One years worth of performance data

First year savings	\$690.27
Simple return on investment after one year	6.94%
Actual one year solar production	3,660 kWh
Self-consumption rate	72%

Future Estimates*

*See assumptions page

Payback period	13.5 years
25 years savings	\$19,369.54

Solar panels: 9 x 300W panels. Inverter: 9 x micro-inverters. Total cost: \$9,940.

Electricity price: \$0.22. Solar export price: \$0.08 . Installation date: May 2017.

Despite using every available inch of their roof for solar power, the Yates still have a need for more power generation, stating "With such a small roof area we can't really cover our needs, but changes to our hot water timer means we are maximizing our solar usage."

Although their roof size might not have the size to accommodate their solar power needs, every effort has been made to reduce their carbon footprint to help the environment, saying "We hope we are making a small contribution to reducing fossil fuel peak load electricity generation through our little bit of solar."

After installing solar power, changing electricity patterns was important. Things like turning on appliances when the sun is out is one way to maximise solar power, "having solar has made me think more about all my power usage." Since having solar power installed the family have reduced their overall power usage, which is fantastic.

Case Study - The McDougall's in The Hawkes Bay



The McDougall's 3.18kW System in the Hawkes Bay
"It feels good that we are using renewable energy"

The Real Numbers

One years worth of performance data

First year savings	\$1,420.55
Simple return on investment after one year	11.48 %
Actual one year solar production	5,063.46 kWh
Self-consumption rate	73%

Future Estimates*

*See assumptions page

Payback period	8.35 years
25 years savings	\$40,926.51

Solar panels: 12 x 264W panels. Inverter: micro-inverter. Total cost: \$12,378.

Electricity price: \$0.30. Solar export price: \$0.08. Installation date: March 2017.

The Hawkes Bay region has seen many families reap the benefits of solar power generation, the McDougall family, for instance, state that "it feels good to be using renewable energy" when powering their home via solar power. They mentioned the added benefits that included "reducing reliance on peak electricity generated by burning fossil fuels, so we are reducing our carbon footprint."

The financial benefits are clearly in favour for the McDougall's, with a great first year return on investment of 11.48%, they mentioned that by generating their own electricity they'll be using less power from the utility supplier. This immediately translated into savings for their energy bill and they can now feed electricity back to the grid.

In terms of the system performance, the owners are happy that it "mostly it operates itself!" The customer service from the solar installation company was appreciated by the McDougall's, they had this to say "when it was set up it was explained to us by our installer and we have not had to contact him regarding it's operation because, it just works!"

Case Study - The Crawford's in Wanaka



The Crawford's 4.24kW System in Wanaka

"I wish everyone else could have a solar power system on their roof"

The Real Numbers

One years worth of performance data

First year savings	\$881.35
Simple return on investment after one year	6.43%
Actual one year solar production	5,903 kWh
Self-consumption rate	47%

Future Estimates*

*See assumptions page

Payback period	14.63 years
25 years savings	\$24,596.69

Solar panels: 16 x 265W panels. Inverter: 16 x micro-inverters. Total cost: \$13,713.54.

Electricity price: \$0.23. Solar export price: \$0.75. Installation date: March 2017.

The Crawford family are revelling in creating their own power, and why shouldn't they?! In the last 12 months their solar power produced 6694kWh, which far exceeds the amount the solar installers had originally predicted.

The owners state that solar power doesn't provide just financial benefits "it feels very good to be a solar power system owner, especially when I am giving back solar power to the grid, or winning out by not paying for power".

After observing the solar power system's performance for two years, the household has determined that they would like more solar power to be produced in the morning; their solar panels are installed on a north-west roof, which provides optimal solar power production during mid day and the afternoon. The owner mentioned that they may invest in more panels for their east facing roof. This is so more of their solar power could be consumed in the morning hours, they're currently debating whether to have batteries installed in the future as well, but it would be dependant on price.



Case Study - The Sowerby's in Tauranga



The Sowerby's 3.12kW System in Tauranga
"I believe we are doing good for the environment"

The Real Numbers

One years worth of performance data

First year savings	\$774.17
Simple return on investment after one year	6.29%
Actual one year solar production	3848 kWh
Self-consumption rate	45%

Future Estimates*

*See assumptions page

Payback period	14.78 years
25 years savings	\$22,037.00

Solar panels: 12 x 260W panels. Inverter: 12 x micro-inverters. Total cost: \$12,310.44.
Electricity price: \$0.31. Solar export price: \$0.07. Installation date: July 2017.

Back in June 2016, the Sowerby household had their solar power system installed and have zero regrets. The benefits were obvious, and having friends that were enjoying solar power systems made the choice easy for the Sowerby's to go ahead with an installation of their own.

Not only have they noticed a reduction in power bills since having their system installed - the environmental benefits have been appreciated too, "I like the concept of using power from the sun, there is a feel good factor in that, I believe we are doing good for the environment."

With 45% of their solar power being exported to the grid on an annual basis (with very low purchase rates from grid companies), saving more on electricity each year will be a goal and investigating ways to increase their solar power self-consumption is a great place to start. The household have discussed the possibility of installing batteries, once they become an economically viable option for the family.

Case Study - The Lock's in Tasman



The Lock's 2.34kW System in Tasman

"We don't worry about how much power we are using or if we can afford it"

The Real Numbers

One years worth of performance data

First year savings	\$485.31
Simple return on investment after one year	5.42%
Actual one year solar production	3,687 kWh
Self-consumption rate	30%

Future Estimates*

*See assumptions page

Payback period	17.38 years
25 years savings	\$13,150.58

Solar panels: 9 x 260W panels. Inverter: micro-inverters. Total cost: \$8,855.

Electricity price: \$0.25. Solar export price: \$0.08. Installation date: July 2016.

Installing solar panels on their home in the sunny Tasman region allows the Lock family to take full advantage of the sun drenched location, stating "We live in a high sunshine area, so we are harnessing a natural resource - and feeling good about it."

The owners say they are totally happy with the system's performance, adding "We look at the solar tracking system every day, and we also check to see if the solar panels are dirty - making sure we maximise the panels production".

The household exports a fair amount of solar power, initially not knowing how much power they would export when the system was first installed. Because they sell a lot of power to the grid (and given the small prices paid from electrical companies for their solar power), they state "it would be nice for the electricity retailer to give us a bit more for our efforts!"

Overall, they had this to say "I feel very smug to be a solar power system owner. I am paying so much less on power than other people. We don't worry about how much power we are using, or even if we can afford it."



Case Study - The Donaldson's in Rangitikei



The Donaldson's 3.12kW System in Rangitikei
"The system performance is as good as gold"

The Real Numbers

One years worth of performance data

First year savings	\$701.76
Simple return on investment after one year	6.84%
Actual one year solar production	4,126 kWh
Self-consumption rate	41%

Future Estimates*

*See assumptions page

Payback period	13.84 years
25 years savings	\$19,529.85

Solar panels: 12 x 260W panels. Inverter: 12 x micro-inverters. Total cost: \$10,266.

Electricity price: \$0.30. Solar export price: \$0.08. Installation date: April 2016.

The Donaldson family were delighted to see the money they had saved on power after the first full year of installing the solar power system, with the family stating that the system performance is "good as gold" and that "the solar panels are working well!"

Like many owners of smart solar power systems, they wash their solar panels a couple of times a year to eliminate pollen build up and to maximise their solar panels performance.

Using as much solar power that they can during the day, the Donaldsons are shifting their energy load by putting on appliances, such as the dishwasher, at lunchtime.

On an environmental note, the owners stated they're "glad that they're not using power from other sources e.g. Huntly", which they believe should have been shut down years ago.



Research Methodology

Accounting for difference in electricity pricing

To make sure the data collection was as consistent as possible from one case study to another. Rules and guidelines were established;

- Electricity prices (import and export) have been taken from the participants most recent power bill available.
- If different rates are being charged to the customer e.g. day time / night time, then the latest electricity bill is analysed to work out the average cost per kWh across all different rates establish one electricity price.
- Fixed costs are not factored into electricity prices.
- Discounts are not factored into electricity prices, as it is unknown whether the customer was awarded the discount or not.



Assumptions

To work out estimates produced for each case study some assumptions have been made. All assumptions are listed below;

- Electricity prices are expected to increase by a rate of 2.1% every year over the next 25 years (as cited in the EECA solar tool).
- Exported solar power prices are expected to increase by a rate of 0.5% every year over the next 25 years (as cited in the EECA solar tool).
- A solar power system is expected to last at least 25 years, based on the average performance warranty of tier 1 solar panels (reference: Wikipedia).
- Solar panels are expected to degrade over time. At minimum most solar panel manufacturers warranty their panels for 80% of their nominal capacity after 25 years, therefore this rate has been built into the calculations.
- For an estimate figures it is assumed that the self-consumption ratio stays the same every year for 25 years.
- The electricity savings over 25 years does not take into account any additional costs of owning a solar power system, it only reflects how much savings a consumer can expect to take off their electricity costs.



Appendix A

Participant requirements:

- A 1.5kW to 10kW solar power system has been installed and operational for 12 months or longer.
- The solar power system was purchased and installed within the last 4 years.
- Was purchased outright, no financed systems.
- Grid-connected systems only, meaning no hybrid/battery systems.
- Be able to supply a photo of the solar power system, or the ability to obtain one.

Appendix B

Required participant data:

- Following the solar installation; one year of total energy consumption (kWh), one year of solar generation (kWh), one year of solar power exported¹ (kWh) (or the amount of solar power used in the home), the price of power during this year and the buy-back price paid for the exported solar power.
- The total price of the solar power system, the separate cost for the export meter, lines and council costs.
- Name brand and size of solar panels and inverter (including the number of solar panels).
Home address, orientation and angle of the roof that the solar panels were placed.



References

Solar Panels:

- https://en.wikipedia.org/wiki/Solar_panel

EECA Solar Tool:

- <https://www.energywise.govt.nz/at-home/solar-electricity/>

¹ The Griffiths case study only used 3 months worth of export data. This was due to the system size installed was to be large enough to accommodate for future appliances. Therefore once the new appliances were installed, we used export figures from then on. This was done to show a better representation of future results of this system.