# milestone report

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# Processor Microgrids for a Carbon Neutral Red Meat Processing Facility

## 1. Initial feasibility and detailed cost/benefit analysis (CBA)

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Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government and contributions from the Australian Meat Processor Corporation to support the research and development detailed in this publication.

# Executive Summary

This first milestone, initial feasibility and cost/benefit analysis, has confirmed that a microgrid ancillary/emergency solar PV system and battery storage can provide a cost effective risk management solution to electrical services for Hardwick's Pty Ltd meat processing facility at Kyneton. In particular, the system can be constructed to provide:

- A project which has an estimated pay-back period of 5.7 years and which is also expected to be cash flow positive from year 1;
- Load shedding technology/battery storage/operational interface controls which allows the microgrid system to provide emergency power on an uninterrupted basis for an extended period during daylight hours (presently undeveloped in commercial operations) should a major external grid failure occur;
- Economic benefits from solar energy, even in a location with low temperatures and long periods of cloud cover;
- Site integration with Hardwick's electrical network to allow energy management and energy usage control; and,
- Benefits from integrated grazing management for stock grazing and shading under solar arrays.

This milestone report also provides the basis of the "Go/No Go" decision point detailed at this stage of the project within the Project Agreement Milestones schedule.

R&D Proposal for the Development of the Project

In terms of the "Go/No Go" decision point, it is proposed that the Research and Development (R&D) activities to be undertaken during the detailed design, construction and initial operations of this project will be of significant benefit to the Australian red meat industry. In particular, the novel R&D activities to be explored further are noted in the table below:

| **Novel R&D activity (i.e. what is novel for the Australian red meat industry)** | **Existing examples, if they exist in other parts of the world and in other industries** | **Industry value proposition (i.e. number of locations where the innovation could be applied if proven successful in the proposed project)** |
|---|---|---|
| Demonstrate the technical and economic feasibility of microgrid "Load Shedding" technology which can enable a site to operate independently of the power grid. Load shedding technology also allocates costs to areas or equipment. Hardwick's will be able to collect, calculate and report costs for specific lighting circuits | Our research has found only two examples of similar microgrid load shedding developments. They are both used for remote area support where unreliable grid supplies exist. One is located for a village in Zambia, and one for a town in WA. | The project could provide an innovative solution to all meat industry operations particularly where sufficient land is available for the technology. The present situation with the Australian power grid and change to renewables with the exclusion of base load coal and gas power stations, greatly increases the risk of major grid |

| | | |
|---|---|---|
| or types, buildings, or microgrid production | | failures and extended power outages. In Hardwick's case, the potential loss from a major power failure could total $6M+. |
| Development of battery storage.<br><br>Traditional grid tied inverters are designed to disconnect from the grid if an outage occurs but also isolate the solar system to ensure energy generation isn't passed up the line and onto the distribution network. Project research will be conducted to access whether the use of Tesla Lithium battery storage technology can play a role in maintaining Hardwick's operation if there was a grid outage throughout the day.<br><br>NGE will test whether keeping the inverters alive with batteries during day light hours to ensure the solar panel harvest continues and then systematically distributing then energy production to Hardwick's plant through energy control equipment. This could provide a cleaner and cheaper way of providing back up power versus diesel power generation.<br><br>This system will also enable the monitoring of power quality, voltage, current and power factor, whilst enabling Hardwick's management to split out and highlight how much energy certain areas of the abattoir are using. Data analysis will also highlight any irregularities in energy usage where rectification may be required quickly | None known. | Similar comments to the above. In addition, the effective development of the load shedding aspects could assist other meat industry operations in working towards "off grid" solutions. This is becoming an increasing focus due to the rapid increase in power costs, and the projection of further substantial increases. It is also a crucial step in heading to a carbon neutral focus. |
| This project represents a unique opportunity to trial an | While test cases for various innovation projects exist, such | Similar comments to both of the above sections. |

| | | |
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| innovative approach to outage mitigation. Hardwicks has experienced a minimum of one outage per year, with up to 3 hours of down time. As the site is not equipped with backup generation, the outage has a direct impact on the operations of the business. At this stage, due to the robustness of the external power grid, business losses from these outages have been minimised. However, taking the SA experience into account, along with the recent removal of Hazelwood from service in Victoria, there is a risk of an outage over a number of days with the potential of large losses of product held in cool storage. It is becoming increasingly concerning that power reliability is not being guaranteed by levels of Government and Hardwick's consider that they need to take control of own power generation destiny and risk management. | as airports and even industrial precincts with food processing industries[1], they have never been implemented in a full scale project. Up until now, the urgency of establishing a microgrid system has not been imperative due to the reliability of the power grid. This situation has rapidly changed following the removal of traditional power stations from the grid and system failures. | |
| Additional R&D will be undertaken to also design the battery system for supplying energy for extended periods of time, bringing the reliability of the system from sun-times only to anytime. In this process, we will be able to build on the experience developed by CitiPower and Powercor from the 2MW/2MWh Li-ion battery where the islanding capability has been extensively tested. | Some initial work has been completed as noted by CitiPower and Powercor. This will extend this knowledge to a practical application. | Similar comments to above. |
| Development of an integrated land use management plan associated with the solar array. The differences in installation and unique business | Although some solar installations have trialled vegetation control using sheep, none are known to have undertaken more detailed | The approach could be replicated in any other location with sufficient available land. |

[1] See the study released by ENEA in February 2017: https://www.enea-consulting.com/en/urban-microgrids-opportunities/

| | | |
|---|---|---|
| opportunities provide an opportunity to study additional dual land use research topics including:<br><br>• Advancing research into crop/grass growth under various dual purpose and partial shade situations;<br>• Measurement and quantification of operational cost reduction as a result of dual purpose land use combining sheep grazing and PV installation;<br>• Opportunities for advertising and branding studies for "Hardwick's Solar Sheep" or similarly branded products. | crop/grass assessment or marketing advantages. This project provides a cutting edge example of the research possibilities of dual land use available through ground mounted PV renewable energy systems. | |

The load shedding interface involves previously untried control systems and procedures associated with the external power grid system. The planned design incorporates the use of a battery system to ensure uninterrupted operation of the solar system during major external power grid failures/shutdowns. We are unaware of any similar installations in Australia or elsewhere involving uninterrupted operation. In traditional solar systems, the solar system shuts down during external outages. The solar and power electronics systems can be further developed to allow for back-up generation in case of outage events, effectively allowing the precinct to keep running in the absence of grid power. Such a system with islanding capabilities is considered as an industrial microgrid, taking community microgrid technologies to industrial uses. While test cases for various innovation projects exist, such as airports and even industrial precincts with food processing industries[2], they have never been implemented in a full scale project. Up until now, the urgency of establishing a microgrid system in Australia has not been imperative due to the reliability of the power grid. This situation has rapidly changed following the removal of traditional power stations from the grid, and system failures. The development of this interface is becoming more critical as coal/gas baseload power stations are becoming a reduced part of the Australian generating system which has increased the power system operating risks (eg: recent power outages in SA, severe shortages and shedding in Tasmania, the closure of Hazlewood Power Station in Victoria). Hardwick's are concerned with the risk of adverse business impacts due to these increasing issues in their own situation, and in proceeding with this project they will also be accepting the risk of funding development of a microgrid system for the rest of the industry. The proposed control and interface system will have significant potential benefits for other businesses within the red

[2] See the study released by ENEA in February 2017: https://www.enea-consulting.com/en/urban-microgrids-opportunities/

meat supply chain, especially those with the high commercial risks associated with major power system outages. Hardwicks has experienced a minimum of one outage per year, with up to 3 hours of down time. As the site is not equipped with backup generation, the outage has a direct impact on the operations of the business. At this stage, due to the robustness of the external power grid, losses from these outages have been minimised. However, taking the SA experience into account, along with the planned removal of Hazelwood from service in Victoria, there is a risk of an outage over a number of days with the potential of large losses of product held in cool storage. An opportunity exists to investigate the feasibility of protecting an abattoir against outages where learnings can be applied industry wide.

The power requirements of Hardwick's are also growing due to increasing production and processing of red meat and offal products.  Hardwick's is faced with the challenge of major infrastructure costs to upgrade grid connection and alternative technologies such as a microgrid based on solar PV represent a cost efficient solution as well as risk mitigation against an increasingly unreliable external power grid as noted above. As the business grows, the economic risk of an extended power outage has major impacts on perishable product and production. The microgrid system mitigates this risk.

An economic model and cost/benefit analysis has been developed as part of the project. Extensive analysis of the Hardwick's power usage trends, demands and future loads was conducted. Several technologies were analysed including battery storage, combustion generation, thermal storage, HV customer, power correction and solar PV based microgrid. This package has been used to highlight a detailed value proposition based on customer input data and average system operational data for systems of a similar size from the Beon Energy Solutions customer database, taking into consideration all known costs, losses, gains and savings. This model and approach can be repeated for other customers within the industry, saving time and money during the research phase.

The planned project involves the provision of a 1.5MW microgrid power generation system and will therefore demonstrate the first use of a microgrid system in an Australian abattoir. Present annual electricity usage by Hardwicks is 7,225 MW Hrs per annum. The planned system will also provide 2,359 MW Hrs per annum, or approximately 30% of total electricity usage. By exploring this technology, which is not currently being adopted by the red meat processing sector, the project will pioneer the adoption of a large-scale microgrid that has the potential to significantly improve sustainability of the red meat processing sector in Australia. By proving the overall performance of a solar based microgrid project for meat processing facilities in a cool climate with extensive periods of cloud cover, a successful project in Kyneton will also provide a case study basis which can provide confidence in other areas where hotter weather and increased solar energy are available.

Another R&D activity will involve developing the requirements for site integration with the Hardwicks power supply network. This will require sophisticated internal control and management systems to maximise cost advantages and provide control and management decision inputs on power usage during emergency system outages where solar will be the sole source of plant electrical supplies (e.g. management of cooling systems etc).

Another novel area of R&D will include the demonstration of intensive multi-purpose land utilisation. The land to be made available for the microgrid solar array will also be used for stock grazing, which will require the development of an integrated land use management plan taking into account access and maintenance requirements of the solar array, as well as the vegetation and shading requirements of the animals that will graze underneath the arrays. The land loss from solar arrays is presently seen as a negative issue to the implementation of solar systems at meat processing plants and this R&D will provide a basis for overcoming this issue into the future.

Hardwicks note that throughout the completion of Milestone 1, Next Generation Electrical and Beon Energy Solutions have demonstrated high levels of advanced knowledge and expertise in microgrid technology and have demonstrated the potential benefits of new load-shedding/battery/control systems with power grid interfaces. Hardwick's have a high level of confidence that the proposed R&D will provide a beneficial solution with ready application for the Australian red meat industry.

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## 1.1 Milestone 1

### 1.1.1 Initial feasibility and detailed cost/benefit analysis (CBA)

Milestone report detailing:

- 2.1) Projected electricity generation from the solar array
- 2.2) Benefits of integrated grazing management plan for stock grazing and shading under solar arrays
- 2.3) Integration with site electrical network
- 2.4) Feasibility of load-shedding technology
- 2.5) Planning considerations
- 2.6) Detailed explanation of the mechanics of the environmental upgrade agreement for the project
- 2.7) Summary of costs and benefits (economic, social, and environmental)
- Appendix 1 – Designs
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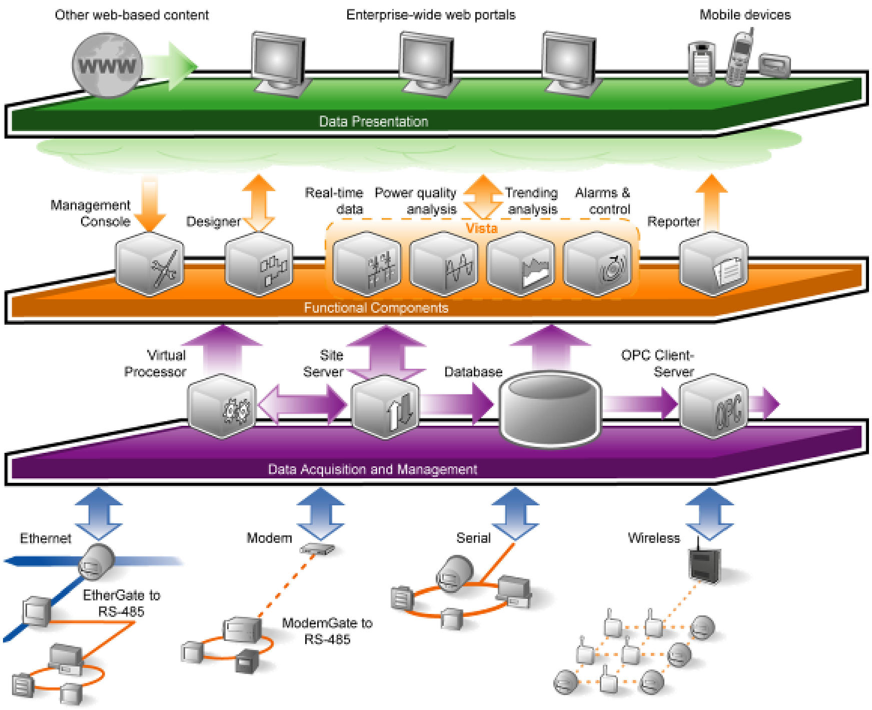
- Appendix 3 – EUA Cash flows
- Appendix 4 – GANTT Chart

# 2 Project objectives

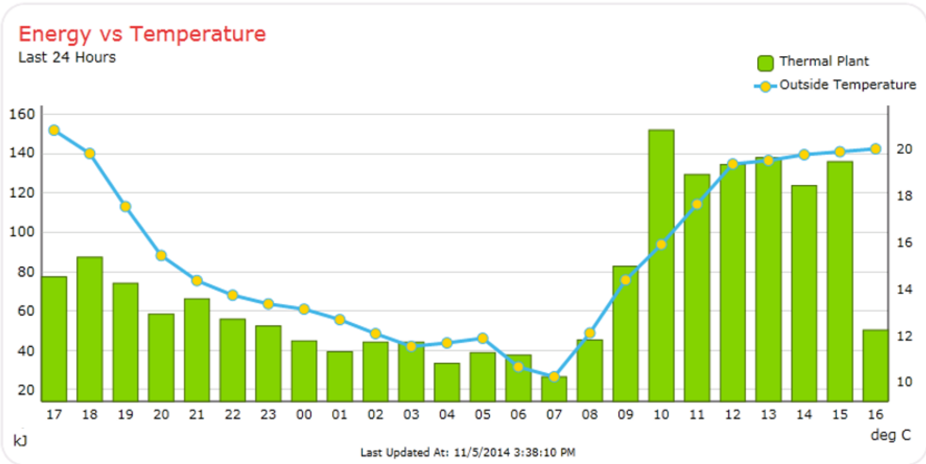
## 2.1 Feasibility of load shedding and battery storage technology

### 2.1.1 Energy control

Load shedding technology provides insight and understanding into energy usage, allowing Hardwick's to take control and turn complex power analysis into simple, actionable information. Energy monitoring focuses on real-time and historical trends while analysing energy quality and availability to measure efficiency, reveal opportunities and verify savings. This is achieved through displaying energy usage in an easy to understand format, such as viewing energy cost in dollars instead of KWh, auditing efficiencies and justifying lighting / solar by tracking ROI and forecasting payback. The hardware and software unpinning the load shedding technology is highlighted below:




Load shedding technology also allocates costs to areas or equipment. Hardwick's will be able to collect, calculate and report costs for specific lighting circuits or types, buildings, or microgrid production. Various energy drivers, such as temperature can also be overlayed and analysed:




## 2.1.2 Battery Storage

Traditional grid tied inverters are designed to disconnect from the grid if an outage occurs but also isolate the solar system to ensure energy generation isn't passed up the line and onto the distribution network. Project research will be conducted to access whether the use of Tesla Lithium battery storage technology can play a role in maintaining Hardwick's operation if there was a grid outage throughout the day.

NGE will test whether keeping the inverters alive with batteries during day light hours to ensure the solar panel harvest continues and then systematically distributing then energy production to Hardwick's plant through energy control equipment. This could provide a cleaner and cheaper way of providing back up power versus diesel power generation to not only Hardwick's but all industries.

This system enables the monitoring of power quality, voltage, current and power factor, whilst enabling Hardwick's management to split out and highlight how much energy certain areas of the abattoir are using. Data analysis will also highlight any irregularities in energy usage where rectification may be required quickly.

# 3 Innovation

The electronics systems can be further designed to allow for back-up generation in case of outage events, effectively allowing the precinct to keep running in the absence of grid power. Such a system with islanding capabilities is considered as an industrial microgrid, taking community microgrid technologies to industrial uses. While test cases for various innovation projects exist, such as airports and even industrial precincts with food processing industries[3], they have never been implemented in a full scale project. Up until now, the urgency of establishing a microgrid system has not been imperative due to the reliability of the power grid. This situation has rapidly changed following the removal of traditional power stations from the grid and system failures.

This project represents a unique opportunity to trial such an innovative approach to outage mitigation. Hardwicks has experienced a minimum of one outage per year, with up to 3 hours of down time. As the site is not equipped with backup generation, the outage has a direct impact on the operations of the business. At this stage, due to the robustness of the external power grid, business losses from these outages have been minimised. However, taking the SA experience into account, along with the planned removal of Hazelwood from service in Victoria, there is a risk of an outage over a number of days with the potential of large losses of product held in cool storage. An opportunity exists to investigate the feasibility of protecting an abattoir against outages through the following process:

1. What is to be gained? Mitigation of business risks which would be incurred by the business as a direct result of outages. This includes costs involved with lost hours of operations, process restart costs, additional cleaning and loss of products.
2. How, and at what costs?
   - Market research of successful community projects to be built upon
   - Load study to prioritise processes and appliances and setup a merit order of what should have priority in terms of remaining powered. Optimum design (and costs) will combine typical outage durations with process resilience's
   - Specifications for the site and related costs
3. What is the value for the industry?
   - Resulting value for Hardwicks
   - Typical value for a brownfield, retrofit project
   - Typical value for a greenfield project

If sensible, the results of the feasibility will be transferred to similar industries and activities, in order to assess the potential deployment across other businesses.

In practicality, the microgrid system will not only sustainably power the site for its business "as usual" operations but will reduce business risks by providing an increased reliance against grid instability. Cost optimisation will be completed by keeping critical processes running; as defined by the industry experts. As for any insurance mechanism, microgrid setups must be designed to various levels of event criticality.

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[3] See the study released by ENEA in February 2017: https://www.enea-consulting.com/en/urban-microgrids-opportunities/

A particular care will be given to the handling of inverters, which may require a specific battery system for power support to allow the solar array to provide load to the precinct. An extension of this work will be to also design the battery system for supplying energy for extended periods of time, bringing the reliability of the system from sun-times only to anytime. In this process, we will be able to build on the experience developed by CitiPower and Powercor from the 2MW/2MWh Li-ion battery where the islanding capability has been extensively tested.

## 3.1 Detailed explanation of the mechanics of the environmental upgrade agreement for the project

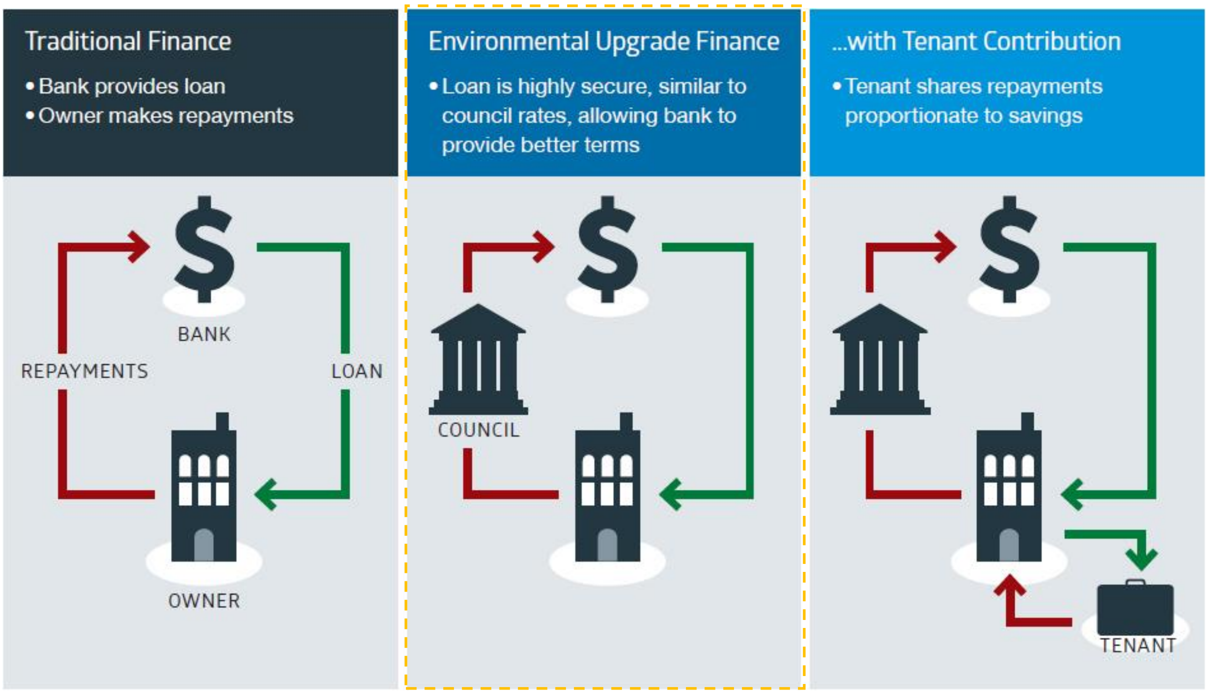
### 3.1.1 Overview

Hardwick's have selected to use the Environmental Upgrading Agreement (EUA) as the funding vehicle, which has recently been established by the Melbourne City Council in partnership with the Sustainable Melbourne Fund. The financing is an agreement between a site owner, a lender and the local council for works that improve the environmental efficiency of commercial premises.

To date, the Sustainable Melbourne Fund has injected over $12 million in building upgrades in Melbourne. This has included boiler and chiller upgrades, variable speed drives, renewable energy systems, lighting solutions and regenerative lifts resulting in the reduction of over 62,000 tonnes of greenhouse gas emissions.

### 3.1.2 How It Works

A number of financiers including NAB, ANZ and Bank Australia currently offer Environmental Upgrade Finance. This kind of finance is secured against the building, rather than the building owner, with repayments collected for distribution to the lender by the local council who, in turn, returns the property charge to the lender. This structure makes Environmental Upgrade Finance lower risk for financiers, and allows them to offer more attractive finance terms, such as longer terms (10 years) and lower interest rates.



### 3.1.3 Benefits

Environmental Upgrade Finance can help Hardwick's improve their property asset without the risks and negative cash flow implications of traditional finance. It can fund improvements to buildings which can reduce operating costs, increase yields, help attract and retain tenants, and increase asset values. Benefits include:

- **1. No upfront capital or security**: Upgrades can be made at zero upfront cost to Hardwick's, and with no additional security required. Traditional finance often requires additional security, and will usually not cover all project costs.
- **2. Competitive interest rates and term length, reducing re-financing risk:** Competitive interest rates are available, fixed for 10 years or potentially longer. This reduces the re-financing risk and allows Hardwick's to plan with more certainty. Traditional finance is generally only available for terms of 2-5 years.
- **3. Improved cash flow:** Longer finance terms mean lower annual repayments, delivering immediate cash flow benefits to Hardwick's. Under short term traditional finance, capital intensive upgrades may be unattractive due to the significant impact on cash flow.
- **4. Option to share costs** (if the site is tenanted), delivering a better asset for Hardwick's, and a lower-cost and improved working environment for tenants. Environmental Upgrade Finance provides a secure and transparent mechanism for Hardwick's and potential tenants to share the costs in proportion to the benefits they receive. Without this mechanism, it can be difficult for upgrades to be negotiated until the end of a lease.

### 3.1.4 Eligibility

The following are the requirements to be eligible for an EUA:

- Pays council rates;
- Funding is for a retrofit project in a non-residential building / site; and
- Project delivers environmental benefits such as energy, waste and water.

In total, there are 71 water and energy upgrades that can be funded – full details can be found at http://sustainablemelbournefund.com.au/

### 3.1.5 Fees and Other Implications

- Administrative fees are payable (these vary by council area), which can be included in the finance amount.
- The council can charge penalty interest for payments that are made late. If customers default on payments, the council is required to use its enforcement powers to recover the charge and repay the finance provider. Council can issue proceedings and recover the charge, penalty interest and costs. The charge will be prioritised over any other non-council charges or encumbrances over the land
- Customers must give notice of the EUA to existing mortgages, and provide details of your existing mortgages to council.

- There are no reporting obligations contained in the EUA, however customers are required to join the council's 1200 Buildings program, which includes annual progress reports to the council and a final assessment report once the project is completed.
- Customers must get the consent of the finance provider and the council to any sale or dealing in the land (other than leases). In some circumstances it is possible that consent may be refused. In this case, customers can fully pay out the charge in order to be able to proceed with the proposed dealing. If you want to assign your obligations under the EUA, the purchaser would need to sign a deed poll agreeing to be bound by the terms of the EUA. If the conversion involves a dealing or subdivision of the land you will need the consent of the other parties to that dealing.

### 3.1.6 Cash flows

The cash flows, as prepared by Sustainable Melbourne Fund under guidance from NGE and Beon Energy Solutions, assume the following:

- Financed amount: $2,362,191.6
- Term length: 10 years
- System size: 1,500kW

The cash flows highlight the immediate cash flow benefits to Hardwick's with an annual net cash benefit available to Hardwick's throughout the 10 year finance term (as per item 8. Net Cash Benefit after tax).

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Electricity Savings | 298,120 | 305,153 | 312,351 | 319,719 | 327,261 | 334,982 | 342,884 | 350,972 | 359,252 | 367,726 | 376,401 | 385,280 | 394,369 | 403,672 | 413,194 |
| 2. LGC Value (inc GST) | 226,688 | 215,477 | 209,255 | 207,931 | 192,192 | 179,108 | 177,953 | 176,880 | 175,808 | 174,653 | 115,720 | 115,005 | 114,290 | 113,575 | 112,860 |
| 3. Operating Expenses | -16,500 | -16,995 | -17,505 | -18,030 | -18,571 | -19,128 | -19,702 | -20,293 | -20,902 | -21,529 | -22,175 | -22,840 | -23,525 | -24,231 | -24,958 |
| 4. EUA Payments to Council (inc Fees) | -320,195 | -319,547 | -318,956 | -318,329 | -317,664 | -316,956 | -316,206 | -315,409 | -314,563 | -313,665 | | | | | |
| 5. Tax Benefit / (Cost) (@ 30%, depreciation: 20 Yr, Interest, fees and LGC income) | 14,300 | 17,506 | 15,734 | 12,499 | 12,786 | 12,189 | 8,078 | 3,711 | -1,037 | -6,033 | 6,424.00 | 6,801.00 | 7,182.00 | 7,570.00 | 7,963.00 |
| 6. GST expense (Project and LGC's) | -233,517 | -19,589 | -19,023 | -18,903 | -17,472 | -16,283 | -16,178 | -16,080 | -15,983 | -15,878 | -10,520 | -10,455 | -10,390 | -10,325 | -10,260 |
| 7. GST Credit (Project and Fees) | 216,818 | 2,166 | 2,159 | 2,150 | 2,138 | 2,125 | 2,109 | 2,090 | 2,069 | 2,044 | 2,016 | 2,076 | 2,139 | 2,203 | 2,269 |
| **8. Net Cash Benefit after tax*** | **185,714** | **184,171** | **184,014** | **187,037** | **180,671** | **176,036** | **178,938** | **181,871** | **184,643** | **187,317** | **467,866** | **475,867** | **484,065** | **492,464** | **501,068** |

A brief discussion on each cash flow item is as follows:

1. Electricity Savings: This represents the savings to Hardwick's annual energy bill, should they proceed with the project. The savings are calculated, at a high level, as the delta between Hardwick's current load profile and the generation profile of the 1,500 MW solar PV system, multiplied by exiting tariffs and escalated by a conservative 3.0% per annum in-line with CPI.

2. LGC Value (Inc GST): This represents LGC's federal government Large-scale Generation Certificate (LGC) subsidy based on the actual net energy generated and exported by the system (as per "LGC volume" below) by an accredited and registered renewable energy power station. These are for Solar PV systems over 100kW, or more than 250MWh and certificates are created annually. Current LGC prices above $90/MWh (up from $33/MWh in January 2015) however a forward curve (shaping downwards) has been applied in these cash flows (as per "LGC Price (ex GST)").

| | Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LGC Volume** | # | **2,240** | **2,226** | **2,212** | **2,198** | **2,184** | **2,171** | **2,157** | **2,144** | **2,131** | **2,117** | **2,104** | **2,091** | **2,078** | **2,065** | **2,052** |
| **LGC Price (ex GST)** | $ | **92** | **88** | **86** | **86** | **80** | **75** | **75** | **75** | **75** | **75** | **50** | **50** | **50** | **50** | **50** |

3. Operating expense:
This represents the annual operating and maintenance expenditure of the solar system, escalated by 3.0% in-line with CPI. The operating and maintenance contract includes provision of one on-site technician (for a maximum of 4 hours once monthly at an agreed time and date) to complete the following services:

- inspection and monitoring of inverter terminal (email notification)
- software and hardware tests, communication speed testing
- thermal scan of solar distribution board where applicable
- panel cleaning using non-toxic, biodegradable detergents made from plant extracts

4. EUA Payments to Council (inc Fees): This represents the fixed re-payments of principle and interest (at 6.024% per annum) via council rates.

5. Tax Benefit / (Cost) (@ 30%, depreciation: 20 Yr, Interest, fees and LGC income): As a number of items are tax assessable or deductible, this represents the tax benefit / cost of the solar system taking into account:

- straight line deprecation across 20 years (deductible)
- interest (at 6.024% per annum) on the outstanding balance payable to council (deductible)
- administrative fees (deductible)
- LGC income derived from the actual net energy generated and exported by the system (assessable)
- Income tax rate (at 30% corporate income tax rate) on the net cash benefit

6 & 7 GST expense (Project and LGC's) & GST Credit (Project and Fees): This represents the GST consequence of the above transactions

8. Net Cash Benefit after tax*: This represents the overall benefit of the solar system to Hardwick's, should they proceed with the project.

The cash flows, in their entirety, have been attached in Appendix 3.

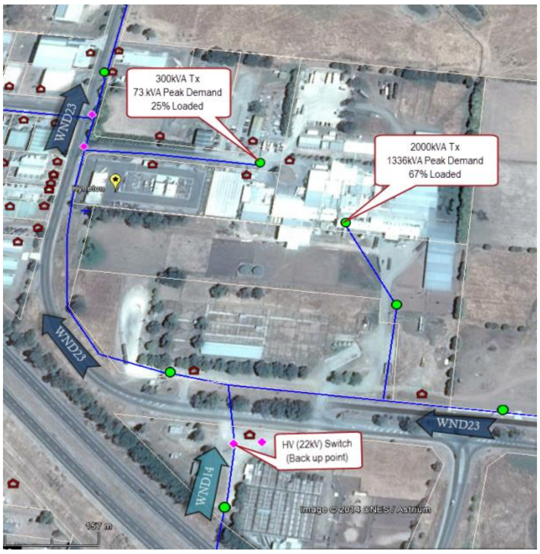
### 3.1.7 High Level Steps

- Contact Sustainable Melbourne Fund to participate in the program (Complete)
- Undertake a Level 2 energy audit (Complete)
- Identify projects that are cost effective and will improve your building's NABERs rating (Complete)
- Secure finance (SMF can assist with this process) (In-Progress)
- Sign the environmental upgrade agreement (To be complete)
- Commence your building retrofit project (To be complete)
- Realise the energy savings and cost savings from your project (To be complete)

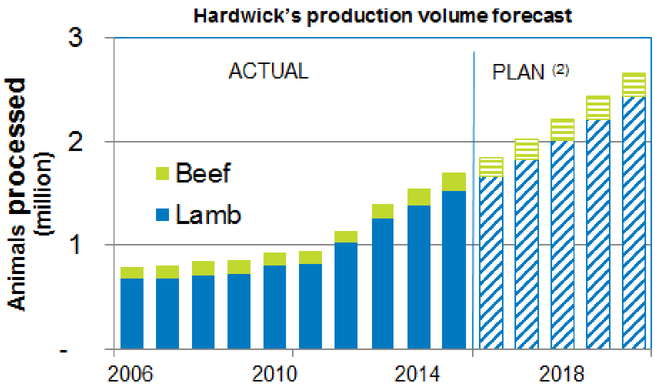
## 3.2 Projected electricity generation from the microgrid

### 3.2.1 Overview

Hardwick's is a one million head plus per annum abattoir and, due to expected growth, explored power capacity increases, backup supply and bill reduction methods in partnership with Next Generation Electrical and Beon Energy Solutions.




1. Peak instantaneous load witnessed as at 23rd Feb 16
2. Growth Plan (year on year):
Lamb 10%
Beef 5%
3. Long term peak load on small Transformer



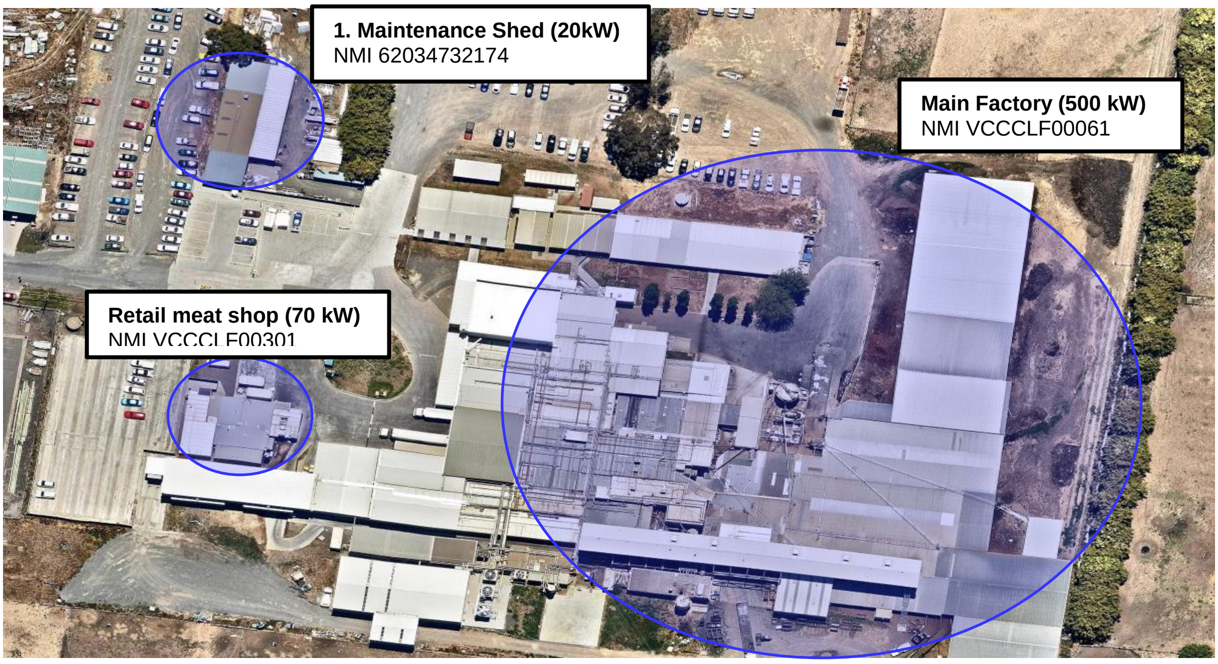

To understand the drivers of Hardwick's current load profile, analysis focused on the 2,000 kVa connection, comprising of:

- 1 x freeze compressor, 70 – 90 kW with a steady load
- 3 x chilling compressors, 150 – 465 kW with intermittent loads
- Other loads, 400 – 600 kW (conveyors, cutting and lights) with intermittent loads

Six technologies were assessed against a benchmark HV connection upgrade option to reduce the current load profile. A high level summary of the assessment is as follows:

| Technology option | Application suitable for assessment | | | | Comment |
|---|---|---|---|---|---|
| | Freezing | Chilling | Other | Economic assess. | |
| ① HV Connection upgrade | ✓ | ✓ | ✓ | $ | Benchmark option to enable > 2MVA Tariff improvement for HV customer |
| ② Thermal energy storage | × Steady load | ✓ Intermittent | × | $ | Relatively low cost |
| ③ Li-ion Battery | × Steady load | ✓ Intermittent | ✓ Intermittent | $$ | Feasible as an ancillary solution due to relatively higher cost |
| ④ Solar PV | ✓ | ✓ | ✓ | $ | Good correlation of load and system generation |
| ⑤ Demand Management | × Steady load | × Delay un-acceptable | × Delay un-acceptable | $$$ | Demand management is unsuitable for chilling, operational or constant loads |
| ⑥ Switch some load to the 300kVA Tx | ✓ | ✓ | ✓ | $$ | Technically feasible, legal option, however not recommended; higher tariff |
| ⑦ Diesel generation | ✓ | ✓ | ✓ | $$$ | Suitable for backup only, not economically viable |

It was concluded that a microgrid system incorporating solar PV installation presents best value to addressing current and future load requirements with the benefits of reduced outage risks and complexity to the benchmark option of a HV connection upgrade. The microgrid solar PV system was optimised to maximise roof space, resulting in the following options:

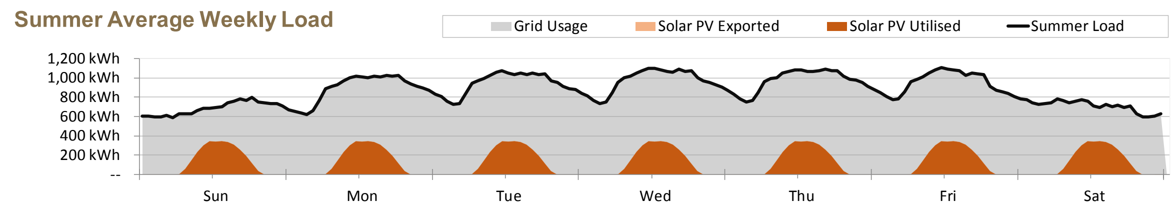


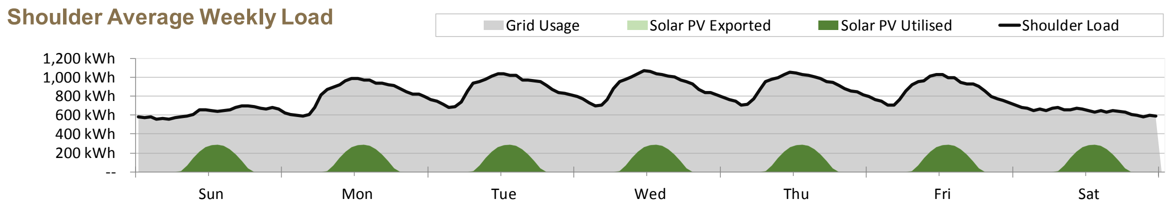

However, it was recognised that a combined 590kW solar system would not fully address current load and growing capacity requirements, nor provide a substantial microgrid emergency system. Based on detailed analysis, the 500kW solar system proposed for the main factory rooftop would only offset 10.5% of Hardwick's actual full year load profile (2015 interval data); represented as "Total Solar Energy Utilised" 765 MWh / "Total Energy Utilised" 7,225 MWh in the following operational outputs:

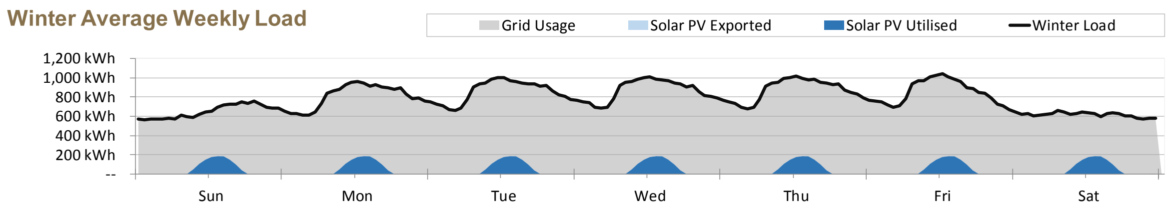
**Operational Outputs**

| | | |
|---|---|---|
| Peak Solar Energy Utilised P.A. | 540 MWh | The amount of peak solar energy utilised with a typical 500 kW solar PV system given customer load profile. |
| Off-Peak Solar Energy Utilised P.A. | 225 MWh | The amount of off-peak solar energy utilised with a typical 500 kW solar PV system given customer load profile. |
| Total Solar Energy Utilised | 765 MWh | The total solar energy utilised by a typical 500 kW solar PV system given customer load profile. |
| Grid Energy Utilised P.A. | 6,459 MWh | The total grid energy utilised with a typical 500 kW solar PV system given customer load profile. |
| Total Energy Utilised | 7,225 MWh | The total energy utilised by the customer based on 2015 load data for NMI VCCCLF00061. |
| Solar Feed-In P.A. | 0 MWh | The total solar energy exported to grid with a typical 500 kW solar PV system given customer load profile. |
| Total Solar Energy Generated | 765 MWh | Estimated total solar energy generated by the 500 kW solar PV system. This saves approximately 1048 tonnes of CO2 per year. |
| % Solar Energy Utilised | 100.0% | The percentage of the solar energy generated that is utilised by the customer (and not exported to grid). This is 100% if weekends are excluded. |

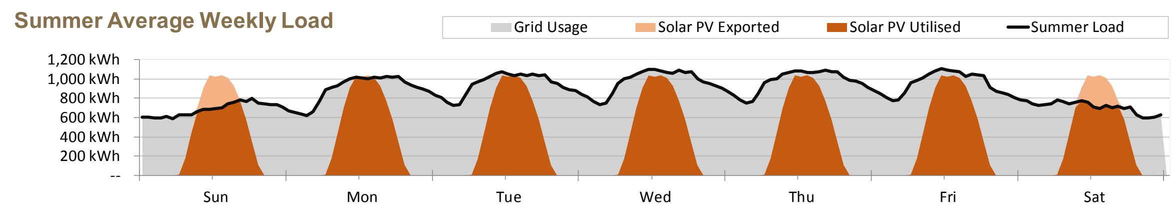
Further, the graph below presents the expected performance the 500kW solar system overlayed against average weekly load for the three seasons based on Hardwick's historical consumption profile and existing tariff.

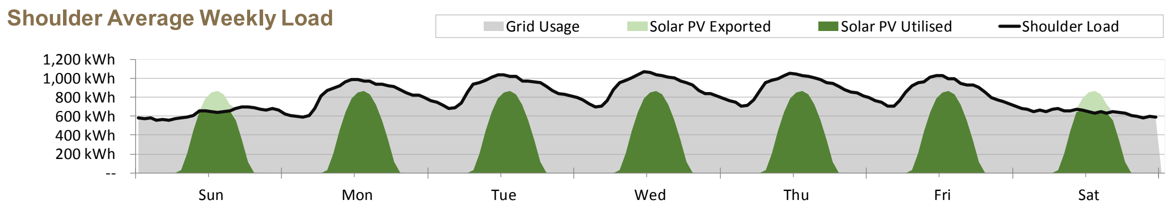


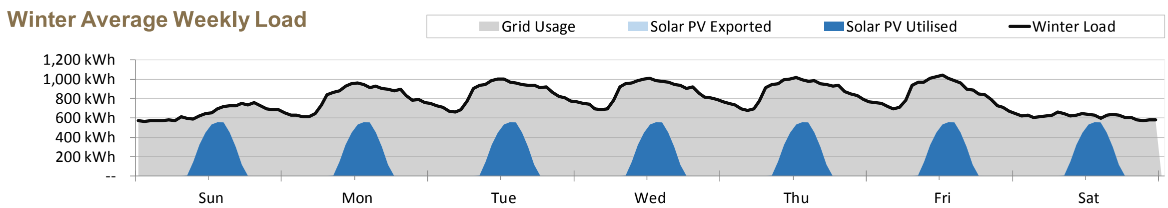




Therefore, a ground mount 1.5MW solar system was proposed using the idle 9.9 acre land to the north of the main factory, resulting in the following expected performance against the same historical consumption profile and existing tariff. This will also provide a substantial emergency microgrid system to enable continuation of operations of significant cool stores during an extended external power outage:



### 3.2.2 Normalised Production and Performance Ratio

**Main simulation results**

System Production — **Produced Energy** **2359 MWh/year** — Specific prod. 1536 kWh/kWp/year

Performance Ratio PR 86.05 %

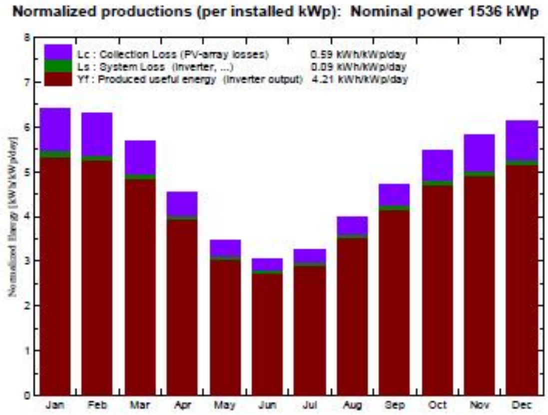



Chart highlights average daily production per 1 kW solar array in Kyneton. Mitigation – Routine maintenance and on-going monitoring

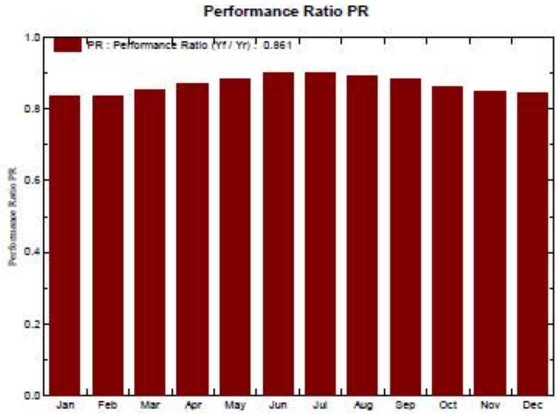



Chart highlights average daily performance as ratio of 1 (maximum). Current performance of 0.861 above industry average

**New simulation variant**

**Balances and main results**

| | GlobHor kWh/m² | T Amb °C | GlobInc kWh/m² | GlobEff kWh/m² | EArray MWh | E_Grid MWh | EffArrR % | EffSysR % |
|---|---|---|---|---|---|---|---|---|
| **January** | 207.2 | 18.12 | 198.3 | 182.0 | 259.7 | 254.5 | 14.06 | 13.78 |
| **February** | 169.7 | 17.71 | 176.3 | 162.5 | 230.4 | 225.8 | 14.03 | 13.75 |
| **March** | 152.3 | 16.04 | 176.3 | 162.8 | 234.9 | 230.3 | 14.31 | 14.02 |
| **April** | 104.0 | 12.61 | 136.0 | 125.6 | 185.1 | 181.4 | 14.61 | 14.32 |
| **May** | 70.4 | 9.64 | 107.5 | 99.3 | 148.5 | 145.4 | 14.84 | 14.53 |
| **June** | 56.7 | 7.24 | 91.4 | 84.3 | 128.9 | 126.3 | 15.14 | 14.83 |
| **July** | 64.8 | 6.45 | 100.4 | 92.6 | 141.7 | 138.8 | 15.16 | 14.84 |
| **August** | 89.3 | 7.33 | 123.0 | 113.9 | 171.8 | 168.2 | 14.99 | 14.68 |
| **September** | 118.5 | 9.10 | 141.5 | 130.5 | 195.8 | 191.8 | 14.85 | 14.55 |
| **October** | 157.6 | 11.12 | 169.2 | 155.8 | 228.7 | 224.0 | 14.51 | 14.21 |
| **November** | 180.2 | 14.34 | 174.5 | 160.4 | 231.3 | 226.5 | 14.23 | 13.94 |
| **December** | 204.4 | 16.22 | 190.2 | 174.7 | 250.9 | 245.8 | 14.17 | 13.88 |
| Year | 1575.0 | 12.13 | 1784.6 | 1644.4 | 2407.6 | 2358.8 | 14.49 | 14.19 |

| Legends: | | | | |
|---|---|---|---|---|
| | GlobHor | Horizontal global irradiation | EArray | Effective energy at the output of the array |
| | T Amb | Ambient Temperature | E_Grid | Energy injected into grid |
| | GlobInc | Global incident in coll. plane | EffArrR | Effic. Eout array / rough area |
| | GlobEff | Effective Global, corr. for IAM and shadings | EffSysR | Effic. Eout system / rough area |

### 3.3 Benefits of integrated grazing management plan for stock grazing and shading under microgrid solar arrays

This dual use land project is capable of offering not only grazing land for sheep and renewable energy electricity generation, but utilises these to create a partly renewable energy consumer product (lamb and beef) with 30% of power demand being provided by on site renewable energy. The project combines farming, growing and processing into a unique vertically integrated value chain. The project not only provides the agricultural land to graze sheep but also the clean energy required to process the sheep on-site into end products for consumers.

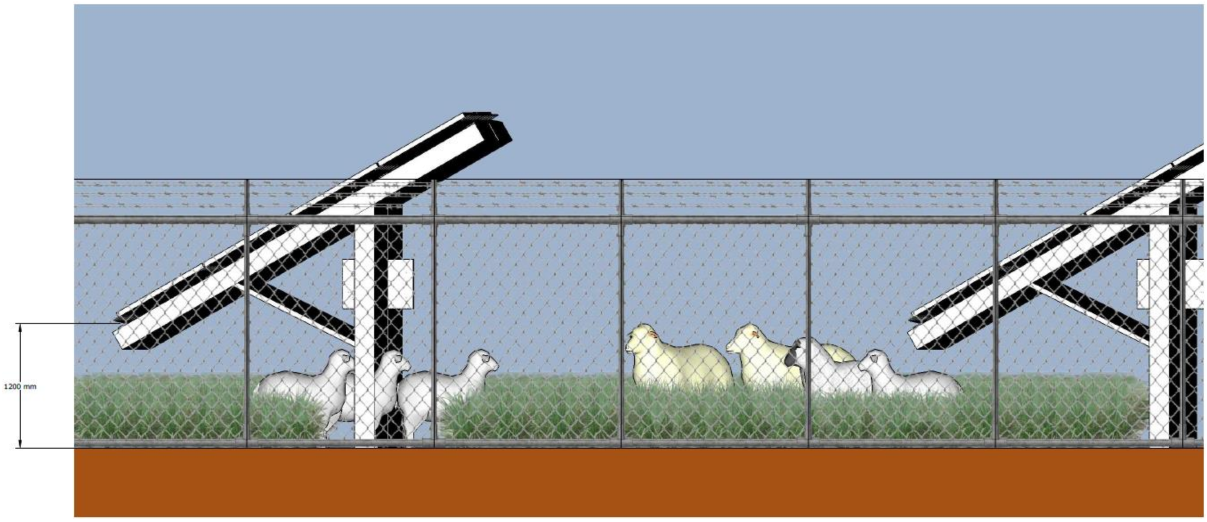
Critics of large scale solar developments often point to the amount of productive land taken up by solar arrays; agriculture is critical to the national economy. This project provides a cutting edge example of the research possibilities of dual land use available through ground mounted PV renewable energy systems. Dual land use combining renewable energy systems and agriculture is not new. Examples of dual land use include:

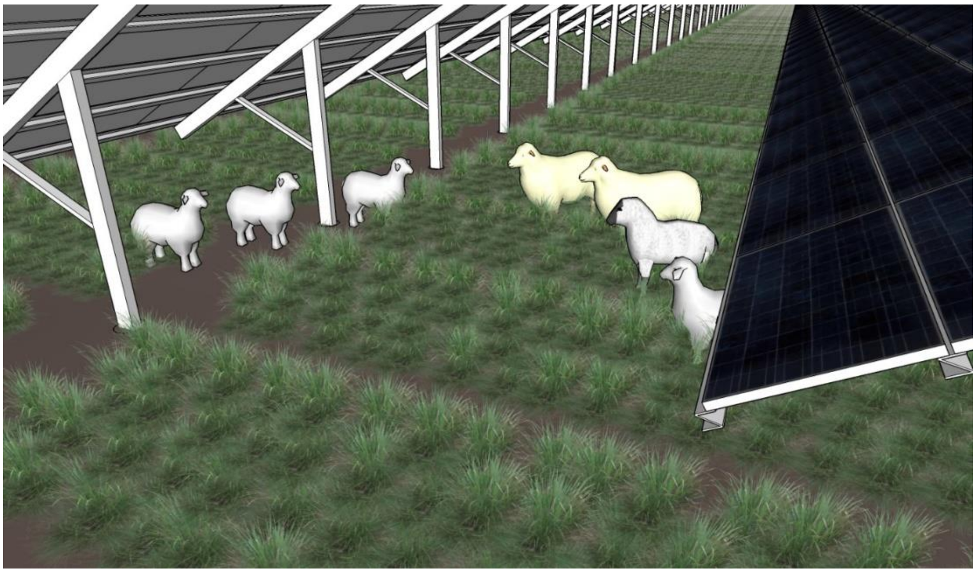
- Japanese “Solar Sharing”: http://www.renewableenergyworld.com/articles/2013/10/japan-next-generation-farmers-cultivate-agriculture-and-solar-energy.html
- University of Queensland dual use operation saves O&M costs on sheep feed and PV farm ground maintenance : http://www.abc.net.au/news/2016-08-15/uq-uses-sheep-to-cut-grass-at-gatton-solar-research-farm/7734770
- Greenough River Solar Farm trialing vegetation control vs Sheep damage: http://www.all-energy.com.au/RXAU/RXAU_All-Energy/documents/2013_Day_1_Presentations/Wed%20Solar%201100%20Mark%20Rayner.pdf?v=635191354957379747
- Dual Purpose land use mitigates land use conflicts: https://www.gses.com.au/wp-content/uploads/2016/03/GSES_utility-scale-dual-purpose-land-usage.pdf
  Newlands Farm 66 acre dual purpose solar farm - http://www.bbc.com/news/uk-england-hampshire-24274074

The physical installation has several advantages over the above examples:

- Sheep can walk under the array – In this installation there is clearance of 1.2m between the ground and the array. This allows sheep full access to the grass under the array as well as increased array cooling from improved ventilation.
- Mitigation of array damage from sheep - This project aims to improve on the examples above by mitigating any damage from the sheep due to the elevated array. The vast majority of adult sheep are below 1.2m in height and can therefore pass under the array uninhibited.
- Site Security - In this installation there will be an installed 1.8m high chain mesh fence, which will prevent humans, foxes, feral cats entering within the solar farm.

This can be visually represented as below:



The above differences in installation and unique business opportunities provide an opportunity to study additional dual land use research topics including:

- Advancing research into crop/grass growth under various dual purpose and partial shade situations;
- Measurement and quantification of operational cost reduction as a result of dual purpose land use combining sheep grazing and PV installation;
- Opportunities for advertising and branding studies for “Hardwick’s Solar Sheep” or similarly branded products.

The project will encompass the above studies. Such diversity of land use will increase the overall land value and productivity and will be felt not only by the land owner, Hardwick’s, but also by communities as the land creates a new identity and purpose for itself.

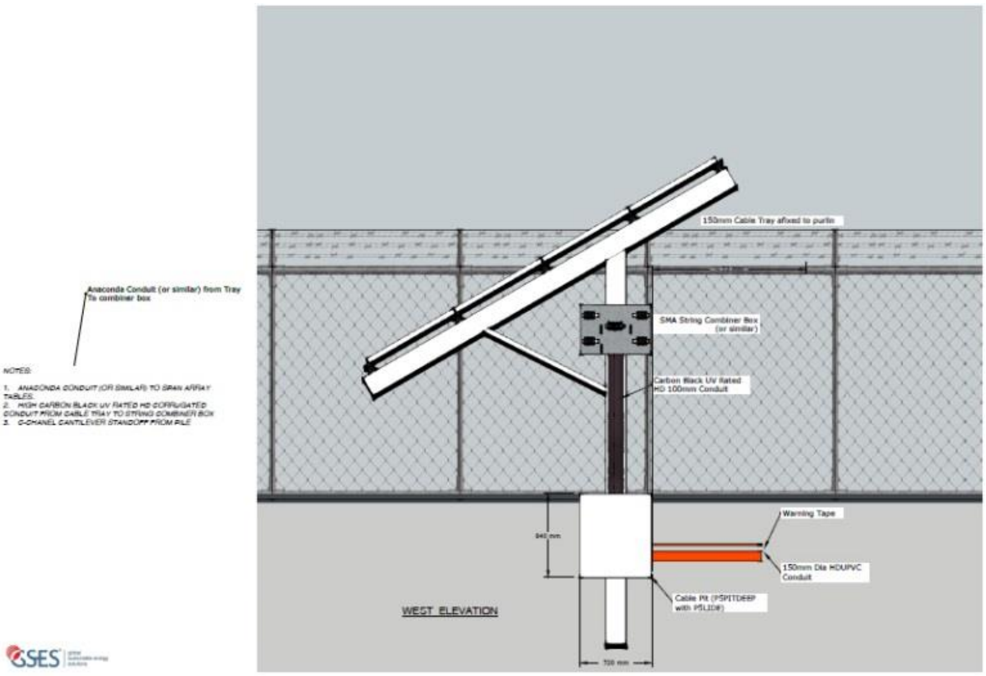
## 3.4 Integration with site electrical network

### 3.4.1 Build Plan

The array field will host a fixed-tilt, ground mounted system. The system is comprised of 120 fixed array tables, 44 of which are exterior tables (i.e. edge tables) and 76 are interior tables. Each fixed tilt array table is comprised of 4 rows of 10 modules each, using the Jinko 320W module. At the current project phase, the table mounting design is awaiting a pull out test on site.

Cable management on the fixed tilt array tables is achieved by running all cables back to the centre of the array field. A string combiner box will be mounted on the fixing pole lining the centre of the array field using a vertically mounted section of slotted c-channel (ezystrut or similar). UV rated, HD flexible conduit will enter the string combiner box at the top. 100mm Diameter Black UV rated, UHD conduit will exit the bottom of the string combiner box. A 45 degree angle will be used in the 100mm Black UV rated, UHD conduit so as to create separation from the pile driven pole which supports the array table. The conduit will be supported by a cantilever (angle bracket from ezystrut or similar) which is also mounted to the vertically fixed section of slotted c-channel which is fixed to the west side of the western most pile driven pole.

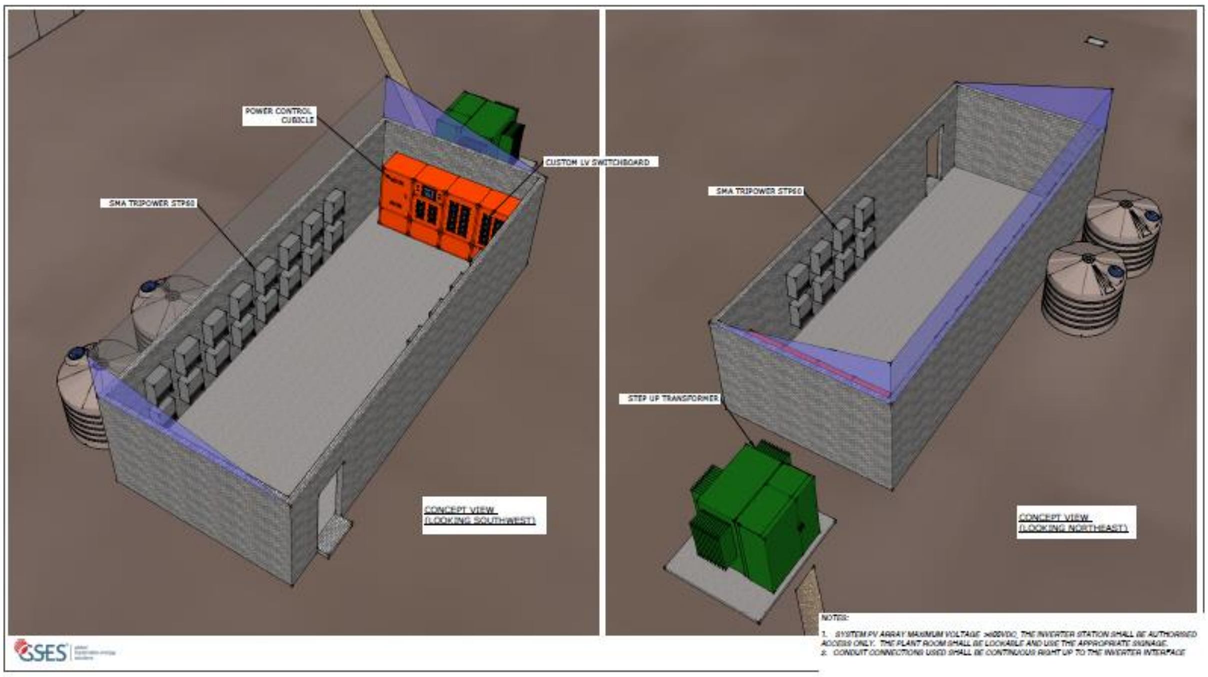
Trench lines are to be created running north-south through the centre of the array field. Cable pits will be used to create junctions for the trench lines at each array table row. String combiner boxes will all include DC isolation as well as overcurrent protection. The DC isolation device used is the 160A nominal rated isolator which comes as standard with the SMA combiner box.

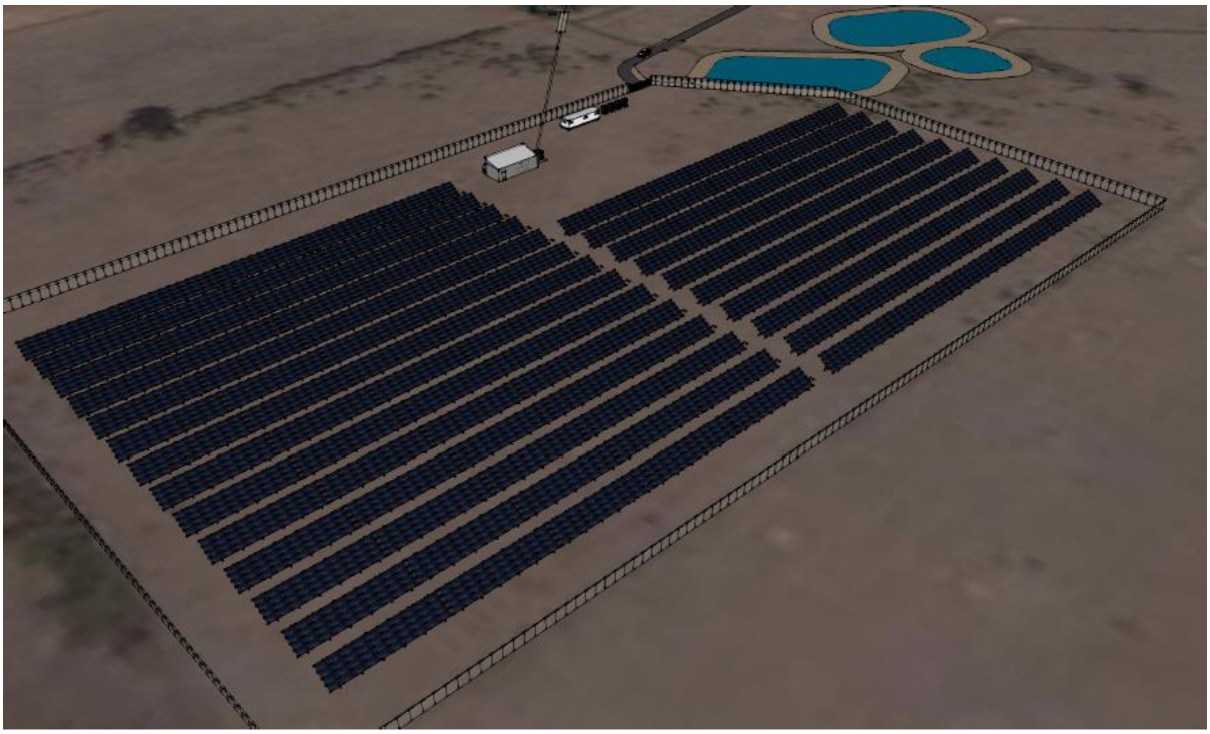



DC conductors will travel back to the inverter room. The complete system will be connected via 24 x SMA STP60 Inverters. The inverters will be paralleled in a custom LV board within the inverter room. From the LV board, conductors will connect to a 22kV step-up transformer.

The 22kV line will then travel back to the main site where the main switch board is located on the south side of the Hardwick's Meat main property. This cable run is approximately 380m. External to the site main switch board will be a pad mount step down transformer. The LV conductors from the step-down transformer will then join the main switch board bus, which must be retrofitted to accept the connection.

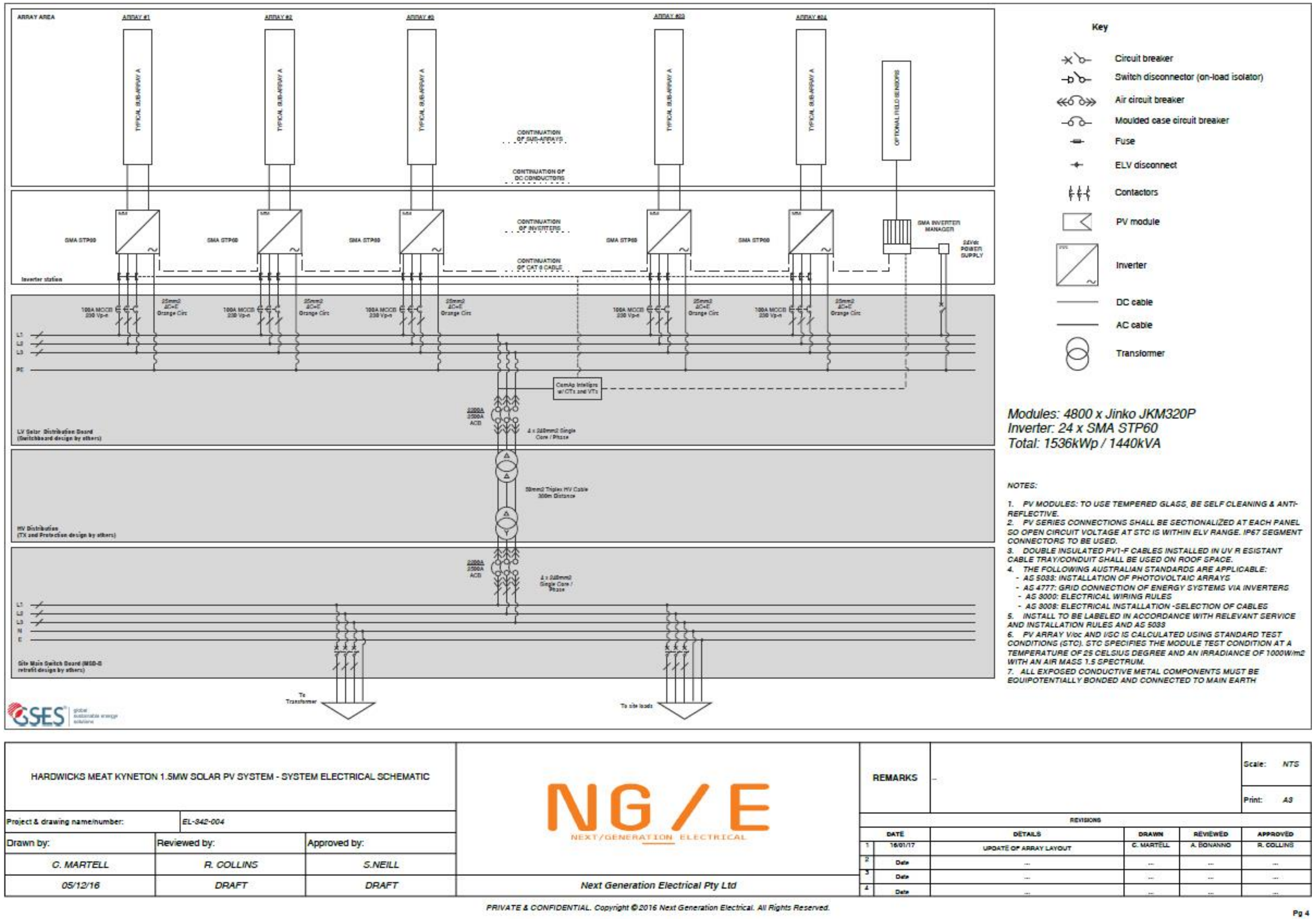
Detailed designs can be found in Appendix 1.



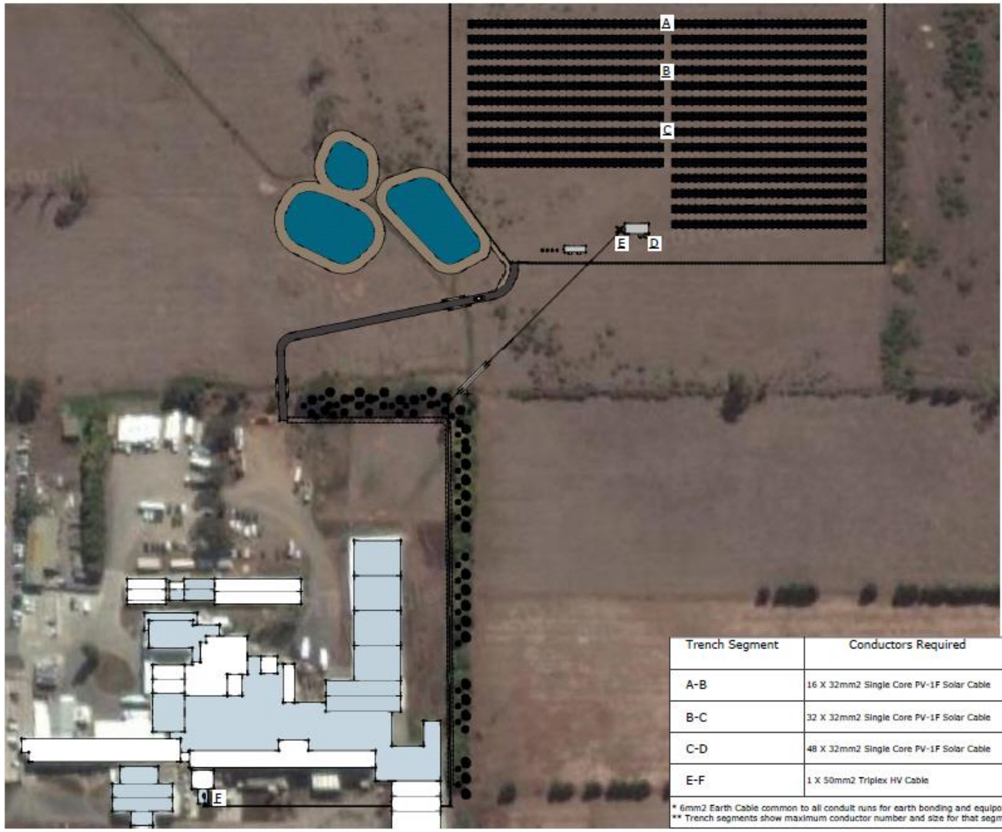
## 3.4.2 System Electrical Schematic

As per NGE detailed designs



### 3.4.3 Trench and Cable Plan

As per NGE detailed designs




| Trench Segment | Conductors Required | Conduit Required |
|---|---|---|
| A-B | 16 X 32mm2 Single Core PV-1F Solar Cable | 1 x 150mm HDUPVC |
| B-C | 32 X 32mm2 Single Core PV-1F Solar Cable | 2 x 150mm HDUPVC |
| C-D | 48 X 32mm2 Single Core PV-1F Solar Cable | 3 X 150mm HDUPVC |
| E-F | 1 X 50mm2 Triplex HV Cable | 1 x 100mm HDUPVC |

* 6mm2 Earth Cable common to all conduit runs for earth bonding and equipotentially bonding of arrays, fences, etc.
** Trench segments show maximum conductor number and size for that segment only

GSES global sustainable energy solutions

HARDWICKS MEAT KYNETON 1.5MW SOLAR PV SYSTEM - TRENCH AND CABLE PLAN

| Project & drawing name/number: | GE-342-007 | |
|---|---|---|
| Drawn by: | Reviewed by: | Approved by: |
| C. MARTELL | R. COLLINS | S.NEILL |
| 05/12/16 | DRAFT | DRAFT |

NG / E NEXT/GENERATION ELECTRICAL

Next Generation Electrical Pty Ltd

REMARKS –

Scale: NTS
Print: A3

REVISIONS

| | DATE | DETAILS | DRAWN | REVIEWED | APPROVED |
|---|---|---|---|---|---|
| 1 | 16/01/17 | UPDATE OF ARRAY LAYOUT | C. MARTELL | A. BONANNO | R. COLLINS |
| 2 | Date | ... | ... | ... | ... |
| 3 | Date | ... | ... | ... | ... |
| 4 | Date | ... | ... | ... | ... |



Pg 7

## 3.5 Planning considerations

### 3.5.1 Topology & Soil Testing Results

NGE has engaged Chadwick Geotechnics to prepare a detailed soil testing report to determine the ground conditions at Hardwick's and to provide geotechnical design parameters for the design of the proposed foundations. The report ensures the structural integrity of the solar PV arrays.

Based on the proposed works, six (6) boreholes were proposed to be drilled to 3.45m or refusal whichever was the lesser, with in situ standard penetration tests and shear vane testing. Disturbed samples were collected for visual classification.

The fieldwork was carried out on 29th August 2016. The fieldwork comprised:

- Six (6) boreholes.
- Six (6) dynamic cone penetrometer tests.
- Six (6) Standard Penetration Tests.
- Shear Vane Tests.

Details of the individual field tests are dealt with separately in sections and can be found in the comprehensive report in Appendix 2. An example of one of the borehole results (BH1), provided overleaf, highlights the suitability of the proposed 1.8 meter design.

The following summary of the subsurface stratigraphy is inferred from the available site investigation data, and as such only represents the site conditions at the locations of the field testing. It is possible that conditions at locations between the field tests may be quite different and therefore this summary should only be understood to apply to the test locations.
The subsurface materials encountered in the boreholes at the site could be categorised into three main geological units and summarised as follows:

Unit 1 - SILT
This material was found in the top part of all the boreholes and extended to depths ranging from 0.15 to 0.35 m below ground level (bgl) and was described as a SILT which was moist and soft to firm consistency.

Unit 2 – CLAY (QVN)
This unit was found in all the boreholes beneath the SILT. The unit was described as clay of high plasticity and was firm to very stiff consistency and extended to depths ranging from 1.1 to 2.0m.

Unit 3 – CLAY (DG)
This unit was found in all the boreholes beneath the quaternary clays. The unit was described as clay of medium to high plasticity and was very stiff to hard consistency and extended to termination depths of 3.45m.

The detailed soil testing report confirms the proposed site will be appropriate for construction works.

CHADWICK GEOTECHNICS

# BOREHOLE LOG

BOREHOLE NO: ***BH1***
SHEET: 1 OF 1

| | | | |
|---|---|---|---|
| CLIENT: | ***NG Electrical*** | DATE COMMENCED: | ***29.8.2016*** |
| PROJECT: | ***Lot 4 Knight Court Kyneton*** | DATE COMPLETED: | ***29.8.2016*** |
| LOCATION: | ***See Location Plan*** | LOGGED BY: | ***SZM*** |
| JOB NUMBER: | ***1000288.000.R1*** | CHECKED BY: | ***RWMc*** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Drill Contractor:** | Chadgeo | **Bore Size:** | 150mm | **Hole Angle:** | ° | **Easting:** | | **Surface R.L.:** | | | |
| **Drill Model:** | AMS | **Drill Fluid:** | | **Bearing:** | | **Northing:** | | **Offset:** | | | |

| Method | RL (m) | Depth (m) | Geological Unit | Classification Symbol | Material Description | Moisture Condition | Consistency / Strength | Cementation / Weathering | Sample / Test | Tests: PSP | Tests: SV (kPa) | Tests: PP (kPa) | Tests: MC (%) | Field Records / Comments | Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SA | | 0.0 | QVN | ML | Silt, brown, non plastic | M | VS | | | | | | | Water observed at 0.2m | |
| SA | | 0.35 | QVN | CH | CLAY, pale orange with red seams, high plasticity, trace of rounded gravel | M | S | | | | | | | | |
| SA | | 0.55 | QVN | | | | | | SV | | 130 | | | | |
| SA | | 1.0 | QVN | | Becoming drier with depth | M - D | VSt | | SV | | 180 | | | | |
| SA | | 1.5 | QVN | | | | | | SV | | 195 | | | | |
| SA | | 2.0 | DG | CI-CH | CLAY, red with white and yellow inclusions, medium to high plasticity, trace of fine sand | D - M | VSt | | | | | | | | |
| SA | | 2.6 | DG | | Sand transitioning to fine to coarse grained | D - M | VSt | | | | | | | | |
| SA | | 3.0 | DG | | | | | | SPT 14,18,13 N=31 | | | | | | |
| | | 3.45 | | | **End of BH1 at 3.45m** | | | | | | | | | | |

This log should be read in conjunction with the T&T Pty Ltd Log Summary Sheet and the Project Plan

Library Template: CG V1.1A.GLB; Report Template: BORELOG

File: T:\DANDENONG\GEO PROJECTS\1000288\WORKINGMATERIAL\GINT\1000288.000.R1.GPJ

### 3.5.1 Local Council Feasibility

A development application has not been completed at present however, the council is aware of the project and supportive of the initiative and approach. Upon acceptance of the project, council building permits will be submitted for approval.

### 3.5.2 Network Study

An enquiry application has not been completed at present. Upon acceptance of the project, an application will be submitted to Powercor for approval.

Dial-Before-You-Dig has been completed, highlighting no presence of water, electricity and/or telecommunication services running through the site.

### 3.5.3 Infrastructure

Civils: The design for the following works is to be completed by a civil engineer:

- The improvement of the embankment area, around the existing damns and the west side of the array field and access; and
- The 4 metre access road, which will leave the array field and head west and then south back to the car park of Hardwick's Meat. This path will take the access road across two creek beds. A reinforced culvert will be used at each of these crossings

Site security and access: A 1.8m tall fence with 0.2m of barbed wire atop will line the northern and eastern property boundary around the array field. The fence will continue just to the east side of the three dams which will form the western side of the array field. Within the fence will be a void area which will help to mitigate risk from shading and from vandalism. The void area will also act as a vehicle access path.

The array fence will have a 6 metre sliding security gate in the south western corner of the southern fence, controlled with swipe access. Inside of the sliding security gate will be a secured check-in/parking area.

### 3.5.4 Design Considerations

All design dimensions have been developed using approximate real world references and, as such, all site set-outs, site orientation and build dimensions must be verified onsite by a land surveyor. If variances occur, mounting manufacturer installation drawings and instructions should be used. For trenching lines, any variance should refer to elevation standoff dimensions.

### 3.5.5 Finance & Taxation Considerations

Next Generation Electrical (NGE) engaged an independent accounting firm, Jones Louros & Associates Pty, to provide advice on the financial and taxation implications of the Hardwick solar project. This engagement was a pro-active measure from NGE to ensure appropriate financial due diligence on behalf of Hardwick's. The transaction review covered the implications of funding from Meat & Livestock Australia, the Environmental Upgrading Agreement (EUA) and changes to Group structure (operational implications, stamp duty implications, capital gains tax and other tax implications and risk mitigation including but not limited to asset protection and transactional risk). The independent review ensures the structure of the project will be optimised to best suit Hardwick's and can be relied upon for projects of a similar nature going forward.

# 4 Summary of costs and benefits (economic, social, and environmental)

## 4.1 Economic

The power requirements of Hardwick's are growing due to increasing production and processing of red meat and offal products. Hardwick's is faced with the challenge of major infrastructure costs to upgrade grid connection and alternative technologies such as a microgrid based on solar PV represent a cost efficient solution as well as risk mitigation against an increasingly unreliable external power grid. Hardwick's currently does not have any back up power supply during a network power outage and as the business grows, the economic risk of an extended power outage has major impacts on perishable product and production. The microgrid system mitigates this risk.

An economic model and cost/benefit analysis has been developed as part of the project. Extensive analysis of the Hardwick's power usage trends, demands and future loads was conducted. Several technologies were analysed including battery storage, combustion generation, thermal storage, HV customer, power correction and solar PV based microgrid. This package has been used to highlight a detailed value proposition based on customer input data and average system operational data for systems of a similar size from the Beon Energy Solutions customer database, taking into consideration all known costs, losses, gains and savings. This model and approach can be repeated for other customers within the industry, saving time and money during the research phase.

The economic model leverages:

- Customer inputs such as interval data, retail invoices (and assumed escalation rates) and site locations to determine weather conditions and renewable credit prices and;
- Averages system operational data for systems of a similar size from the Beon Energy Solutions customer database such as capacity factors, seasonalised utilisation factors for both peak and off peak periods to account for weather conditions, degradation profiles, irradiation profiles, useful lives and maintenance costs)

The economic headline for the 1.5MW Solar PV based microgrid system is a simple payback period of 5.7 years and an internal rate of return (IRR) of 17.6%, meaning the project would be NPV positive with a discount rate of up to 17.6%. This includes:

- Year 1 electricity saving of $298,120, year 5 electricity saving of $327,261 and total 20 year electricity saving of $7,501,074
- Year 1 LGC income (incl. GST) of $226,688, year 5 LGC income of $192,192 and total LGC income (to 2030 when incentive ends) of $2,507,395.

This analysis does not include any potential losses associated with a major external power grid outage. Should a major external failure occur for an extended period, the project could pay for itself immediately.

## 4.2 Social

Next Generation Electrical will deploy it's tried and test approach to installing commercial solar, using experienced internal resources to project manage the installation and contract local electricians to deliver part of the installation. Further, while most of our equipment from tier 1 manufacturers is procured from overseas, they all have offices throughout Australia with locally employed resources.

The Environmental Upgrading Agreement (EUA) has been selected as the source of funding (outside of the MLA contribution) which is a financing agreement between a customer, a lender and the local council. Such an agreement provides local and economic stimulus through jobs and training.

## 4.3 Environmental

A solar PV based microgrid is a method of capturing the sun's energy to generate electricity cleanly. Solar PV is a vital component of the Australian energy mix as energy usage continues to grow and expand across the nation. Without the use of such alternative energy sources, the consumption of fossil fuels will grow to unsustainable levels.

Energy production and conversion are the main sources of greenhouse gas emissions (carbon dioxide, methane and nitrous oxide). Coal mining in particular can have significant impacts to the environment and a vital step to reducing CO2 emissions is to deploy renewable energy. The 1.5MW solar PV system will save approximately 3,145 tonnes of $CO^2$ per year, or 30% of the present CO2 resulting from electricity used at Hardwick's.

The Commonwealth Government's Mandatory Renewable Energy Target (MRET) scheme are meant to encourage additional generation of renewable energy. The Renewable Energy Target (RET) is an expansion of the MRET and requires an additional 20% of Australia's total electricity supply to be sourced from renewable projects by 2020, assuring that national greenhouse gas emissions are reduced to meet Commonwealth Government targets. The 1.5MW microgrid system will generate an estimated 2,296 MWh (roughly one-third of total energy consumed at the site).

The establishment of this project not only shows significant environmental leadership amongst the Meat & Live Stock industry but to all industries due to the sheer size and grid risk management capability of the microgrid system. The array contains 4,688 solar panels over a 10-acre expanse. Whilst there are larger solar arrays nationally, this system will be the largest in Victoria according to the Clean Energy Council.

# 5 Success in meeting the milestone

## 5.1 Milestone 1: Successful

The milestone was successfully completed, engaging various internal and external stakeholders. Importantly, the completion of these milestones ensures Hardwick's receive a bespoke and cost efficient solution to their growing energy requirements.

The initial feasibility and detailed cost/benefit analysis provides the foundation to commence the overall project. Many aspects of the project will rely heavily on the information obtained from various reports and models, developed internally and externally. Further, this milestone is critical in determining the Go / No Go outcome.

# 6 Overall progress of the project (optional)

## 6.1 Milestone 1 of 6

All information is now available for Hardwick's to make an informed decision on whether to proceed with the project and cost investment. Should the project proceed, an additional 5 milestones will need to be completed covering designs and approvals, install and commissioning, system operation and a final report including a presentation video.

Please refer to the GANTT chart, attached in Appendix 4, for further information.

# 7 Conclusions/recommendations

## 7.1 Conclusion

This first milestone, initial feasibility and cost/benefit analysis, has confirmed that a microgrid ancillary/emergency solar PV system and battery storage can provide a cost effective risk management solution to electrical services for Hardwick's Pty Ltd meat processing facility at Kyneton.

The intellectual property acquired from this milestone can be disseminated to similar customers within the MLA, saving significant time during the research and development phase. The market assessment of all available technologies and funding models completed as part of this project ensures potential customers not only receive an objective approach to reducing their energy bill and contributing to a greener environment, but also achieve substantial business protection from major external extended power grid failures.

This milestone report also provides the basis of the "Go/No Go" decision point detailed at this stage of the project within the Project Agreement Milestones schedule.

In terms of the "Go/No Go" decision point, it is proposed that the Research and Development benefits resulting from the intellectual property to be developed during the detailed design, construction and initial operations of this project will be of significant benefit to MLA stakeholders.

Hardwicks note that throughout the completion of Milestone 1, Next Generation Electrical and Beon Energy Solutions have demonstrated high levels of advanced knowledge and expertise in microgrid technology and have demonstrated the potential benefits of new load-shedding/battery/control systems with power grid interfaces. Hardwick's have a high level of confidence that the proposed R&D will provide a beneficial solution with ready application for the Australian red meat industry.

# 8 Appendix

## 8.1 Appendix 1 – Detailed Designs

Please see separate attachment, Appendix 1 – Detailed Designs.pdf

## 8.2 Appendix 2 – Topology Report

Please see separate attachment, M1.Appendix 2 - Topology Report.pdf

## 8.3 Appendix 3 – EUA Cash flows

Please see separate attachment, M1.Appendix 3 – EUA Cashflows.xlsx

## 8.4 Appendix 4 – GANTT Chart

Please see separate attachment, M1.Appendix 4 – GANTT Chart