

Gauteng Department of Economic Development (GDED)

SME Green Support Incentive Program

**ENERGY CONSUMPTION ASSESSMENT FOR
Demco Gas Solutions**

157 Houthamer RD, Devland, Soweto, 2064

6 May 2022

Prepared for: CSIR National Cleaner Production Centre South Africa
CSIR Pretoria Campus
Pretoria

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This project report is to remain confidential between the NCPC-SA/CSIR and Demco gas Solutions and may not be revealed in any way to a third party without the prior written permission of the NCPC-SA/CSIR.

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Nomenclature

CDD	Cooling Degree Days
CFL	Compact fluorescent lamp/light
CO _{2e}	Carbon dioxide equivalents
CP	Cleaner Production
Deg.C	Degrees Celsius
Hr	Hours
kL	Kilolitres
kVA	Kilovolt Amperes
kW	Kilowatts
kWp	Kilowatt Peak
kWh	Kilowatt-hours
LED	Light-emitting diode
NCPC-SA	National Cleaner Production Centre of South Africa
R	Rands
PV	Photo-voltaic
RECP	Resource Efficient and Cleaner Production
W	Watts

EXECUTIVE SUMMARY

An Energy Assessment was conducted at Demco gas based in Soweto, Johannesburg. This was done to evaluate the company's operation by assessing how much energy they utilize on their site and assist in cost reduction of the consumed energy. The annual Electricity consumption per year is R24 000 with a 23 000 kWh consumption.

Identified energy efficiency opportunities were identified as follows:

- Opportunity for approximately 100% of electrical energy to be sourced from an alternate energy source (saving of 23 000 kWh and R 24 000)
- Estimated Carbon Dioxide reduction of 24 tonnes identified
- Overall identified investment cost of R 125 400.

A summary of the material to be purchased is contained below:

Table 1: Solar Panel raw material

Solar Equipment	Quantity	Cost(R)
Canadian Solar 455 W Super High Power Mono Perc_Hiku with MC4-EV02	26	2 938.93
Sunsynk Sun 12kW Three Phase LV Hybrid Inverter	1	30 000
Three Phase Earth-Neutral Bridge Box For Inverters Up To 12kWac	1	1 765.79
600V Protection Box 2 Inputs 2 Outputs 16A Isolator Type I_II SPD	1	6 554.17
4mm2 single-core DC cable 50m - Black & Red	1	1 366.37
MC4-Evo2 1500V DC Connector Twin Pack 0086/0087 (Kit 1)	10	164.82
MC4 Pre terminated cable 2m (1 Pack)	4	138.05
10 Panel Mounting Kit - IBR Roof c/w earth plate clamp kit & profile splice	1	4 942.72
70mm2 by M10 Ring Terminal Lug	1	468.79
PV on Roof and Hazard Labels Pack	1	135.51
Delivery to Germiston	1	1 527.48
Total	-	125 373.41

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1. INTRODUCTION

Demco Gas Solutions is gas energy distribution company situated at Houthamer Road, at Devland, in Soweto, Gauteng Province. The Global Positioning System (GPS) coordinates are (-26.280577, 27.930862). The company is producing and selling gas to the local markets in South Africa. The company has employed about 6 people, who are working in a single 12-hour shift. For their operations, the factory consumes electricity supplied by City Power and has no other sources of energy.

The Energy Assessment commenced on the 22 April 2022 with a brief introduction meeting with the establishment owner together with the NCPC-SA energy team and followed by the site walk-about and the energy audit.

This review forms part of the Gauteng Department of Economic Development (GDED)'s SMMEs Green Support Incentive Program, whose objectives are to assist SMMEs based in Gauteng to implement energy saving strategies, optimising energy use and installing alternative sources of energy to mitigate the high cost of energy and green their operations through reduced carbon emissions. This review report presents the relevant findings contained in the RCEP Assessment Report and information obtained from the site visit relating to energy usage and opportunities for energy performance improvements and renewable energy resources that can supplement grid power. The opportunities are evaluated for technical and financial feasibility. High level investment costs, energy and cost savings and simple payback periods are presented.

2. COMPANY INFORMATION

Table 2: Company Information

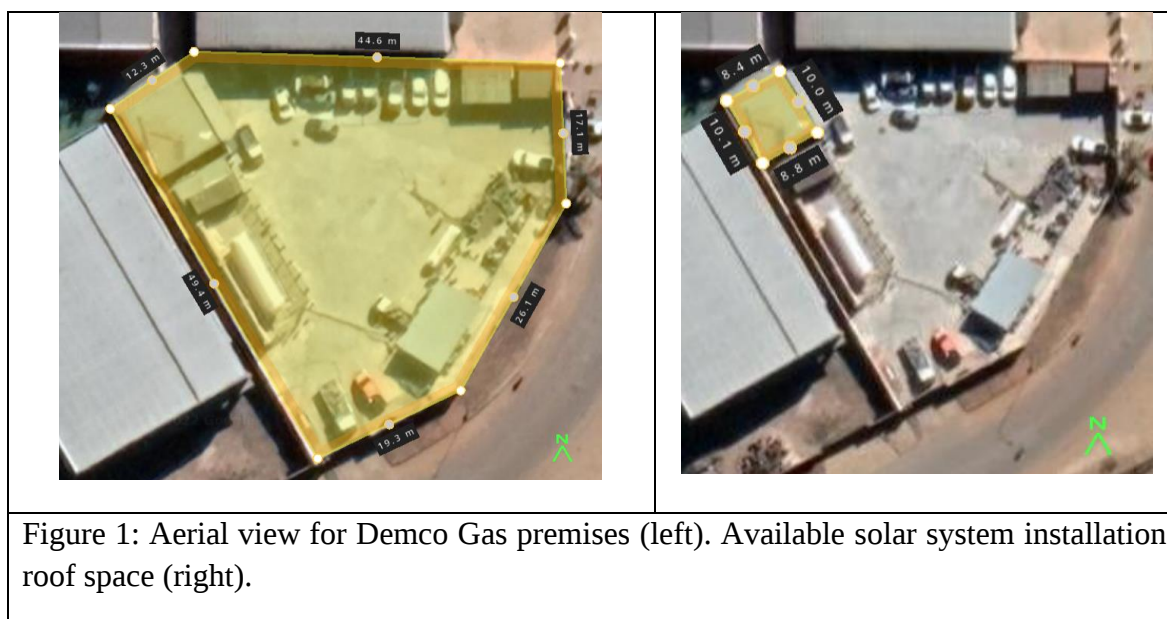
Assessment Type	Review of Energy Efficiency and Renewable Energy opportunities
Assessment Period	April 2022
Company Name	Demco Gas
Physical Address	157 Houthamer RD, Devland, 2064
Phone	082 419 0299
Trading Since (year)	2010
No. of Full time Employees	6
Industrial Processes	Gas
Company Contact Person:	
Name:	Mrs Philani
Designation:	Founder
Telephone: Mobile: E-mail:	+27 824190299 philani@demcogas.co.za

3. PLANT PROFILE

Demco Gas Solutions Company is a gas dispatching business as indicated in the introduction. The main business activities include sourcing gas from service providers and selling it to public and corporate clients. In the site, they pump the gas into gas cylinders (bottles), store and make it ready for clients. The company service their clients in large numbers and works almost in full capacity throughout the day. The company employs people who work in a single 8-hour shift. This sometimes extends up to 21h00 in the evening.

Error! Reference source not found. shows the Demco Gas Solution's premises as well as the location as obtained from the Google Earth's Satellite View. The space occupied by the factory is clearly marked in the figure. The Demco Gas Solutions premises occupy an area of 1811 m² (left) with the available roof area (right) of 78.8 m². Not shown in the map, they have built a car park, with which they can extend their roof space.

The structure, on which the panels can currently be placed, is a storeroom. It has a flat rooftop, and it faces northeast. Other structures in the premises are avoided for safety reasons from fire. Since the business operates mainly during the day, they can exploit the solar system, fully, with the option of adding a battery bank for evening operations.



- (i) Annual average solar energy intensity on horizontal surfaces in Soweto, the GHI, which is 170.5083 kWh/m^2 , which corresponds to average peak sun hours (PSH) of 5.3 h/day

4. PROJECT METHODOLOGY

Table 3:Project methodology

Step	Action Plan	Purpose and results
1	Plan and organise (walk through audit and informal Interview)	Resource planning, Organise instruments and time frame, Macro data collection, Familiarisation of process and plant activities
2	Conduct brief meetings with stakeholders	Building up cooperation, awareness creation and issuing a questionnaire
3	Primary data gathering, a Process flow diagram	Historical data analysis and baseline data collection.
4	Conduct detailed trials for different solar panels, inverters and batteries	Trials on new products available on the market
5	Identification and development of potential value addition products	Conceive, develop, and refine ideas. Review previously suggested ideas and contact vendors for new/efficient technologies.
6	Cost-benefit Analysis	Assess technical feasibility, economic feasibility and prioritisation of the most promising projects. Prioritise by short, medium and long-term measures.
7	Reporting and Presentation to top management	Documentation and report presentation to top management
8	Implementation and follow-up	Assist and implement recommendation

4.1 Production process flow chart

Demco gas' core business is refilling of gas bottles to supply to their customers. The process begins by receiving of the LPG bottles which are filled and weight according to the size of the customers. After filling the bottles, they are then handed over to the customer.

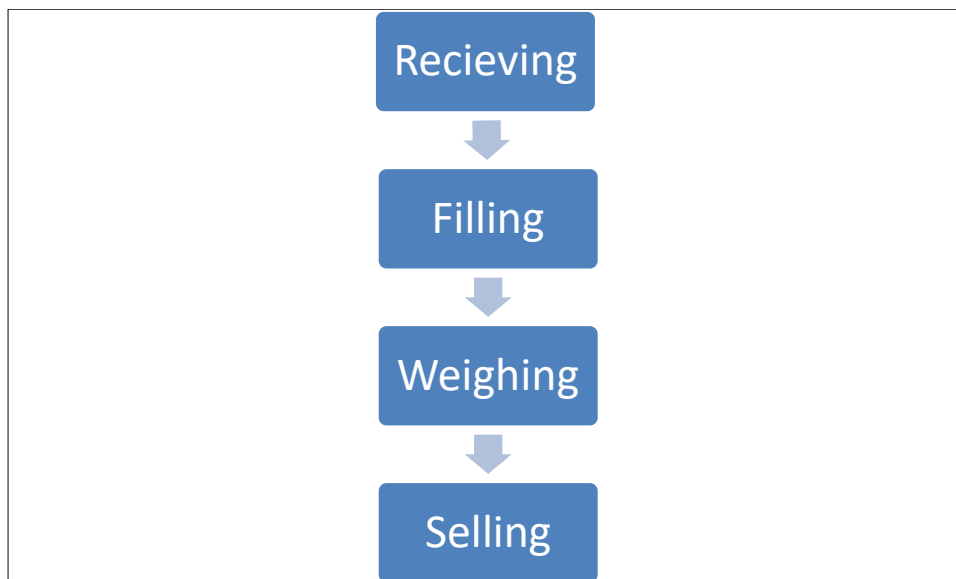


Figure 2:Process flow diagram

5. ENERGY CONSUMPTION

5.1 Electricity

Electricity consumption data was not provided as the company does not keep records of that. They are on a prepaid so the amount of electricity they purchase on a month-to-month basis is R2000 and at times a top-up will be made during the month as a need arises. The number of bottles they fill every month is also not recorded.

5.2 Establishment

A baseline couldn't be done because there were no production figures available.

5.3 Identification of Significant Energy Users

An energy balance was done on site accounting everything that utilises electricity on site. The total on the balance would tie up with the total from their electricity balance. It is purely based on estimates and simply highlights where the electricity on site is going to. This aids in establishing the Significant energy users on the site. Because there are no records of electricity consumption on site, balance done wont necessary mean that's how much is used, it will be used as a guideline to showcase the estimated energy consumption on the available equipment on site.

Table 4: Estimated energy uses

Equipment	Estimated kWh/year	%Energy Consumed
Filling	22 932	99%
Lighting	144	1%
Fridge	31.75	0%
Desktop	38.40	0.17%
Printer	0.036	0.00%
CCTV	34.56	0.15%
Total	23 180.75	100%

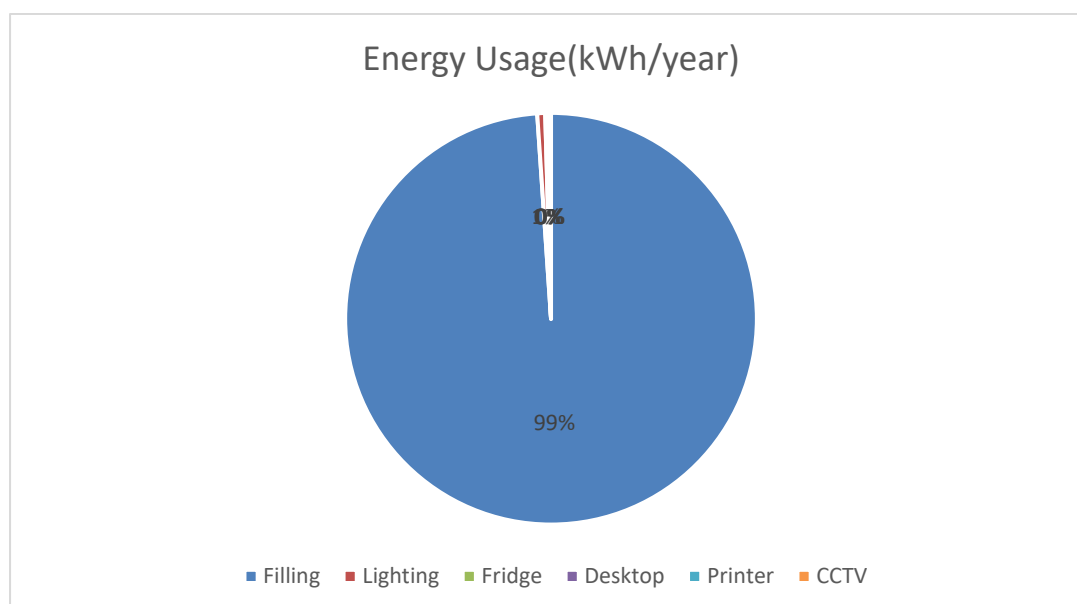


Figure 3: SEU's

As it can be seen on the estimated energy balance, the biggest user of energy is the filling equipment. In essence, this would be true because the site fills in gas into cylinders and that is the core of their business. The company also indicated that the highest demand is during winter months, thus making it their peak season. Due to loadshedding, the demand for gas is even more.

6. DETAILED ASSESSMENT FINDINGS AND RECOMMENDATIONS

6.1 Installation of Solar PV

Comments

This section looks at the potential of installing a solar system at the Demco Gas Solutions premises as an energy solution. Figure 4 shows the proposed PV system installation with a potential of generating about 7 kWp of DC power. For this reason, installing a solar system in these premises is recommended, as it will help them lower their electricity bill and enable them to reach even high revenue levels.



Figure 4: Installation Capacity (left). The possible expansion of the PV installation space.

Potential benefits

To explore the benefit of installing a PV system on the available roof space and possibly on the additional one, we consider the following stated parameters:

- (ii) The daily average energy consumption of Demco Gas Solutions amounts to 23180.75 kWh/year and can be translated to 89 kWh/day, if they only operate during weekdays as shown in Table 5. In addition,
- (iii) the necessary mounting area of the corresponding PV generator amounts to about 25 m², which facilitates its installation to a limited extent.
- (iv) The DC system voltage is chosen to be 24 V in order to limit the battery block voltage under a dangerous value

Table 5 shows the sizing of the PV system that is recommended for installation on the limited roof space of Demco Gas. Since the company operates from 8h00 to 17h00, and sometimes go through to early evenings, installation with a battery bank is recommended to also cater for the never-ending load shedding. The operations' time factor is considered to be 5 days a week, 4.33 weeks a month (52/12) and 12 months a year.

Table 5: Background information for PV System sizing

Daily Work % break down	100%	70%	30%		
Annual Consumption	23180.75	16226.52	6954.22	kWh	From Installed Capacity
Monthly Consumption	1931.73	1352.21	579.52	kWh	
Daily Consumption	89.23	71.38	26.77	kWh	Weekdays
Blended Tariff	1.51	1.51	1.51	ZAR/kWh	
Sun Peak Hours (hrs)	5.74			hrs	For min Insolation (from PV Watts)
Sun Peak Hours (hrs)	6.02			hrs	For average Insolation

Table 6 shows the actual PV system sizing based on the energy demand. calculated from

Table 6: PV System sizing

PV System Sizing at 100%	Worst case	Average case	
PV power demand= (Daily consumption/Sun peak hours) *1.3	20.21	19.28	kW
	20207.83	19281.28	W
Solar Panel peak Wattage	540	540	W
Number of solar panels	37	36	

Power output Budgeted for	9.72	9.72	kWp
Number of solar panels budgeted for	18	18	
% Worst Case Savings	48	50	%
Number of solar panels that fit the available space	12	12	
Roof Space Power output	6		kWp
Daily PV Electricity generation	39		kWh
Annual PV Electricity generation	10135		kWh
Cost of Annual PV Electricity generation	15305		ZAR
Investment	235265	0	ZAR
Payback Period	15		Years
% Energy Savings	34	%	

Figure 5 shows the line diagram of the system, with components connections, the module and inverter specifications and wires dimensions highlighted.

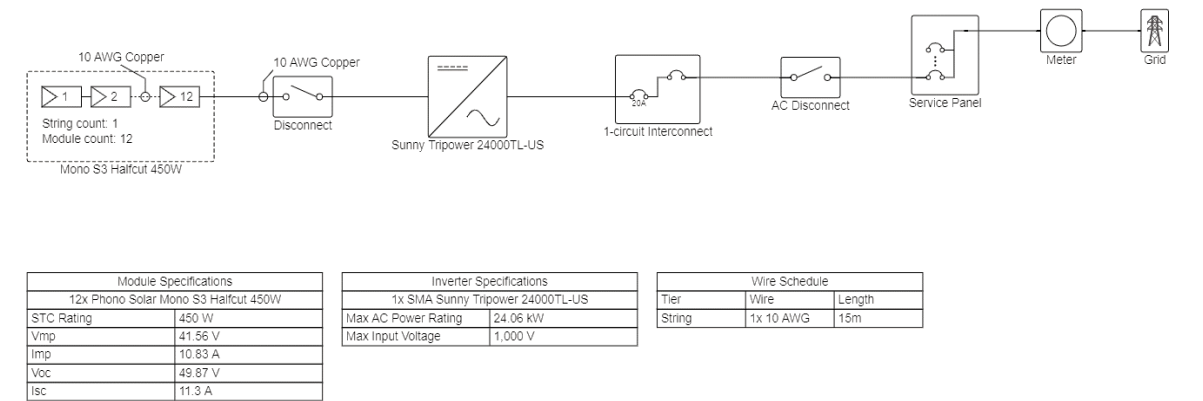


Figure 5: Line diagram for the space budgeted for.

Error! Reference source not found. presents the predicted grid power output in relation to the plane of array irradiance and the global horizontal irradiance. The grid performance is in line with plane of array irradiance, especially in March and April as well as September and October. This can be attributed to the equinox impact. On the other hand, the GHI is high in summer and low in winter. Here it can be seen that all parameters are in line with the GHI because of the flatness of the building.

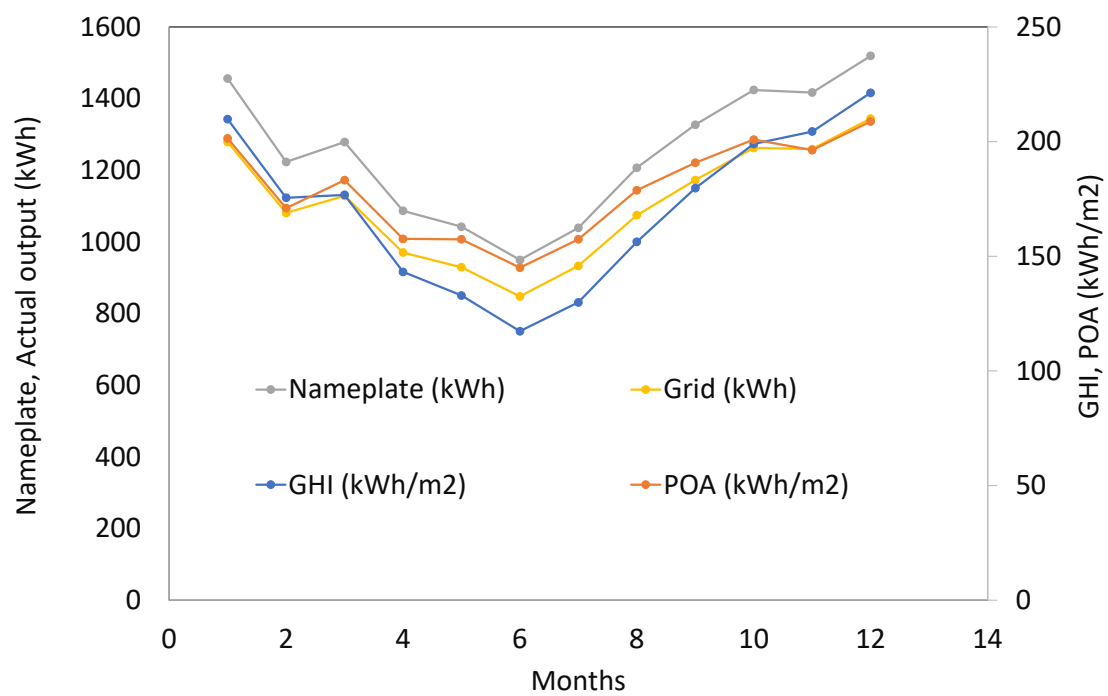


Figure 6: Actual and nameplate electricity generated monthly relative to the plane of array and global horizontal irradiance.

Indicative Cost benefit**Investment cost:**

Table 7: Investment cost for installation

Solar Equipment	Quantity	Rating	Amount	
Canadian Solar 455 W Super High Power Mono Perc_Hiku with MC4-EV02	19	0.54	3850	73150
Sunsynk Sun 12kW Three Phase LV Hybrid Inverter	1	12	47429.14	47429.14
Freedom Won Lite Home 10/8 LiFePO4 Battery N	1	Unit	58652.22	58652.22
CANBUS Cable for Freedom Won and Sunsynk or Goodwe combination	1	Unit	318.55	318.55
Three Phase Earth-Neutral Bridge Box For Inverters Up To 12kWac	1	Unit	1765.79	1765.79
70mm2 Battery Cable (H01N2-D) 2m – PAIR	1	Unit	948.78	948.78
600V Protection Box 2 Inputs 2 Outputs 16A Isolator Type I_II SPD	1	Unit	6554.17	6554.17
4mm2 single-core DC cable 50m - Black & Red	1	Unit	1366.37	1366.37
MC4-Evo2 1500V DC Connector Twin Pack 0086/0087 (Kit 1)	10	Unit	164.82	1648.2
MC4 Pre terminated cable 2m (1 Pack)	4	Unit	138.05	552.2
KETO 1 BaCery Disconnecter with 250A Fuses	1	Unit	1882.36	1882.36
10 Panel Mounting Kit - IBR Roof c/w earth plate clamp kit & profile splice	2	Unit	4942.72	9885.44
70mm2 by M10 Ring Terminal Lug	1	Unit	468.79	468.79
BaCery Hazard label Li-ion (230mm * 90mm)	6	Unit	39.28	235.68
BaCery Hazard label Li-ion (230mm * 90mm)	1	Unit	42.86	42.86
PV on Roof and Hazard Labels Pack	1	Unit	135.51	135.51
Delivery to Germiston	1	Unit	1527.48	1527.48
			Total	206563.54
			Vat	28918.8956
			GrandTotal	235482.4356

Potential cost savings: R24 000 p.a

Potential kWh savings: R23 000 p.a

Payback Period: 5.22 years

7. IMPLEMENTATION PLAN

The objective of the implementation plan is to provide Demco gas Solution with the confidence that all the energy saving opportunities will be considered when implementing the project, and make sure a to list the tasks is done, activities and processes involved in producing deliverables. It is also to make decison on the allocaton of resources and specifying the project priority levels. The report highlights the sizing option for the Solar OV installation. The plan is highlighted and discussed on the report. A service provider would be able to install the PV's per the scope of the report.

8. CONCLUSION

Demco gas sees the importance of being energy efficient in their operations. Due to being charged high amounts of access charge, implementation of Energy Efficiency projects is of high importance. And the company is in the process of enlarging its facility by addition of other operations. They will be able to adopt what has been done on the current operations and implement this on the new facility. Because of the Energy Audit, they have seen the importance of understanding more about Energy and would like to do courses at the NCPC to know and understand more on this topic.