Energy Savings Assessment Report for:

City of Guelph
Material Recovery Facility
110 Dunlop Drive
Guelph, Ontario

PREPARED FOR:

WASTE DIVERSION ONTARIO'S
CONTINUOUS IMPROVEMENT FUND,
CITY OF GUELPH
CIF PROJECT NO. 216

PREPARED BY OPTIMIRA ENERGY CANADA LIMITED,
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Contacts

Jack Carcasole

Director of Business Development

Phone: 647 827 - 0608

Peter Daldoss

Senior Project Manager

Phone: 647 827 - 0609

Report Authors

Lou Pascoa

Engineering Supervisor

Phone: 647-827-0627

Charles Spencer

Senior Energy Engineer

Phone: 502-381-0176

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Confidentiality Statement

Optimira Energy Limited respectfully requests that Waste Diversion Ontario (WDO) and the City of Guelph (Guelph) treat this report and all matters connected with this report as confidential information and that WDO and Guelph, or their agents, acting on their behalf, not disclose any of the foregoing to any person. If requested to disclose the foregoing, WDO and Guelph will claim an exemption for disclosure to the Freedom of Information and Protection of Privacy Act and the Access to Information Act.

1.0 Introduction and Executive Summary

The Material Recovery Facility located in Guelph, Ontario is a major energy user spending almost $400,000 per year in electricity and natural gas. The most recent energy consumption data breaks down as follows:

- Electricity: 2,401,941 kWh's at a cost of $236,736, and
- Gas: 371,154 M^3 at a cost of $161,802

Waste Diversion Ontario, through their Continuous Improvement Fund is targeting energy as one means to reduce operating expenses. They commissioned Optimira Energy to undertake a study of the Guelph MRF and report on implementing opportunities to reduce the facility energy and operating costs.

Our findings are summarized in this report, the highlights include:

- A collection of mechanical and lighting energy efficiency "measures" that will improve the facility and improve worker comfort, as well as generate savings
- We identified two renewable energy opportunities including a passive thermal solar wall to reduce gas consumption, and a roof-top solar photovoltaic (PV) system reducing the facility dependency on grid power
- Both of the renewable measures will have a significant impact on Green-House-Gas emissions (GHG) associated with the MR Facility

We wish to thank Waste Diversion Ontario, the Continuous Improvement Fund and the City of Guelph staff at the Material Recovery Facility for their cooperation and support in the undertaking of this study.

2.0 Utility Usage Summary

Reviewing and analyzing utilities consumption is a key aspect of determining a facility's energy base and potential for savings. We received 20 months of electrical data and 9 months of gas data for our analysis. Water usage data showed very small consumption and was therefore not considered for this analysis.

As mentioned in the study introduction, the facility spends nearly $400,000 per year in electricity and gas.

2.1 Electricity

The stated operating schedule of the MR Facility is 6 AM to 5 PM, Monday to Friday, with two overlapping shifts. This results in approximately 2,800 operating hours per year. One observation from our utility analysis based on a 2-week power study, indicates the minimum power demand never drops below 150 kW, even at night during weekends. This is an indication that some equipment/systems are probably operating when not required.

Electricity Rates

- According to Guelph Hydro, the MR Facility is on a Time-Of-Day rate system. There is no evidence the City gains any advantage from this, since their operating schedule is almost completely during the peak hours periods. The electricity bills indicate none of the use at the facility is charged at off-peak rates.

- The electric cost per kWh without demand is currently $0.07581. This is the rate used for energy savings calculations which do not affect demand.

Power Factor

- The Power Factor for the facility varies considerably throughout the year; it is higher in winter and lower in summer - indicative of electric heat in use. The published utility tariff indicates there is a penalty when power factor falls below 90%.

- Power factor correction capacitors were installed at the main electric service entry several years ago. As of last year, they had been in a partial failure mode for at least a few years, with parts burned out and the overall correction being realized only at about 35%.

- The resulting extra hydro cost due to the failing power factor capacitors is higher than reported in the last electrical systems analysis. It was over $1700 for the most recent year.

- Power Factor at the main electrical service was 80% during the survey. However, at MCC-1 it was 64% and at MCC-2 it was 70%. This indicates that the correction being done at the mains is not doing anything to help with reactive loads downstream, which is actually expected but not desirable. The low power factors results in higher electrical bills and places stress on the facility electrical system, causing high temperatures in conductors and other gear, and aging the components prematurely.

Overall Electrical

- The building system voltage has been very high, well over 600 volts, where 575 volts is nominal. This does put a strain on the entire power system, although it is not as bad as being too low.

- There is an indicative index called Equivalent Full Load Hours (EFLH), which is the number of hours per month required to use the billed kWh at the billed kW rate. When this number is significantly higher than the stated hours of operation, it indicates that equipment is operating when it probably should not. Based on the schedule of 11 hours per day, M-F, and allowing for holidays, the expected hour per year would be 2700. As can be seen in the chart below, the EFLH actually remains pretty steady at 4700. Because the index is based on the maximum demand (which only occurs briefly each month), the actual hours of extended operation are higher than this.

- The Demand chart for kW's appears inverted compared with most facilities with air conditioning. The peak demand occurs in winter, the minimum in summer. Although the air conditioning clearly operates, its electrical capacity compared with the rest of the equipment is relatively small. However, the winter increase in demand is nearly 100 kW, suggesting that a large amount of electric heat is in use even though the building's primary heating systems are gas-fired. Conversion to more gas heating may save a considerably amount of money.

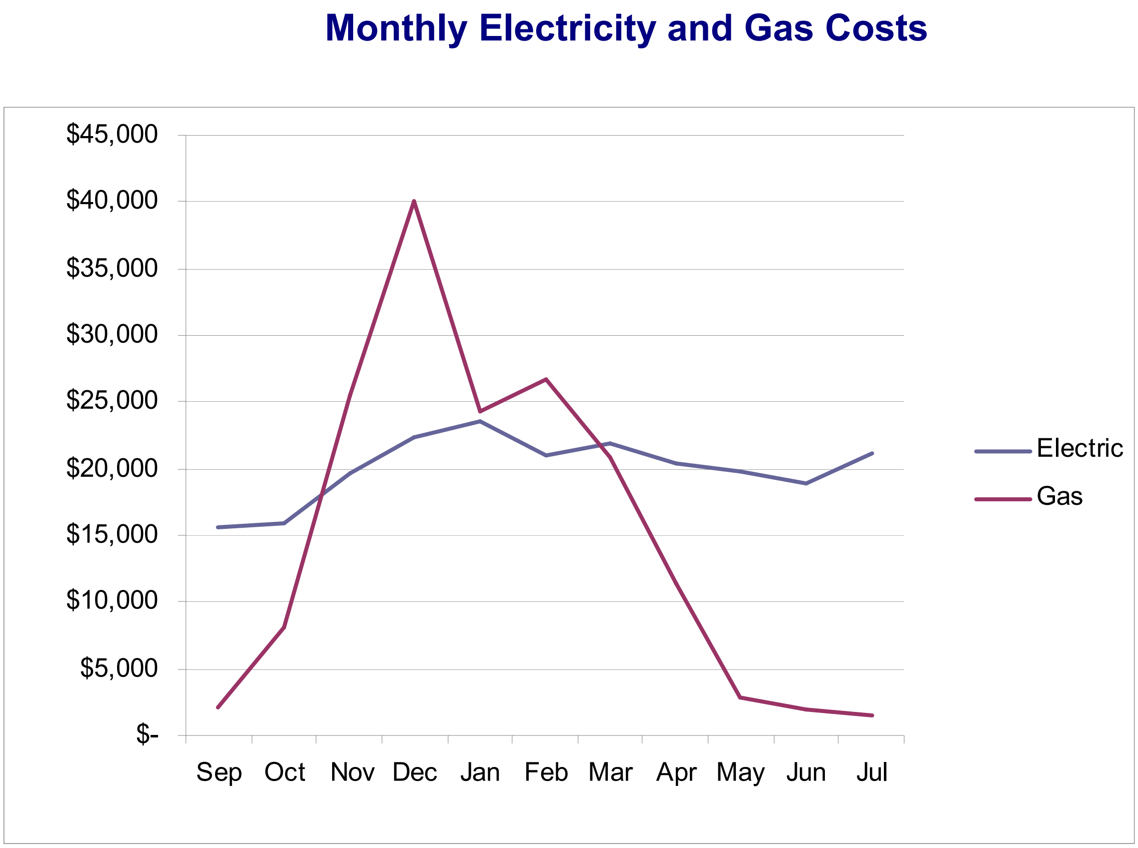
2.2 Natural Gas

- Natural gas data were only available for 9 months, but they included one full heating season, so the data are useful. A total of 371,000 M^3 were used in the period. This is a very high number, with a heat use index of 165,000 BTU/Ft^2/Year.

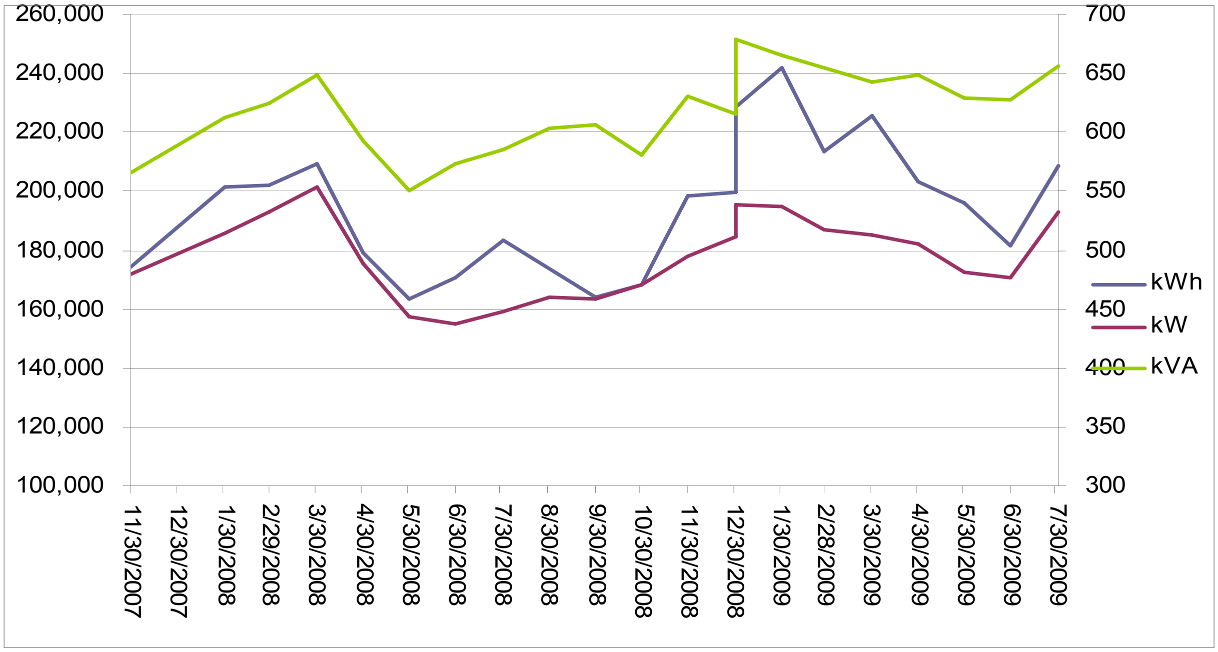
- Calculations of heating loads compared with historical weather data would indicate that the entire HVAC system, including the two large make-up air units, run 24x7 all year. If they heat outside air up to 60 Deg F, that would account for about 95% of the present gas consumption.

- Based on the stated operational schedule of 11 hours per day, 5 days per week, there is clearly a very large opportunity for gas savings by installing HVAC controls. A very significant portion of all gas consumption could be avoided.

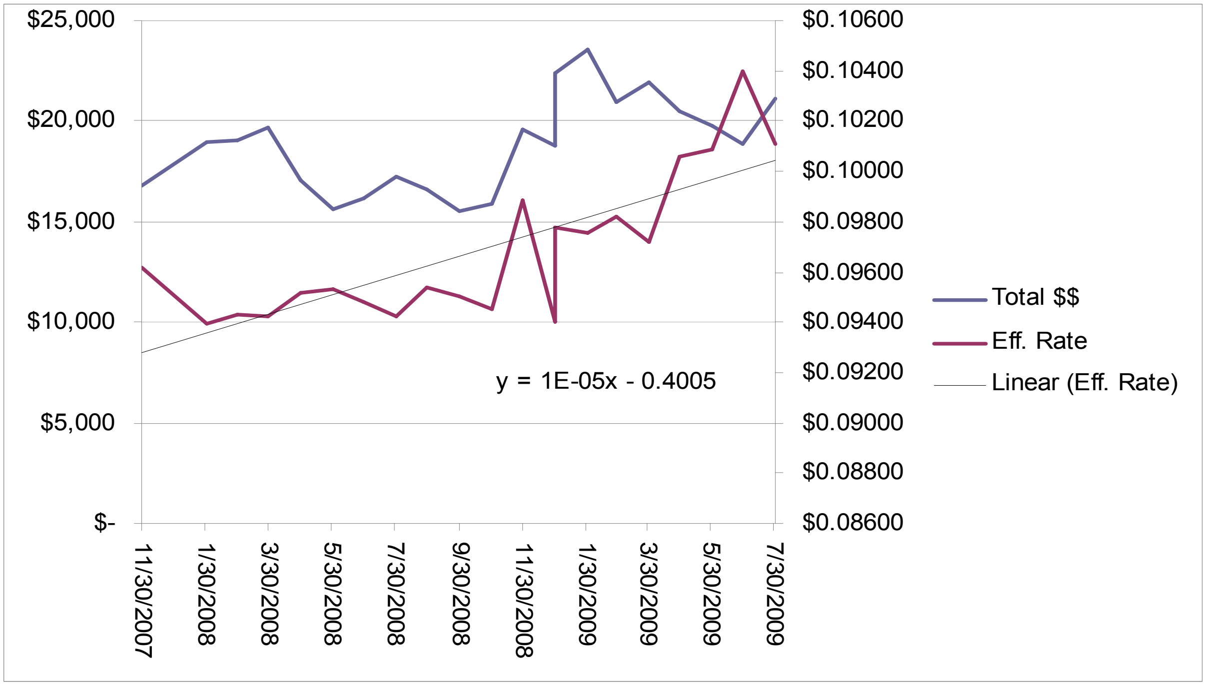
Charts and Graphs

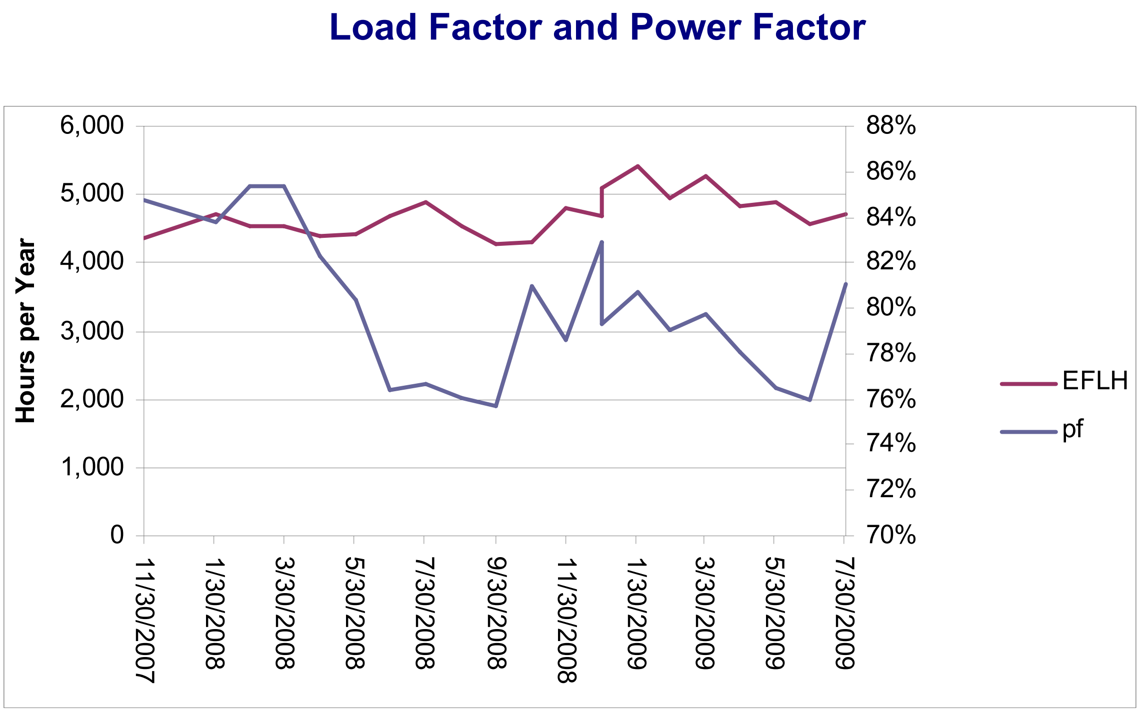


Electricity – Demand and kWhrs



Electricity Rates




Load Factor and Power Factor
Hours per Year
6,000
5,000
4,000
3,000
2,000
1,000
0
88%
86%
84%
82%
80%
78%
76%
74%
72%
70%
11/30/2007
1/30/2008
3/30/2008
5/30/2008
7/30/2008
9/30/2008
11/30/2008
1/30/2009
3/30/2009
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EFLH
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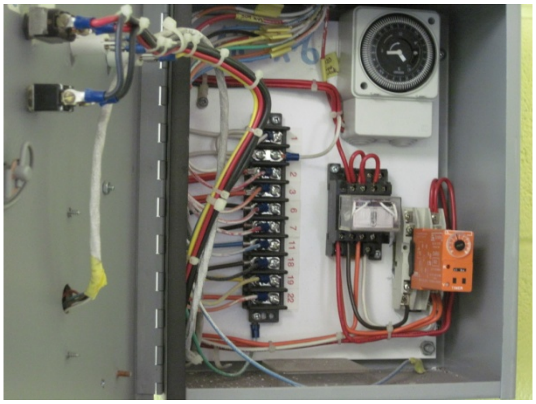
3.0 Mechanical and HVAC Systems

3.1 General Information and Observations

Rooftop HVAC Units and Controls



- The MR Facility is heated and cooled via eight HVAC units
- These units consist of a built-up air-handling system with indirect gas heater plus a split DX coil for cooling. The condensing units range from 1.5 to 3 tons. 7 of the units condition the sorting rooms and the 8th serves the locker and lounge areas
- Each unit is connected to a wall-mounted thermostat with built-in electro-mechanical time-clock. The time-clocks have apparently never been used.
- Filters are reportedly changed once per month, and a change was being done during the survey. We examined some of the discarded filters; they appeared to be only lightly charged with material. Filters actually work best when they have some material accumulation in them. We believe that considerable extra labor and material is being used to replace filters which still have useful service life.

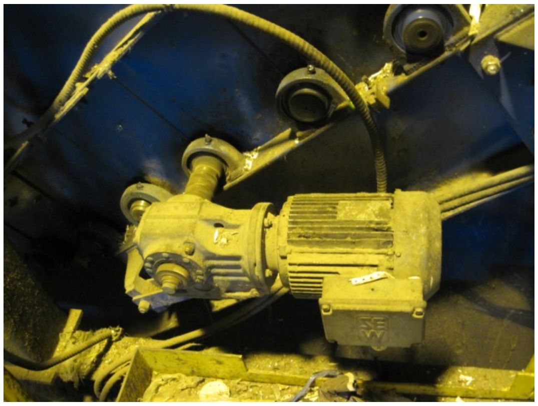
A more reliable means to service filter banks is by measuring their differential pressure, and changing them when the DP reaches the manufacturer's recommended level. This is a standard practice where either the signals from a DP sensor are tied to a BAS or someone regularly reads an external pressure differential display.

Makeup Air Units

- Two additional 30,000 CFM direct gas-fired makeup air units supply the building. One is located on the roof, the other on a steel platform off the north end of the building. They are 100% outside air units. Based on the gas usage for the facility and the lack of automatic controls, we believe these operate 24/7.

VFD's on Conveyor Motors

- Many of the conveyor motors are controlled by Variable Frequency Drives - VFD's. Reportedly, they are only used in a constant speed application for setting the appropriate line speed, (as opposed to feedback control as is the case in HVAC applications). They are also being used to provide “soft start” capability because of the VFD’s ability to ramp up to full speed gradually.
- However, noise and disturbances in electrical power supply are common and these tend to trip VFD's, which then have to be manually restarted. This limits the effectiveness of the soft start capability.
- The VFD’s in operation at the MR Facility have an inherent 5% energy loss. This is the amount of energy they use even if the controlled motor is running at the 100% setting. In such cases the VFD is costing a 5% energy premium with no benefit.



Dust Collection System

- A Farr Gold-Series dust collector is mounted outside the East building wall, with pickups extending into the plant, mostly to transfer points on conveyors where dust can be expected to develop. The unit is a cyclonic bag type, with automatic compressed air bag shakers. A small motor at the bottom of the cone appears to be for pushing the collected dust into a trash container.
- The unit has a 100 hp motor. Motors this size have a high efficiency and power factor whether premium duty or not. However, the amp measurements of the unit show that it actually draws only 67 hp and probably could be replaced with a 75 hp motor should it ever fail.

Electric Baseboard Heaters

- Heating in upper office, washroom and locker areas is by electric baseboard. There appear to be no controls on this equipment other than the unit-mounted dial thermostats. As a result there is no setback, time-clock or other automatic scheduling control.

3.2 Mechanical and HVAC Measures

3.2.1 Premium Efficiency Motors

We conducted an amperage measurement analysis on the electric motors in the facility; this analysis indicates many of the electric motors in the facility are significantly under-loaded if they were sized appropriately initially. Some or all may have been oversized - no data are available on actual motor hp. Through motor amperage, we can determine the percentage of loading. The average loading for all motors in the facility is 53%. Motor power factor drops below 40% if the loading is 50% or less, therefore this is a significant source of energy waste.

Replacing some of the facility motors with new Premium Efficiency motors will deliver benefits through two ways:

- The new motors can be properly sized, ensuring they operate in the most efficient part of their torque curve (oversized motors waste energy because they are too lightly loaded and operate at an inefficient part of their torque curve)
- The new motors, on an equal horse power comparison, are more efficient than older motors

The payback varies by the size of the motor. Overall, motors 2 hp and larger up to 25 hp are good candidates for this replacement. This represents a total of 37 out of 136 motors surveyed.

Where VFD's are in use, they will be reset a few percent due to the higher native speed of the premium efficiency motors. There is an incentive program from Ontario Power Authority for replacement of electric motors; the incentive is very small, about 1$ per hp, or less than 0.3% of the motor material cost.

3.2.2 Capacitor System Repair

The existing capacitor bank for power factor correction was diagnosed with failed sections over five years ago, and currently operates at only 35% capacity. As a result, the facility has been paying approximately $1700 per year in power factor penalties. Correction of this problem is much less expensive than the original installation cost.

3.2.3 Energy Saver Units

Energy Saver Units are an electrical device which converts a portion of the electrical losses (reactive power and harmonics) to real power. In so doing, they reduce kW and kVA, leading to higher power factor and lower electricity costs. Six of these units will be installed at various locations, as close to the motors in question as possible (or at the respective MCC's). The building power factor is running at 80% at the main service, while it is 64% at MCC #1 and 70% at MCC #2 – both very low levels. This poor power factor means that the distribution system is carrying almost 100% over-current above what is required to meet the loads, which contributes to both energy losses and wear on the distribution system. The ESU's will alleviate this problem and provide the added benefit of a high level of surge protection.

3.2.4 Building Automation System

The eight HVAC units, two Make-Up Air units and eight exhaust fans in the facility have only minimal controls in the form of simple room thermostats. These thermostats have no set back capability, and where they have rudimentary time-clock function, it has never been used. The entire building is conditioned for both heating and cooling, and no differentiation is made between the heavily-occupied sorting areas and the lightly-occupied conveyor, tipping and baling areas.

Analysis of the facility power quality audit shows that despite a stated operating schedule of 11 hours per day 5 days per week, the main power level never drops below approximately 200 kW, which is a high level for an unoccupied facility. This suggests a lot of large equipment continues to operate at all times.

A Building Automation System (BAS) is proposed to control all of the main HVAC systems and other significant equipment in the facility. The BAS would allow temperature adjustment based on time-of-day and outside air conditions, setback during the extensive off-hours, and shutoff during unoccupied hours with mild outside conditions.

Further, there appears to be as much as 100 kW of electric heat in use. Unless this can be economically converted to gas heat, the BAS will allow at least some savings, especially in areas with limited or occasional occupancy.

3.2.5 Ventilation Control via VOC Sensors

In the tipping and bailing areas (and occasionally elsewhere where lifts are used), front end loaders and semis are in operation producing significant quantities of diesel fumes. When the outside doors are open (primarily summer), negative pressure and stack effect move these fumes into the building interior. When the doors are closed (primarily winter), diesel fumes accumulate.

At noted earlier, two 30,000 CFM make-up air units along with associated exhaust fans ventilate these areas. Often, the amount of air supplied is too much. By installing VOC sensors controlling new VFD's on the supply and exhaust fans, the energy to condition the building open areas can be reduced while maintaining and even improving air quality.

This is because the sensors will be measuring the actual levels of VOC's in the air (VOC stands for Volatile Organic Compounds, which include CO_2, CO, most solvents, diesel smoke, and many other contaminants). The sensors will send a signal to the proposed building automation system (BAS), which will control the operation of the HVAC equipment for proper space and air ventilation.

3.2.6 HVAC filter ΔP tracking

Filters are changed every month for the HVAC units, regardless of amount of buildup. We were able to see filters just removed. Elapsed time and inspection are not reliable measures of the need for filter change; only filter weighing (not normally practical) or use of ΔP tracking are accurate.

We propose to install ΔP sensors for the HVAC unit filter banks tied into the new HVAC controls to signal maintenance when filter replacement is required. This will not only save filter costs, but will improve and ensure air quality.

3.2.7 Control Changes to Existing VFD's

Many of the larger motors in the Facility are VFD controlled, although not for modulating control, and many are set at a 100% operating speed. As a result, the intent of the VFD's is largely defeated providing no efficiency benefit at all.

The parasitic losses of these drives are at least 5%. Therefore we recommend that the VFD's for these motors be set to bypass until such time as the VFD's are needed. The soft-start capability of the VFD's is of limited value for relatively small motors being rarely cycled, and the surge protection from the Energy Saver units will further protect the motors.

We have identified 31 potential motors as candidates, with 20 of these having VFD's and being operated at full speed. This measure will not apply to those motors replaced with premium efficiency versions. In those cases, the associated VFD will be used for modulating control.

4.0 Lighting

4.1 General Lighting

The majority of the MR Facility operation is lit with High Pressure Sodium (HPS) industrial fixtures (together with a small number of 250 watt High Intensity Discharge (HID) fixtures). The HPS fixtures are 400-watt high-bay lights suspended from the open ceiling structure. They produce a golden-yellow monochromatic light which appears dim inn comparison to other light sources due to their low colour rendering Index (CRI).

Interviews we conducted with MRF staff and supervisors confirmed this observation. Generally speaking, HPS lamps have a CRI of approximately 20 to 22 when compared to daylight (or a reference lamp source) which have a CRI of 100.

This type of industrial lighting is a prime candidate for redesign with high efficiency T5 High-Output (HO) or T8 fluorescent lighting technology. T8 and T5 High-Output fluorescent lamps have a CRI of 82% to 95%, therefore the resulting light colour in the work spaces will be vastly improved.

The proposed redesign would consist of replacing the existing 400-watt HPS industrial fixtures with new T5 High-Output fluorescent luminaires to increase vision acuity and space colour rendering and reduce the electrical load for these spaces by 22% compared to the existing lighting system.

A complete redesign also provides numerous other advantages over the HPS and HID sources, by eliminating startup and re-strike delays (inherent to HID lamps after a brown-out or turning off), built-in redundancy with multiple lamps per luminaire to reduce dark spots should one lamp in a fixture fail, space noise reduction (no humming ballasts), no flicker or strobe effect on motors or rotating equipment, and improved visual acuity and safety for occupants and personnel from the significantly higher CRI.

The purposed T5 high-output luminaires also have the added option of being equipped with internal standby battery packs and ballast technology for “ride-through” capability during power outage or utility generated brown-outs – another safety benefit for the MRF staff.

4.2 Occupancy Lighting Controls

Occupancy lighting controls were found in most of the MRF sorting rooms with the exception of Residential Sorting Room location which had its original occupancy sensor removed when a second conveyer line was added. Our recommendation would be install a new occupancy sensor in this area as well as re-commission all existing occupancy sensors confirm they are operating correctly in each area.

4.3 Incandescent EXIT Signs

EXIT fixtures with incandescent lamps were found at several fire egress door locations throughout the MRF building. Our recommendation is to retrofit or replace these EXIT signs with new solid-state LED (Light Emitting Diode) lamps or entirely new EXIT signs. Exit signs with battery packs and emergency lighting heads should also be upgraded with equivalent LED units.

5.0 Thermal Solar Wall

While not in the category of retrofitting buildings for increased efficiency, renewable energy measures seek to harvest renewable sources of energy to reduce the dependency on conventional energy sources.

In the case of the MR Facility we investigated the viability of a passive thermal solar wall and a solar PV system. This section describes the thermal solar wall; Section 6.0 describes the Solar PV system.

5.1 Thermal Solar Wall

A solar wall is a passive solar heating system captures renewable energy in the form of thermal radiation from the sun to pre-heat outside air used for building ventilation.

Using a self contain ventilation system the solar wall can preheat intake air by as much as 30° C (54° F), thereby displacing the need to heat this air using conventional gas or electrical means resulting in significant annual heating savings – and a solar wall is a fully recognized renewable energy source which reduces green house gas emissions.

The proposed solar wall will consist of vertical transpired collector cladding installed on the exterior of the building as follows:

- On the upper half of the south-west facing walls along the Baling and Sorting-Conveyer sections and,
- Along the south-west and south-east walls of the Tipping Floor section exterior

The cladding provides additional benefits including:

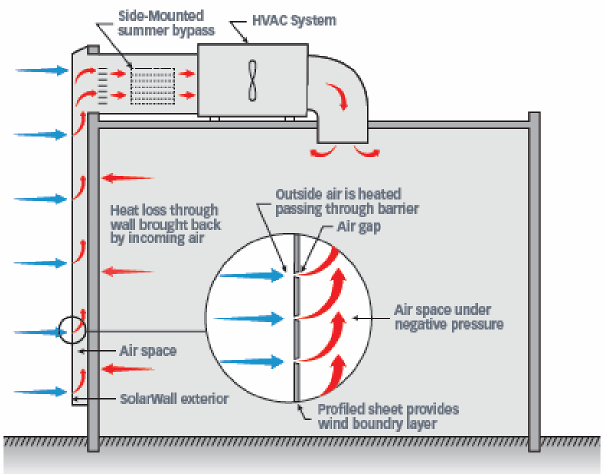
- Upgraded weather resistance of the building exterior
- Reduced heat loss of walls through increased insulating properties
- De-stratification of trapped ceiling heat in large condition spaces
- Improved air quality by continuous induction of fresh air, elimination of drafts and negative air pressure problems

The proposed system for the MR Facility uses two systems to heat interior spaces: a self contain ventilation system for the Baling and Sorting/Conveyer sections and a pre-heating conditioning system for the Tipping Floor fresh air make-up unit.

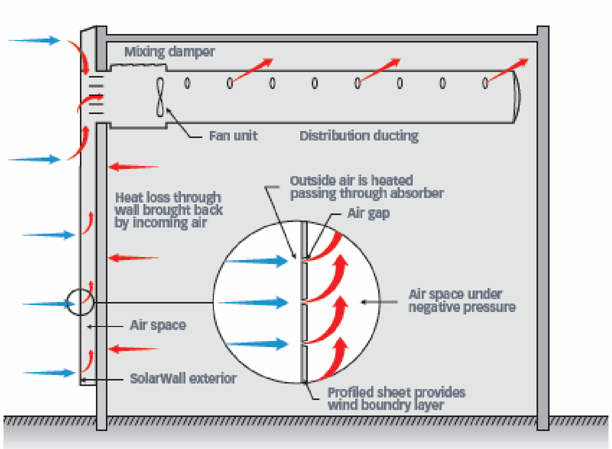
The Ontario government is making $14.4 million available over four years to encourage the industrial/commercial/institutional sector to convert to solar thermal heating.

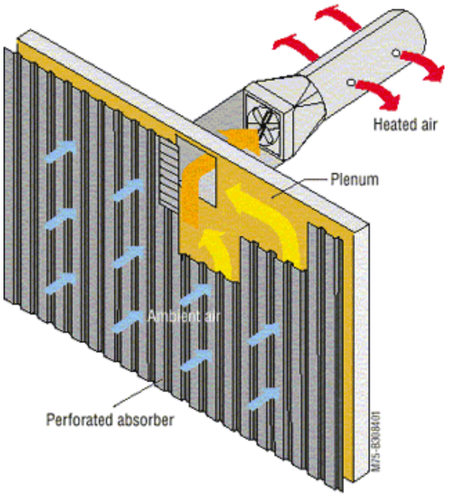
This initiative is cumulative to the Federal ecoENERGY Renewable Heat Program. The Federal program allows businesses, industries, schools, universities, municipalities and hospitals to receive 25% of the cost of the installation of a solar thermal heating system to a maximum of $80,000. The Ontario Provincial government will match the Federal offer and contribute an additional 25% leading industrial/commercial/institutional solar projects to receive a 50% rebate on the initial upfront development costs. Overall an attractive incentive package. We have included some illustrations here for more clarity.

Tipping Floor – Solar Wall HVAC Pre-heat System with Summer Bypass Louvers:

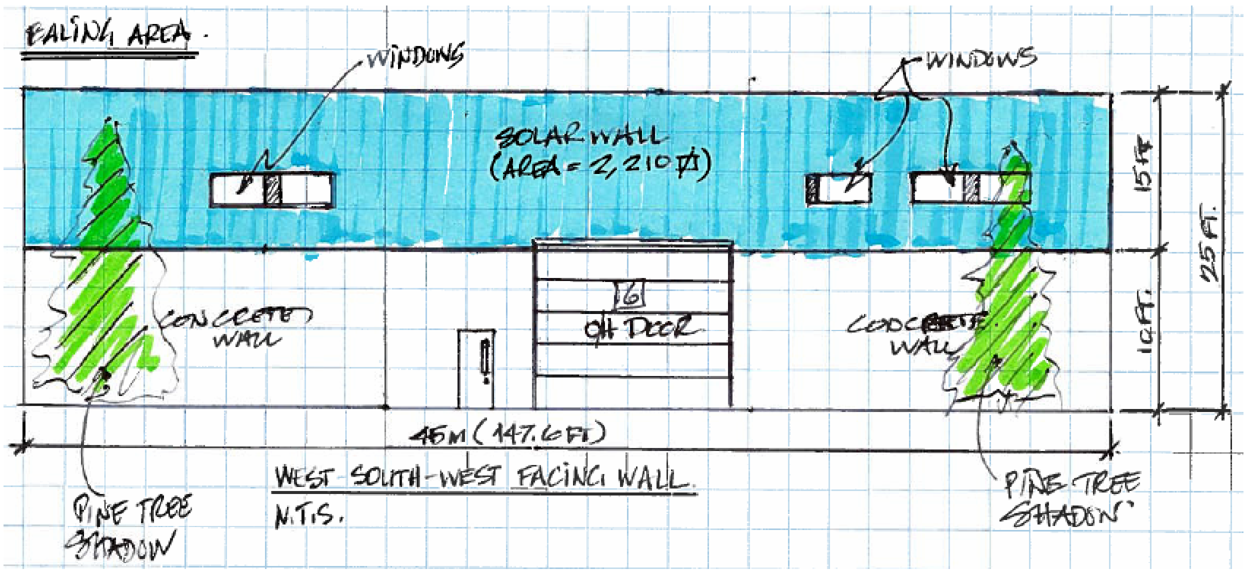


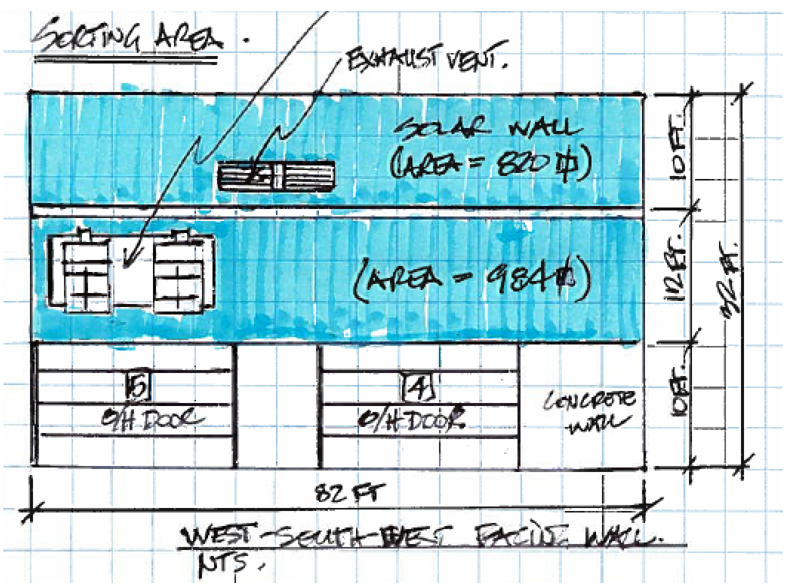
Sorting/Conveyer Sections – Solar Wall Air Heating - Distribution Duct System with Summer Bypass Louvers:



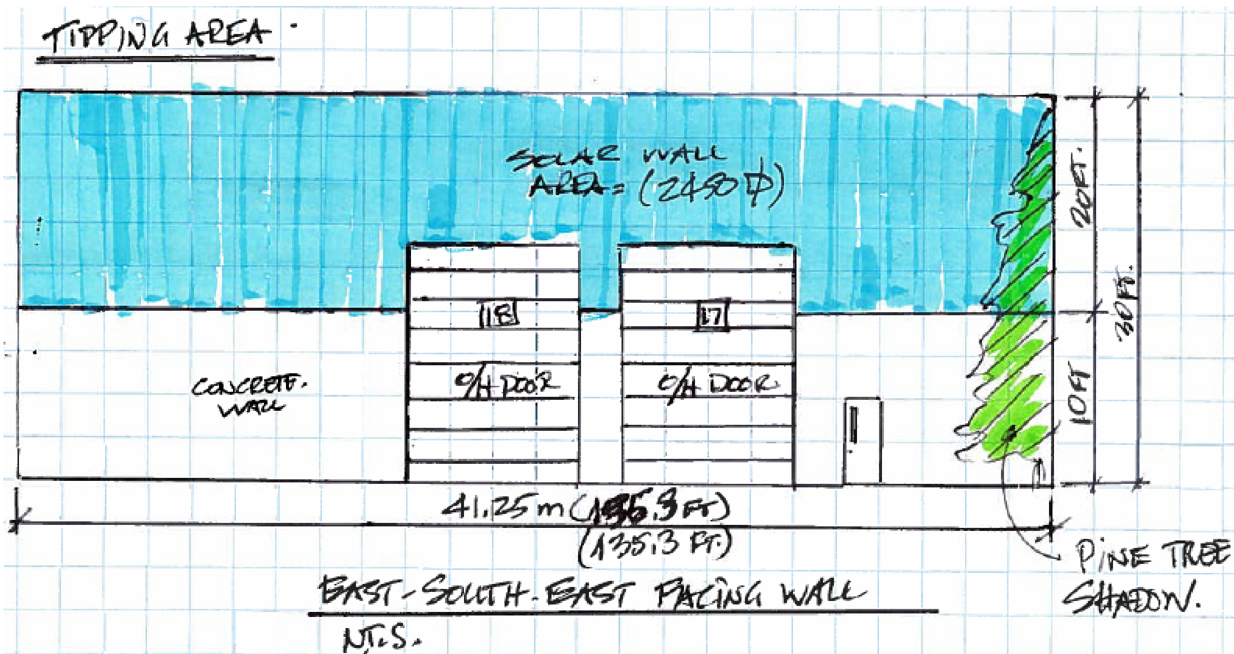


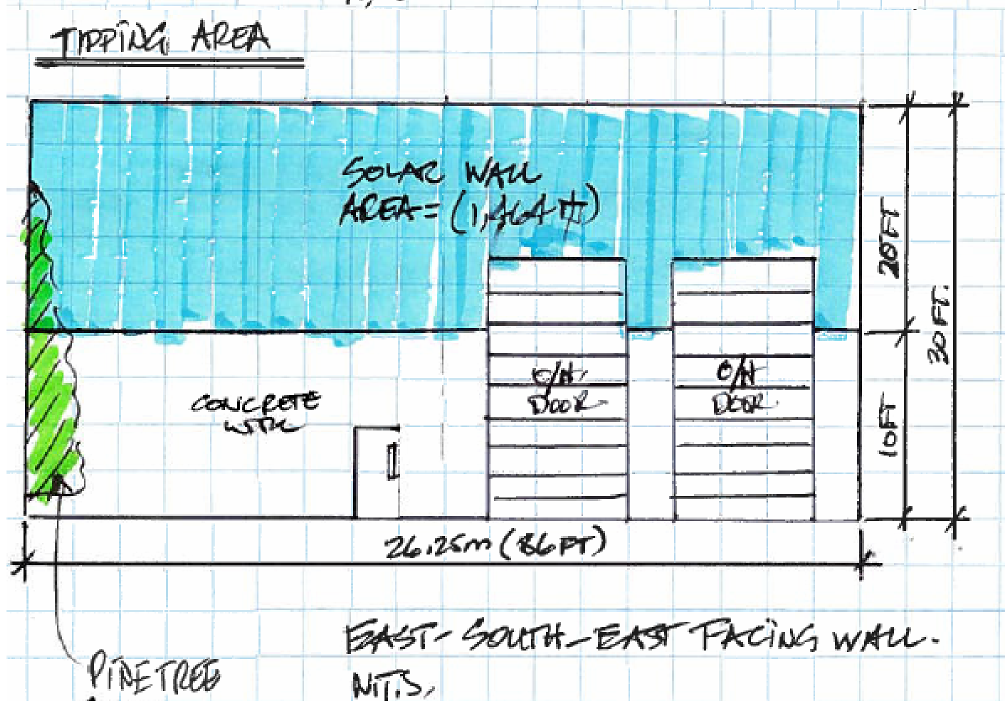
The illustrations below are conceptual drawings of the building façade in the Bailing and Sorting areas (coloured in blue):





The illustrations below are conceptual drawings of the building façade in the Tipping area (coloured in blue):





6.0 Solar Photovoltaic (PV) System

As mentioned earlier in the report renewable energy measures seek to reduce facility dependency on conventional energy sources such as natural gas and grid power.

Given the large open roof of the MR Facility, it is a good candidate for a roof-top solar PV system. Based on our preliminary assessment (intentionally conservative at this juncture), approximately 200 kW of solar power could be realized (possibly more depending on permitted roof coverage and roof load-bearing capacity).

6.1 Ontario Power Authority FIT Program

The Province of Ontario through the Green Energy Act, more specifically through the Feed-In-Tariff (FIT) Program administered by its agency, the Ontario Power Authority, has taken an aggressive approach aimed at encouraging solar PV energy development in Ontario.

Depending on the size and type (roof vs ground mounted) the OPA FIT Program will pay between $0.13 and $0.80 per kWh for a term of 20 years for electricity generated by a solar PV system.

6.2 Preliminary Analysis for the Guelph MRF

Based on a 200 kW PV system the following analysis would apply:

- 200 kW of solar panel capacity inclined at 30 to 45 degrees – roof-mounted and south facing
- Energy production based on historical data for solar PV in Ontario is 1100 kWh/kW/year
- 200 kW times 1100 kWh/kW/yr = 220,000 kWh annual energy production

Based on these figures, a 200 kW PV system would produce approximately 220,000 kWh's per year at the facility.

Referencing the OPA Guidelines (Appendix II), this would result in the following basic terms:

- For a system size between 10 kW and 250 kW
- OPA contract price = $0.713/kWh
- Term of 20 years

Therefore the OPA would be prepared to pay $0.713 times 220,000/year = $156,860 per year for 20 years, or $3,137,200 over the term of the agreement.

The cost of a solar PV system varies depending on size, location, panel type, roof-type, electrical connection, metering requirements, etc, however for this preliminary analysis we have assumed a range of $6,000 to $7,000 per kW, therefore the cost of a 200 kW system for the MRF would be $1.2 to $1.3 million.

The solar PV system would add an additional 275 tonnes/year of GHG avoidance to the program.

With an initial capital cost of between $1.2 and $1.4 million and a revenue stream of approximately $3.14 million over 20 years, we feel the solar PV measure merits a more detailed analysis which would include the following:

- Detailed concept and design specific to the facility
- Solar resource study (solar measurements)
- Roof coverage, racking system, and load-bearing analysis
- Implementation plan
- Detailed budget and financial analysis
- Initiate discussions with the Ontario Power Authority
- Initiate discussions with Guelph Hydro

We propose to undertake this work scope given sufficient interest from the WDO, CIF and City of Guelph. We would be pleased to meet with the WDO to discuss the solar PV measure in greater detail towards gaining their approval to proceed with further study.

In the interim, an aerial view of the Material Recovery Facility and preliminary concept for a solar PV system are included here in Appendix III for illustrative purposes.

7.0 Sorting Rooms Lighting and HVAC

Over the course of our audit we observed the nature of the MRF operations in the conveyer sorting areas. There are 5 rooms in all as listed here. Three are in operation while two are currently not in use:

Those in use and where staff work are:

- Pre-Sort Sorting Room
- Residential Sorting Room
- Secondary Sorting Room

Those currently not in use or are not staffed are:

- Aluminum Recovery Station
- Commercial Sorting Room

7.1 Sorting Rooms Lighting

We observed a significant lighting issue in the sorting rooms due to light contrast levels. F32 T8 lighting is used directly over the conveyer belts in these areas, providing light levels of 450 to 500 lux (which meets/exceeds the recommended levels for the sorting task in these areas). However, the adjacent passage ways between conveyer lines and the walls in the conveyor belt rooms are significantly under lit. This results in significant contrast between the area over the belts and the balance of the work space. The contrast factor is 6:1 to as much as 15:1 in certain spots.

The human eye has difficulty adjusting from light to dark when contrast levels exceed 5:1. As in the case of coming into a dark room from outside on bright sunny day, the eye takes several seconds to adapt, and this delay takes longer as one gets older.

High contrast lighting environments create a safety hazard for workers when moving through spaces or around equipment as is the case in the sorting rooms we observed.

Consider:

- High light levels over the belts
- The movement of the belts themselves
- The need for workers to glance up at shelves placed on the walls opposite their work station to observe "sample items" for picking and then look down again at the belts

These factors combine to create significant eye strain and disorientation. We also observed many of the conveyer belts have elevated platforms and there have been reports of workers becoming disoriented and even falling off these platforms when stepping down from them. The solution to this issue is to provide higher illumination levels on the walls and areas around the sorting belts to reduce the light contrast levels.

We also observed the existing light fixtures are positioned such that air from the ventilation system is causing significant dust and dirt accumulation on the fixtures. This both reduces the light output from the fixtures as well as shortening their service life.

As a minimum, we recommend the following:

- One step would be to raise the existing lighting system above the conveyer sorting line by two feet (where possible). The increased height will result in better illumination of the walls and passage ways, thereby somewhat alleviating the lighting contrast issue.

- A second measure would be to move lighting found directly under air vents to a location slightly over the passage ways and closer to the walls. This would also improve the lighting and result in less accumulation of dust\dirt on lamps and fixtures.

A more comprehensive solution would involve replacement of the existing lighting with new enclosed luminaires, complete with dust-proof wrap-around lenses to reduce dust and dirt accumulation.

The new system would produce even light levels throughout the walls and ceilings in these areas, reduce eye strain for staff, and reduce the associated maintenance for this equipment.

7.2 Sorting Rooms HVAC

Base on our observations and interviews with staff, the HVAC delivery for the sorting rooms is adding to the difficult work environment in the sorting rooms.

The air delivery in these areas has been configured to dump air from directly above and onto the conveyor belts, which then blows odors and dust up and towards the workers. The temperature of the air is also impacted by the materials on the belts thereby reducing its intended heating or cooling effect. In addition, no air can reach below waist level for the workers, further reducing comfort. This creates an unnecessarily uncomfortable work situation causing undue fatigue.

In addition to the conditions described above, fumes, dust and odours enter the sorting rooms from other areas of the facility.

A proposed solution would include the following:

- Modify the ductwork so that air is supplied behind the workers so it flows down to the floor and then upwards. Note: this would work in concert with our proposed change to the lighting in these areas so that air vents no longer foul the light fixtures.

- Increase the air supply levels and/or reduce exhaust so the sorting area is maintained at a positive pressure with respect to the rest of the building. This will prevent dust, odors and diesel fumes from entering the sorting areas.

We have not included a budget for the lighting and HVAC suggestions made here as they result in little or no savings. Given that we often make such observations during our assessments, we report them and can develop a budget and plan for their inclusion in our program. As such we would seek the WDO's input in this regard.