



## Regular Council Meeting

<b>To:</b>	Mayor and Council
<b>Date:</b>	Dec. 6, 2021
<b>From:</b>	Wayne Hancock, Director of Public Works Kimberley Pope, Director of Finance/Treasurer
<b>Report Number:</b>	Public Works 2021-22
<b>Subject:</b>	Municipal Solar Units December Update

### Recommendation:

That Council receive Public Works Report 2021-22 for information.

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### Overview:

At the November 15<sup>th</sup> Council meeting during discussion on the Public Works Report 2021-20, staff were requested to report to Council outlining the actual versus the projected cost to date, to include the annual deficit with break-even point and provide projections for the solar program.

Attachment No. 1 is an updated spreadsheet containing the additional requested financial information including net annual revenue/deficit, break-even point, cumulative surplus and deficits.

The 20-year average estimated Net Revenue per 10Kw unit is \$48,413, after loan repayments, disposal allocations, maintenance, data monitoring and hydro expenses have been paid. In 2027, the Solar Units reach the break-even point and provide a cumulative surplus thereafter available for transfer to reserves.

November 15, 2021 Motion;

That Council receive Public Works Report 2021-20 for information; and  
That Council approve a reduced interest rate on the internal Solar units loan, from the Asset Replacement Reserve, to two percent (2%) interest from six percent (6%) on the principal of \$161,161.56 remaining at December 31, 2021 under the existing term ending January 1, 2025; and  
That Staff report back to Council after the one year period on the success of the ongoing maintenance program, monitoring of the system and revenues by Generation Solar; and  
That Staff report back to Council outlining the actual versus the projected cost to date and include the annual deficit and provide projections for the solar program.

**Attachments:**

1. Solar Power on Municipal Properties (ARR Loan) with Estimated Revenues & Repayment Terms w. Break Even Point
2. Public Works Report 2021-20

Respectfully Submitted by,

Wayne Hancock,  
Director of Public Works

Kimberley Pope,  
Director of Finance/Treasurer

Reviewed by,

Yvette Hurley  
Chief Administrative Officer

# Attachment No.1 - Solar Power on Municipal Properties (ARR Loan) with Estimated Revenues & Repayment Terms w. Break Even Point

## Solar Power on Municipal Properties (ARR Loan)

with Estimated Revenues & Repayment Terms (11 year term, 20 year useful life)

Eight (8) \$10 Kw ground Mount (based on estimated revenue of \$0.445 per kW generated)

revised Nov. 2021 with reduced interest to 2% (2022-2025)

### PW 2013-26, MicroFIT Projects on 2 Municipal Properties

Equipment, Installation & Warranty per 10kw Unit	\$ 51,490.56
Capital Cost for two (2) 10kw Units	\$ 102,981.12

### PW 2013-29, Solar Power on 6 (revised) Municipal Properties

Equipment, Installation & Warranty	\$ 51,490.56
Hydro One	\$ 2,000.00
Fencing	\$ 3,000.00
Capital Cost per 10kw Unit	\$ 56,490.56
Capital Cost for Nine (6) 10kw Units	\$ 338,943.36
Plus: Additional Hydro Line	\$ 19,334.40

**Total Cost of Eight (8) 10kw Units** **\$ 461,258.88**

	2014		2015		2016		2017		2018		2019		2020		TOTAL
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	
Revenue of two (2) 10kw Units, PW 2013-26	\$ 16,020.00	\$ 28,103.96	\$ 16,020.00	\$ 14,917.25	\$ 16,020.00	\$ 14,648.49	\$ 16,020.00	\$ 11,699.90	\$ 16,020.00	\$ 10,845.51	\$ 16,020.00	\$ 10,064.97	\$ 16,020.00	\$ 9,628.43	
Revenue of Six (6) 10kw Units, PW 2013-29	\$ 48,060.00	\$ 77,919.18	\$ 48,060.00	\$ 39,604.63	\$ 48,060.00	\$ 39,983.91	\$ 48,060.00	\$ 33,278.59	\$ 48,060.00	\$ 32,316.07	\$ 48,060.00	\$ 32,994.27	\$ 48,060.00	\$ 26,523.80	
<b>Total Gross Revenues</b>	<b>\$ 64,080.00</b>	<b>\$ 106,023.14</b>	<b>\$ 64,080.00</b>	<b>\$ 54,521.88</b>	<b>\$ 64,080.00</b>	<b>\$ 54,632.40</b>	<b>\$ 64,080.00</b>	<b>\$ 44,978.49</b>	<b>\$ 64,080.00</b>	<b>\$ 43,161.58</b>	<b>\$ 64,080.00</b>	<b>\$ 43,059.24</b>	<b>\$ 64,080.00</b>	<b>\$ 36,152.23</b>	
Loan Repayment - Principal	-\$27,922.62	-\$27,922.62	-\$32,260.03	-\$32,260.03	-\$34,249.76	-\$34,249.76	-\$36,362.21	-\$36,362.21	-\$38,604.95	-\$38,604.95	-\$40,986.02	-\$40,986.02	-\$43,513.95	-\$43,513.95	
Loan Repayment - Interest (6% 2014-2021, 2% 2022+)	-\$29,460.02	-\$29,460.02	-\$25,122.61	-\$25,122.61	-\$23,132.88	-\$23,132.88	-\$21,020.43	-\$21,020.43	-\$18,777.69	-\$18,777.69	-\$16,396.62	-\$16,396.62	-\$13,868.69	-\$13,868.69	
\$5,000/unit (6 units) Disposal Allocation to Reserve	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	
\$10,000/unit (2 units) Disposal Allocation to Reserve	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	
Maintenance, Data Monitoring & Hydro	-\$3,200.00	-\$2,701.00	-\$3,200.00	-\$2,889.42	-\$3,200.00	-\$6,131.70	-\$3,200.00	-\$449.79	-\$3,200.00	-\$4,956.28	-\$3,200.00	-\$2,821.56	-\$3,200.00	-\$5,307.56	
<b>Total Expenses</b>	<b>-\$63,082.64</b>	<b>-\$62,583.64</b>	<b>-\$63,082.64</b>	<b>-\$62,772.06</b>	<b>-\$63,082.64</b>	<b>-\$66,014.34</b>	<b>-\$63,082.64</b>	<b>-\$60,332.43</b>	<b>-\$63,082.64</b>	<b>-\$64,838.92</b>	<b>-\$63,082.64</b>	<b>-\$62,704.20</b>	<b>-\$63,082.64</b>	<b>-\$65,190.20</b>	
<b>Net Annual Revenue/Deficit</b>	<b>\$997.36</b>	<b>\$43,439.50</b>	<b>\$997.36</b>	<b>-\$8,250.18</b>	<b>\$997.36</b>	<b>-\$11,381.94</b>	<b>\$997.36</b>	<b>-\$15,353.94</b>	<b>\$997.36</b>	<b>-\$21,677.34</b>	<b>\$997.36</b>	<b>-\$19,644.96</b>	<b>\$997.36</b>	<b>-\$29,037.97</b>	
<b>Cumulative Surplus/Deficit</b>		<b>43,439.50</b>		<b>35,189.32</b>		<b>23,807.38</b>		<b>8,453.44</b>		<b>-13,223.90</b>		<b>-32,868.86</b>		<b>-61,906.83</b>	
	2021		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	TOTAL
	Budget	Estimated YE	Budget	Budget	Budget	Budget	Budget	Budget	Budget	Budget	Budget	Budget	Budget	Budget	
Revenue of two (2) 10kw Units, PW 2013-26	\$ 16,020.00	\$ 9,359.72	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 296,468.23
Revenue of Six (6) 10kw Units, PW 2013-29	\$ 48,060.00	\$ 28,011.52	\$ 46,800.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 886,091.97
<b>Total Gross Revenues</b>	<b>\$ 64,080.00</b>	<b>\$ 37,371.24</b>	<b>\$ 62,400.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 63,660.00</b>	<b>\$ 1,182,560.20</b>
Loan Repayment - Principal	-\$46,017.24	-\$46,017.24	-\$48,222.80	-\$53,713.37	-\$54,797.54	-\$4,608.40									-\$461,258.88
Loan Repayment - Interest (6% 2014-2021, 2% 2022+)	-\$11,365.40	-\$11,365.40	-\$2,554.08	-\$1,679.59	-\$595.42										-\$163,973.44
\$5,000/unit (6 units) Disposal Allocation to Reserve	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$1,500.00	-\$30,000.00
\$10,000/unit (2 units) Disposal Allocation to Reserve	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$1,000.00	-\$20,000.00
Maintenance, Data Monitoring & Hydro	-\$3,200.00	-\$26,765.90	-\$10,000.00	-\$10,000.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$4,800.00	-\$120,023.21
<b>Total Expenses</b>	<b>-\$63,082.64</b>	<b>-\$86,648.54</b>	<b>-\$63,276.88</b>	<b>-\$67,892.96</b>	<b>-\$62,692.96</b>	<b>-\$11,908.40</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$7,300.00</b>	<b>-\$795,255.53</b>
<b>Net Annual Revenue/Deficit</b>	<b>\$997.36</b>	<b>-\$49,277.30</b>	<b>-\$876.88</b>	<b>-\$4,232.96</b>	<b>\$967.04</b>	<b>\$51,751.60</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$56,360.00</b>	<b>\$ 387,304.67</b>
<b>Cumulative Surplus/Deficit</b>		<b>-111,184.13</b>	<b>-112,061.01</b>	<b>-116,293.97</b>	<b>-115,326.93</b>	<b>-63,575.33</b>	<b>-7,215.33</b>	<b>49,144.67</b>	<b>105,504.67</b>	<b>161,864.67</b>	<b>218,224.67</b>	<b>274,584.67</b>	<b>330,944.67</b>	<b>387,304.67</b>	

Break Even Year

20 year Average Estimated **Gross Revenue** of Installation/ 10 Kw unit \$ 147,820.03  
 20 year Average Estimated **Net Revenue** of Installation/ 10 Kw unit \$ 48,413.08



## Regular Council Meeting

<b>To:</b>	Mayor and Council
<b>Date:</b>	November 15, 2021
<b>From:</b>	Wayne Hancock, Director of Public Works
<b>Report Number:</b>	Public Works 2021-20
<b>Subject:</b>	Municipal Solar Units Update Revised

### Recommendations:

1. That Council receive Public Works Report 2021-20 for information; and
2. That Council approve a reduced interest rate on the internal Solar units loan, from the Asset Replacement Reserve, to two percent (2%) interest from six percent (6%) on the principal of \$161,161.56 remaining at December 31, 2021 under the existing term ending January 1, 2025; and
3. That Staff report back to Council after the one year period on the success of the ongoing maintenance program, monitoring of the system and revenues by Generation Solar.

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### Overview:

On June 7, 2021 Public Works presented the Municipal Solar Units Update Report 2021-11, to bring forward an information report on the present feed in tariff MicroFIT contracts with Hydro One and several of the issues staff have been dealing with over the last number of years.

Council passed a motion “that Council receive the Municipal Solar Units Update for information; and that staff report back to Council with additional information with a comprehensive review and financial breakdown on the solar unit program to date including the expenses and revenues and the impact of the interest rate at three percent (3%) vs. six percent (6%)”. The Public Works department has reviewed the operations, the ongoing costs incurred to operate the solar units, the revenues achieved and possible improvements to the performance of these solar units.

When the Township first entered into the MicroFIT contracts with Hydro One, we had projected revenues estimated at \$8,000.00/unit per year and a projected loan repayment plan of twelve years, which included an interest rate of 6% payment to the Asset Replacement Reserve, which was the a standard lending rate at that time. The schedule of projected revenue estimates and repayment terms is attached to this report

(Attachment No.1) and was previously provided on historical reports. This schedule included the loan amount, repayment of principle, payment of interest and payment of a reserve fund for the ultimate disposition of the units. This ultimate disposition will be determined at a later date, nearing the end of the present contracts and should be a Report to Council on options on disposition.

During the last number of years, costs have been increasing with increased maintenance costs, and reduced revenues. To compound the problem, the solar industry has changed and many companies who originally installed solar units or maintained them are no longer in business. Staff had worked with various companies on reviewing individual problems and concluded with mixed success. Attachment No. 2 shows the revenues versus costs for the last seven years.

Annually in the budget process, the revenue shortfalls on the solar units budget are reported and have been historically covered by any surplus remaining under the Public Works Department.

In 2019, our Department contacted and hired a company to provide some specific maintenance to our solar units. They are local company and have great expertise in their support staff. The company has arranged to replace key parts to the operation including such parts as inverters, which were under warranty.

Through 2020 and 2021, we have had them review the individual sites to provide comments/recommendations on the sites themselves and review our revenues to date. In Attachment No. 3, the company has provided a Report "Pathway Report for the Township of Cavan Monaghan Toward Maximizing Revenues from Existing Assets". This report outlines the revenues of each site on the second page of the report and it is noted that all sites have fallen short of expectations. It sets out recommendations to correct some issues, such as shading. These issues have been corrected earlier this year. Concerning other operational matters, we have entered into a one-year contract with Generation Solar to ensure proper monitoring is occurring with regular maintenance in place. The annual cost of the contract is \$5,102.00 for all eight units, plus applicable H.S.T.

This company has also projected annual revenues should be at \$7,800.00 per year, which is comparable to our original estimate of \$8,000.00 per year. To monitor our performance through these units, we would have the company perform O & M for the one-year period and report back to Council on the results as it relates to revenues.

### **Financial Impact:**

The original capital cost, in 2013, of eight (8) 10kw Solar Units was \$461,258.88 and was internally financed at the lending rate of six percent (6%) through the Asset Replacement Reserve. A principal value of \$161,161.56 will be remaining as of December 31, 2021 under the existing term with final payment on January 1, 2025.

Attachment No. 1 outlines the original loan, annual loan repayments, disposal reserve transfers and annual maintenance as estimated.

As per Council's motion the Director of Finance, Kimberley Pope, has provided "the impact of the interest rate at three percent (3%) vs. six percent (6%)" comparison. However, we are recommending a two percent (2%) comparison which aligns with current lending rates and matches the internal rate for Development Charges & Federal Gas Tax Reserve balances, as approved by the Auditors, which represents a more current fiscal economic reality.

The following comparators below maintain a principal balance of \$161,161.56 for the Solar Units as of December 31, 2021, with the reduced rate to commence on January 1, 2022 the term ending date of January 1, 2025.

Interest Rate reduced to 3% from 6% (as per motion of Council information request);

- The 3% interest would be reduced the remaining interest revenues to \$7,562.27 from the original \$15,768.25 as projected under the original 6% ARR loan.
- The loss of interest revenue to the ARR reserve will be \$8,205.98 and will also reduce the corresponding interest expense under the Public Works Solar Budget.

Interest Rate reduced to 2% from 6% (as per current lending rates and internal interest rates, as approved by Auditors, used in DC Reserve & Federal Gas Tax Reserve);

- The 2% interest would be reduced the remaining interest revenues to \$5,017.42 from the original \$15,768.25 as projected under the original 6% ARR loan.
- The loss of interest revenue to the ARR reserve will be \$10,750.83 and will also reduce the corresponding interest expense under the Public Works Solar Budget.

Over the past eight years, the Solar Disposal Reserve has accumulated \$20,000 as of December 31, 2021. The annual disposal transfer of \$2,500 will continue for 12 more years to reach the original \$50,000 disposal commitment to the reserve.

Staff are recommending that any future annual surpluses generated, after loan repayment, disposal reserve transfers and operating expenses, to be placed in a separate reserve for Council's future consideration.

**Attachments:**

1. Original Loan Details, Projected Estimated Revenues & Repayment Terms
2. Revenue to Costs Summary 2013-2020
3. Generation Solar Report On Maximizing Revenues

Respectfully Submitted by,

Wayne Hancock,  
Director of Public Works

Kimberley Pope,  
Director of Finance/Treasurer

Reviewed by,

Yvette Hurley  
Chief Administrative Officer

# Attachment No. 1 - Original Loan Details, Projected Estimated Revenues & Repayment Terms

## Solar Power on Municipal Properties (ARR Loan)

### with Estimated Revenues & Repayment Terms

20 year calculation (11 year payback on principal)

Eight (8) \$10 Kw ground Mount (based on estimated revenue of \$0.445 per kW generated)

revised Nov. 2021 with reduced interest to 2% (2022-2025)

	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>	<u>2026</u>	<u>Combined 2027-2033 (same as 2026)</u>	<u>TOTAL</u>	
<b>PW 2013-26, MicroFIT Projects on 2 Municipal Properties</b>																	
Revenue of two (2) 10kw Units	\$ -	\$ 16,020.00	\$ 16,020.00	\$ 16,020.00	\$ 16,020.00	\$ 16,020.00	\$ 16,020.00	\$ 16,020.00	\$ 16,020.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 15,600.00	\$ 109,200.00	\$ 315,360.00	
Equipment, Installation & Warranty per 10kw Unit	\$ 51,490.56																
Capital Cost for two (2) 10kw Units	\$ 102,981.12																
<b>PW 2013-29, Solar Power on 6 (revised) Municipal Properties</b>																	
Revenue of Six (6) 10kw Units	\$ -	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 46,800.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 48,060.00	\$ 336,420.00	\$ 959,940.00	
Equipment, Installation & Warranty	\$ 51,490.56																
Hydro One	\$ 2,000.00																
Fencing	\$ 3,000.00																
Capital Cost per 10kw Unit	\$ 56,490.56																
Capital Cost for Nine (6) 10kw Units	\$ 338,943.36																
Plus: Additional Hydro Line	\$ 19,334.40																
<b>Total Cost of Eight (8) 10kw Units</b>	<b>\$ 461,258.88</b>																
Loan Repayment - Principal		\$ (27,922.62)	\$ (32,260.03)	\$ (34,249.76)	\$ (36,362.21)	\$ (38,604.95)	\$ (40,986.02)	\$ (43,513.95)	\$ (46,017.24)	\$ (48,222.80)	\$ (53,713.37)	\$ (54,797.54)	\$ (4,608.40)	\$ -	\$ -	\$ (461,258.88)	
Loan Repayment - Interest (6% up to 2021, 2% thereafter)		\$ (29,460.02)	\$ (25,122.61)	\$ (23,132.88)	\$ (21,020.43)	\$ (18,777.69)	\$ (16,396.62)	\$ (13,868.69)	\$ (11,365.40)	\$ (2,554.08)	\$ (1,679.59)	\$ (595.42)	\$ -	\$ -	\$ -	\$ (163,973.44)	
\$5,000/unit (6 units) Disposal Allocation to Reserve		\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (1,500.00)	\$ (10,500.00)	\$ (30,000.00)	
\$10,000/unit (2 units) Disposal Allocation to Reserve		\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (1,000.00)	\$ (7,000.00)	\$ (20,000.00)	
Total Annual Maintenance		\$ (3,200.00)	\$ (3,200.00)	\$ (3,200.00)	\$ (3,200.00)	\$ (3,200.00)	\$ (3,200.00)	\$ (3,200.00)	\$ (3,200.00)	\$ (10,000.00)	\$ (10,000.00)	\$ (4,800.00)	\$ (4,800.00)	\$ (4,800.00)	\$ (33,600.00)	\$ (93,600.00)	
Estimated Annual Revenue / (Cost)	\$ 997.36	\$ 997.36	\$ 997.36	\$ 997.36	\$ 997.36	\$ 997.36	\$ 997.36	\$ 997.36	\$ 997.36	\$ (876.88)	\$ (4,232.96)	\$ 967.04	\$ 51,751.60	\$ 56,360.00	\$ 56,360.00		
Total Estimated Revenue of Installation	\$ 997.36	\$ 1,994.72	\$ 2,992.08	\$ 3,989.44	\$ 4,986.80	\$ 5,984.16	\$ 6,981.52	\$ 7,978.88	\$ 7,102.00	\$ 2,869.04	\$ 3,836.08	\$ 55,587.68	\$ 111,947.68	\$ 506,467.68	\$ 506,467.68		
																<i>Average Estimated Revenue of Installation/10 Kw unit</i>	\$ 63,308.46

## Asset Replacement Reserve

Loan @ 6% up to 2021, 2% thereafter	\$ 461,258.88															
Loan Repayment (11 years) - Principal		\$ (27,922.62)	\$ (32,260.03)	\$ (34,249.76)	\$ (36,362.21)	\$ (38,604.95)	\$ (40,986.02)	\$ (43,513.95)	\$ (46,017.24)	\$ (48,222.80)	\$ (53,713.37)	\$ (54,797.54)	\$ (4,608.40)	\$ -	\$ -	\$ -
Balance of Principal Owing	\$ 461,258.88	\$ 433,336.26	\$ 401,076.23	\$ 366,826.47	\$ 330,464.26	\$ 291,859.31	\$ 250,873.30	\$ 207,359.35	\$ 161,342.11	\$ 113,119.31	\$ 59,405.94	\$ 4,608.40	\$ (0.00)	\$ -	\$ -	\$ -
Total Loan Interest Revenue 6% up to 2021, 2% thereafter)		\$ 29,460.02	\$ 54,582.63	\$ 77,715.51	\$ 98,735.94	\$ 117,513.63	\$ 133,910.26	\$ 147,778.95	\$ 159,144.35	\$ 161,698.43	\$ 163,378.02	\$ 163,973.44	\$ 163,973.44	\$ -	\$ -	\$ -

## Attachment No. 2 - Revenue to Costs Summary 2013-2020

Site	2014(revenue)	2014 (expense)	2015 (revenue)	2015 (expense)	2016 (revenue)	2016 (expense)	2017 (revenue)	2017 (expense)
920 Larmer Line	\$14,474.74	\$7,757.60	\$7,760.11	\$7,828.87	\$7,945.70	\$8,179.94	\$6,782.89	\$7,421.83
1256 Syer Line	\$13,629.22	\$7,757.59	\$7,157.14	\$7,828.87	\$6,702.79	\$7,989.14	\$4,917.01	\$7,421.83
1470 County Rd 10	\$13,047.73	\$7,836.32	\$7,856.91	\$7,828.87	\$7,594.50	\$7,989.14	\$5,454.91	\$7,421.83
25 Centennial Lane	\$13,253.30	\$7,825.79	\$4,889.75	\$7,828.87	\$4,413.60	\$7,828.00	\$6,233.65	\$7,421.83
988 County Rd 10	\$12,852.80	\$7,864.38	\$6,322.65	\$7,421.83	\$6,193.88	\$8,724.28	\$5,081.10	\$7,786.14
415 County Rd 21	\$12,712.64	\$7,836.74	\$6,378.75	\$8,408.90	\$6,944.49	\$7,828.87	\$6,004.48	\$7,420.01
Tapley 1/4 Line	\$12,145.24	\$7,836.78	\$6,713.39	\$7,828.87	\$6,809.51	\$7,828.87	\$4,554.69	\$8,017.13
1047 Mount Pleasant Rd	\$13,907.47	\$7,868.44	\$7,443.18	\$7,796.98	\$8,027.93	\$9,646.10	\$5,949.76	\$7,421.83
<b>Totals</b>	\$106,023.14	\$62,583.64	\$54,521.88	\$62,772.06	\$54,632.40	\$66,014.34	\$44,978.49	\$60,332.43
<b>Difference</b>	\$43,439.50		-\$8,250.18		-\$11,381.94		-\$15,353.94	

Site	2018 (revenue)	2018 (expense)	2019 (revenue)	2019 (expense)	2020 (revenue)	2020 (expense)
920 Larmer Line	\$6,136.76	\$7,437.09	\$6,571.07	\$7,813.99	\$5,045.18	\$7,410.85
1256 Syer Line	\$4,708.75	\$11,725.56	\$3,493.90	\$7,813.99	\$4,583.25	\$8,434.56
1470 County Rd 10	\$5,146.54	\$7,437.09	\$5,525.68	\$7,813.99	\$3,376.78	\$7,410.86
25 Centennial Lane	\$6,380.50	\$7,442.58	\$5,779.75	\$7,813.98	\$3,296.45	\$9,766.42
988 County Rd 10	\$5,081.10	\$7,437.09	\$5,214.60	\$7,813.98	\$4,266.75	\$9,400.94
415 County Rd 21	\$5,372.59	\$8,485.33	\$5,968.00	\$8,006.31	\$5,001.91	\$7,684.87
Tapley 1/4 Line	\$6,311.99	\$7,452.35	\$6,057.90	\$7,813.98	\$6,124.22	\$7,670.84
1047 Mount Pleasant Rd	\$4,023.35	\$7,421.83	\$4,448.34	\$7,813.98	\$4,457.69	\$7,410.86
<b>Totals</b>	\$43,161.58	\$64,838.92	\$43,059.24	\$62,704.20	\$36,152.23	\$65,190.20
<b>Difference</b>	-\$21,677.34		-\$19,644.96		-\$29,037.97	





# Pathway Report for the Township of Cavan Monaghan Toward Maximizing Solar Revenues from Existing Assets



## Purpose

To identify realistic targets for MicroFIT revenue going forward and identify the safest and most economical pathway to reach those targets.

## Background

Eight ground-mounted Deger tracking systems were installed at various Township owned sites under the provincial MicroFIT program in 2013 & 2014. Arrays are comprised of 10kW of solar connected to 10kW of inverters. Each system is grid-connected to Hydro One's network and generation is recorded by utility meters at each site. The Township receives payment for the generation directly from Hydro One under the terms of their Connection Agreement and MicroFIT contract. Each system is also monitored via a cellular internet connection to a third party solar monitoring system called: SolarVu by Cachelan. The MicroFIT contracts are for \$0.445/kWh of energy delivered to Hydro One and are paid out monthly directly to the Township.

Eight sites:

920 Larmer Line (Lion's Centre)

1256 Syer Line

1470 County Rd 10 (Township yard)

25 Centennial Lane (Water treatment plant)

988 County Rd 10 (Township office)

425 County Rd 21 (Old Landfill)

Tapley ¼ Line (Old gravel pit)

1047 Mount Pleasant Rd (Firehall)

The Estimated revenue from original installer was set at \$8000/year per site.

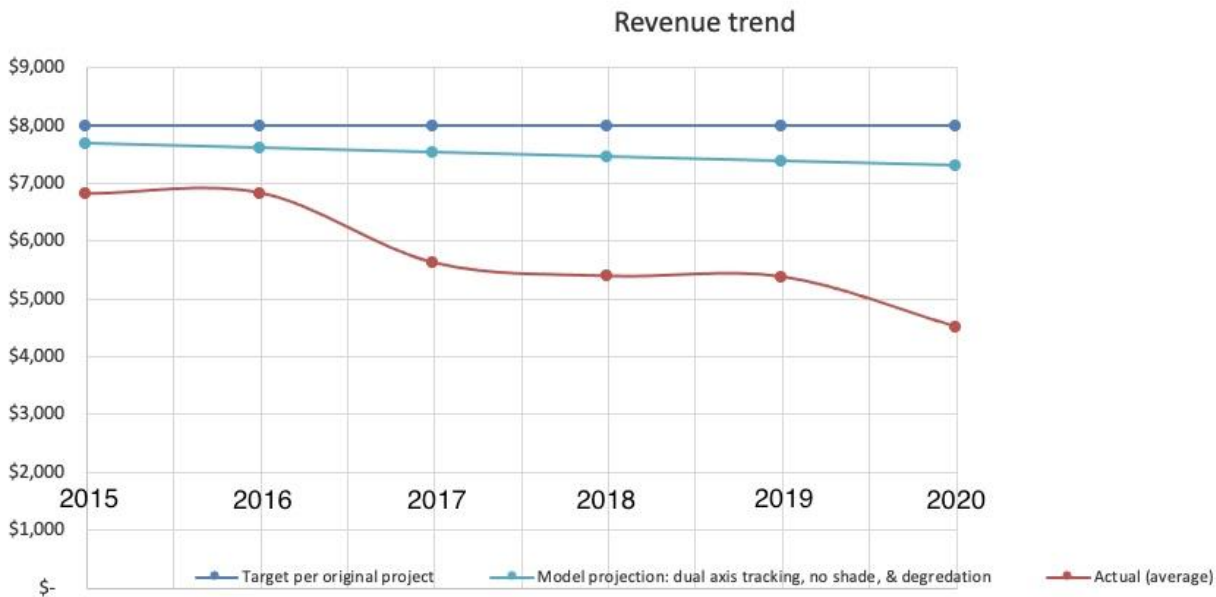
## Review of Township Revenue Data

Site	2014	2015	2016	2017	2018	2019	2020
920 Larmer Line	\$14,475	\$7,760	\$7,946	\$6,783	\$6,137	\$6,571	\$5,045
+/- expected	irregular	-3%	-1%	-15%	-23%	-18%	-37%
1256 Syer Line	\$13,629	\$7,157	\$6,703	\$4,917	\$4,709	\$3,494	\$4,583
+/- expected	irregular	-11%	-16%	-39%	-41%	-56%	-43%
1470 County Rd 10	\$13,048	\$7,857	\$7,595	\$5,455	\$5,147	\$5,526	\$3,377
+/- expected	irregular	-2%	-5%	-32%	-36%	-31%	-58%
25 Centennial Lane	\$13,253	\$4,890	\$4,414	\$6,234	\$6,381	\$5,780	\$3,296
+/- expected	irregular	-39%	-45%	-22%	-20%	-28%	-59%
988 County Rd 10	\$12,853	\$6,323	\$6,194	\$5,081	\$5,081	\$5,215	\$4,267
+/- expected	irregular	-21%	-23%	-36%	-36%	-35%	-47%
425 County Rd 21	\$12,713	\$6,379	\$6,944	\$6,004	\$5,373	\$5,968	\$5,002
+/- expected	irregular	-20%	-13%	-25%	-33%	-25%	-37%
Tapley 1/4 Line	\$12,145	\$6,713	\$6,810	\$4,555	\$6,312	\$6,058	\$6,124
+/- expected	irregular	-16%	-15%	-43%	-21%	-24%	-23%
1047 Mount Pleasant Rd	\$13,907	\$7,443	\$8,028	\$5,950	\$4,023	\$4,448	\$4,458
+/- expected	irregular	-7%	0%	-26%	-50%	-44%	-44%
<b>Totals</b>	<b>\$106,023</b>	<b>\$54,521</b>	<b>\$54,631</b>	<b>\$44,976</b>	<b>\$43,159</b>	<b>\$43,057</b>	<b>\$36,149</b>

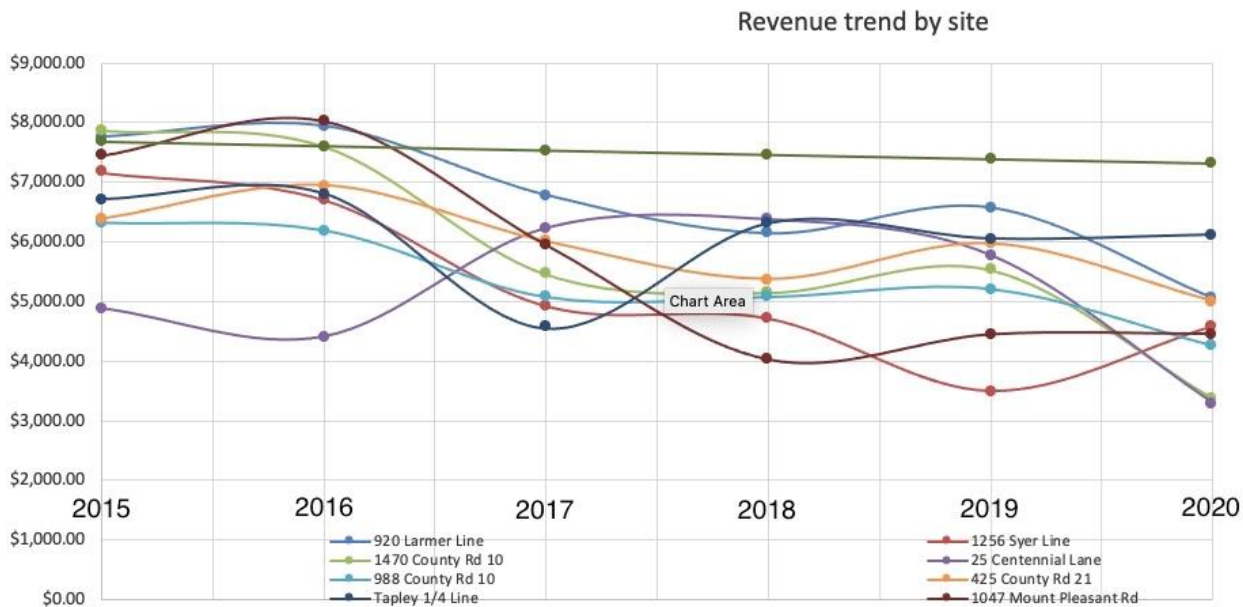
## Review of Expectations

A model was created for an equivalent 10kW system in Millbrook Ontario (dual axis Deger tracker). A simulation was run using System Advisor Model (SAM) by the National Renewable Energy Lab (USA) to compare original performance expectation with the projection of the simulation. Given that all systems are approaching 10 years of age and that tracking repairs are the costliest, it was decided to also look at the revenue effects of tracking. As a comparison, simulations were run to determine expected revenue for the same system with a fixed array (non-tracking) and for a single axis tracker, tracking east west only (AZ tracking). The model assumed no shade and 2014 revenue data was ignored as the values appear to contain more than 1 year of generation.

The first graph looks at average revenue across all 8 sites. It displays the actual production relative to the initial expectation from original installer and the modelled expectation from the SAM model:



The following graph shows the actuals on a site-by-site basis (the flat green line is the modelled expectation):



All sites have fallen below expectations since installation.

## Why is Revenue Not Meeting Expectations?

All solar electric systems decline in performance annually on account of module degradation. The accepted value for module degradation for modules of this vintage is 1% per year. There is also variation in annual performance based on the amount of solar insolation received in a given year. This can vary up or down on a given year making it difficult to see the module degradation on a year over year basis but the trend is still visible over a longer period of time. The Township systems are displaying a decline in revenue far greater than what could be expected for either module degradation or seasonal variation.

The level of decline displayed by the data indicates larger issues. Most likely these issues include:

- Poor tracker performance. A malfunctioning tracker can result in losses that are difficult for remote monitoring alarms to identify. Without a definitive problem like zero production or a specific alarm signal from an inverter, the system may not trigger any email alerts. The SolarVu monitor only flags acute problems.
- Shading. Some shading is unavoidable at some sites owing to geography and unmoveable physical structures. Other shading is from vegetation growth which is usually avoidable.
- Inconsistent review of system performance. The Township does not have a regular Operation and Maintenance program for these systems. The SolarVu monitoring system records basic real-time data and therefore, on its own, is not an adequate O&M program. When systems aren't adequately monitored, they cannot be repaired in a timely manner resulting in the same (or greater) repair expense but with greater revenue loss.

## What Can Be Done?

Not all sites will hit targets every year. There will be factors beyond reasonable control. Some of these factors include:

- Geographic shading
- Inverter or tracker downtime owing to delivery lead times on replacement or warranty parts
- Grid instability or outages

However, most of the Township's systems should be able to achieve modelled targets. If all systems achieved modelled targets, the potential annual revenue gain would be \$58,480/year. This is an increase of \$22,328/year over the 2020 revenue of \$36,152/year. An increase of 62%.

Ways to immediately improve production:

- Immediately act on shading recommendations from previous Generation Solar annual Preventative Maintenance visits. Alternatively, engage Generation Solar to flag the vegetation to be removed.
- Contract out Operation and Maintenance for all systems to solar maintenance contractor like Generation Solar (see Appendix B for Quote). Direct system alerts to O&M contractor and require a minimum monthly review of each site's performance to identify non-alert issues (like tracker issues). Contracting out O&M identifies issues faster and reduces lead time between identifying issue and fixing it.
- Purchase spares to avoid downtime
  - o 5kW inverter (Fronius 5kW Primo or similar)
  - o Common DEGER parts: Actuators, control boards, sensors
- Ensure each site has a reliable internet connection to ensure reliable remote monitoring

Further areas to save on expenditure:

- Modelling shows the most effective tracking is the Azimuth (AZ) direction. Fixing elevation (EL) tilt to 55deg and relying only on the AZ tracking avoids the parts and labour costs of EL actuators while only losing \$200/year in revenue. It also avoids the risk of the tracker failing in an unfavourable position and further compromising revenue.

- Deger EL actuator replacement cost: \$3250 +tx (parts and labour 2021)
- To achieve the highest energy output using AZ tracking the elevation (EL) angle needs to be fixed at 55deg. This exposes the tracker to a high degree of wind during a high wind event. Normally, when the DEGER wind sensor reads high winds, the EL actuator is used to flatten the array to reduce exposure. It is not possible to disable EL tracking yet retain high wind protection. For this reason, disabling EL tracking is not a decision to be taken lightly. Consideration should be made for sites exposed to high wind and to sites where wind failures could result in harm to public or property.
- Replace inverters as they fail out of warranty with an inverter that includes a lifetime remote monitoring platform as part of the initial purchase. Consolidate new inverters together at sites so that existing SolarVu subscription can be reduced.

## Planning For End of Warranty

The only component still under warranty are the inverters. They have a ten-year warranty (2 to 3 years remaining). Once the warranty is up, I recommend purchasing a compatible inverter that does not require a third-party monitoring system. Fronius is one such inverter manufacturer. Fronius have equivalently sized inverters that allow for a simple direct replacement. There is no annual monitoring cost.

The solar module at the Township sites was manufactured by Eclipsall. Eclipsall is no longer in business so there is no more warranty. Fortunately, we have not seen issues with the solar modules at any of the 8 sites. Solar module availability and pricing is constantly changing. I do not recommend holding any non-original spares from a different manufacturer. Should some exact replacement Eclipsall solar modules become available, it would be wise to purchase 5 – 10 as spares.

## Limitations

This analysis only compared the modelled expectations with the average actual output of all 8 sites. Individual site performance will vary. For modelling purposes, shading was assumed to be zero. Site specific shading was beyond the scope of this report.

## Summary

- Remove vegetation shading
- Consider purchase of further spare parts
- Consider third-party O&M

## Appendix A – Tracker vs Fixed Array Performance (For Year 1)

### **Fixed @ 35 deg**

Annual energy: 12,821 kWh (\$5705/yr)

### **2 axis tracking**

Annual energy: 17,448 kWh (\$7763/yr)

### **AZ tracking** (ie tilt permanently fixed at 55 degrees (this yielded maximum annual generation))

Annual energy: 16,952 kWh (\$7544/yr)

We see there is a 35% annual loss when trackers are fixed and a 3% annual loss when tracking in the AZ (east – west) direction only. AZ tracking only results in a loss of \$200/year while no tracking (fixed array) results in revenue loss of \$2000/year.



# Appendix B – Details and Quote for O&M services From Generation Solar



Generation Solar Renewable Energy Systems Inc.

550 Gilchrist Street  
Peterborough, ON K9H 4N9

## Estimate

Date	Estimate #
2020-07-08	16087

Name / Address
Township of Cavan Monaghan Wayne Hancock 988 County Road 10 Millbrook, ON L0A 1G0

Ship To

Terms	FOB	Project
Net 28		

Description	Qty	Cost	Total
Annual O&M Services Contract for Township of Cavan Monaghan PV Sites (Maintenance Contract renews annually based on rates in effect at that time.)			
Annual Preventative Maintenance for the 8 PV sites listed below includes tracker maintenance (per manufacturer's manual) and routine preventative maintenance package (including string testing, electrical inspection and IR).	8	270.00	2,160.00
<ul style="list-style-type: none"> <li>• 920 Larmer Line (Lion's Centre)</li> <li>• 1256 Syer Line</li> <li>• 1470 County Road 10 (Township Yard)</li> <li>• 25 Centennial Lane (Water Treatment Plant)</li> <li>• 988 County Road 10 (Township Office)</li> <li>• 415 County Road 21 (Old Landfill)</li> <li>• Larmer Line west of Tapley ¼ Line (Gravel Pit)</li> <li>• 1047 Mount Pleasant Road (Firehall)</li> </ul>			
Travel	8	56.00	448.00
Discount on line above as we can service multiple sites per trip		-200.00	-200.00
OEM Deger Grease and materials	8	30.00	240.00
<b>Subtotal</b>			<b>2,648.00</b>
Cachelan Monitoring Subscription for 8 sites (annual)	1	1,104.00	1,104.00
Cachelan Admin and Client Support	3	90.00	270.00
Monthly proactive monitoring of each site and remote troubleshooting	12	90.00	1,080.00
<b>Subtotal</b>			<b>2,454.00</b>
HST (ON) on sales		13.00%	663.26
			<b>Subtotal</b> \$5,102.00
Utility fees, if applicable, are in addition to this estimate. Please refer also to the Generation Solar standard terms and conditions. Estimates are subject to change based on actual time and materials; Quotes are firm.			<b>Sales Tax</b> \$663.26
Phone #	E-mail	Web Site	<b>Total</b> \$5,765.26
705-741-1700	info@generationsolar.com	www.generationsolar.com	

GST/HST No.

878943422

Customer Signature \_\_\_\_\_