Pine Tree Park Community Solar Garden Year 1 Operations Report

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Project Overview

New Dawn's Pine Tree Park Estates (PTP) is a non-market residential community located on a decommissioned military base, an 88-acre property on Lingan Road in Whitney Pier, Nova Scotia. It includes 10 duplexes (10 three-bedroom units and 10 four-bedroom units), 4 townhouse-style apartments, 4 three-bedroom houses and the New Dawn Guest Home, a 29-bed DCS-funded Level One (Supportive Care) residential care facility, in addition to a few other smaller non-residential buildings.

Recognizing an opportunity to lower community energy consumption and costs for residents while at the same time taking steps to mitigate climate change by reducing greenhouse gas emissions, New Dawn, in partnership with the Verschuren Centre Inc., undertook a project to perform energy retrofits on PTP facilities and construct a Community Solar Garden to fulfill the community's energy needs.

Project Goals

This project had two ambitious goals:

1. Net-zero greenhouse gas emissions - the property will no longer use fossil fuels
2. Net-zero energy - the solar garden (with reduced consumption via retrofits) will meet 100% of the property's annual energy demand.

Project Execution

Energy Retrofits

Residential Facilities

Energy audits were performed on the 28 residences to establish a baseline and identify required retrofits. Details varied for each residence but for the majority they included replacement of oil furnace with central air-source heat pumps, attic and basement insulation, and air sealing. The residential retrofits were completed in spring of 2023.

New Dawn Guest Home

Heat pumps were installed to cover all building heating requirements. The oil furnace/boiler were kept as the required back-up heat source. The Guest Home retrofits were completed in spring of 2024.

Solar Garden

A 668kWDC (555kWAC) solar PV array was constructed on the Pine Tree Park site and connected to the NSP grid through the Nova Scotia Community Solar Program. The solar array went into commercial operation in November 2024.

Under the Community Solar Program, Nova Scotia Power allocates to each subscriber account a portion of the array capacity proportional to their historical energy consumption.

Allocations to PTP subscriber accounts are shown in Appendix A, Table 2. Historical data for the Guest Home did not reflect the impact of the retrofits, higher electricity use due to switch to heat pumps, so the allocation was lower than expected. The balance of the array was allocated to non-PTP New Dawn residence accounts, Appendix A, Table 3. Although a portion of the array was allocated to non-PTP accounts the energy generated from that portion is still considered to be offsetting PTP energy use.

Results

Energy Use

Residences

Comparison of post-retrofit to pre-retrofit energy use for the residences is a bit of a challenge. Pre-retrofit, only 9 of the 28 residential utility accounts (oil and electricity) were in New Dawn's name, the remainder being in the name of the occupants. This meant that pre-retrofit energy use data for 19 of the residences was not readily available to New Dawn. Being former military housing, the structures and energy systems are very similar therefore energy use for the 19 occupant accounts was estimated based the 9 New Dawn accounts with some adjustments for number of occupants.

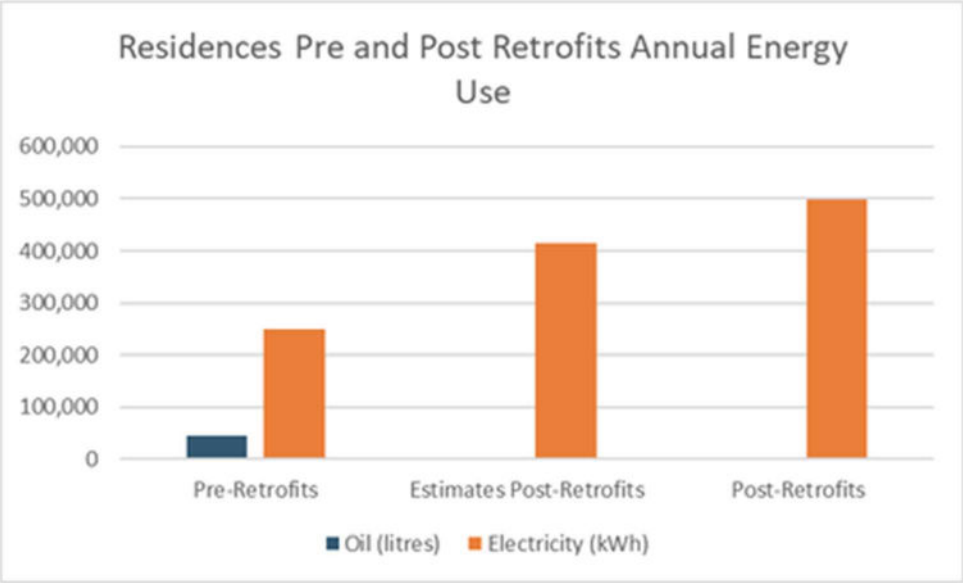
Post-retrofit all accounts were moved into New Dawn's name (utility costs included in the rent) so actual post-retrofit energy use data was available for this report.

Table 1 and Figure 1 show a comparison of the estimated pre- and post-retrofit annual energy use and the actual 2025 annual energy use. For this period the actual energy use was 33% higher than predicted.

Table 1: Residences Pre and Post Retrofits Annual Energy Use

Measure	Oil (litres)	Electricity (kWh)
Estimated pre-retrofits	44,273	249,161
Estimated post-retrofits	0	415,286
Actual post-retrofits	0	498,243

Figure 1: Residences Pre and Post Retrofits Annual Energy Use



Three factors may contribute to the discrepancy:

1. Incomplete pre-retrofit data, as mentioned above energy use for most of the residences was based on the few for which complete data was available.
2. Final retrofit vs projected retrofits, due to project timing the energy use estimations were performed prior to the actual retrofit plans were finalized and not all projected retrofits were performed on some residences in the end due to budget and technical limitations.
3. Change in use patterns, the tendency for occupants to be less conservative with their energy use when it is inclusive in rent.

New Dawn Guest Home

At this point in time the Guest Home is not completely transitioned off fossil fuels as hoped. An oversight in the process meant that the heat coil in the kitchen air exchange which is fed by the oil boiler was not converted to electric. The air exchange must operate continuously for Occupational Health and Safety purposes and must be heated in the winter months (otherwise lowering the kitchen temperature too much). The heat coil in the air exchange continues to be fed by the oil boiler. Funding has been secured to convert it to electric; this work is underway currently and expected to wrap up by the end of May 2026.

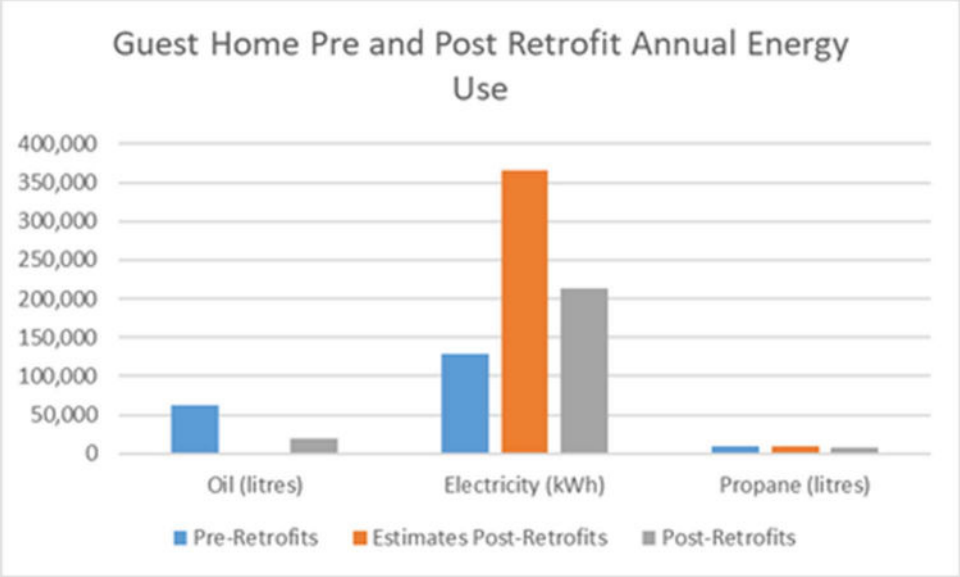
Domestic hot water also continues to be heated by the boiler. A request has been submitted to the province for funding to replace the hot water heaters with electric ones, but where the current heaters are working reliably, it's not classified as urgent, and so will be some time yet before funding is finalized (funding is being issued for urgent needs first). With this funding, if successful, the oil hot water heaters will be transitioned to electric hot water heaters.

Lastly the kitchen is still using propane for cooking. The commercial ranges will be replaced with electric induction ones when the equipment reaches end of life. Despite these challenges the fossil fuel use at the home has been significantly reduced, see Table 2 & Figure 2.

Table 2: Guest Home Pre and Post Retrofit Annual Energy Use

Measurement	Oil (litres)	Electricity (kWh)	Propane (litres)
Pre-retrofits	63,273	128,400	9663
Estimates post-retrofits	0	366,000	9663
Actual post-retrofits	20,073	213,917	7,471

Figure 2: Guest Home Pre and Post Retrofit Annual Energy Use



Further reductions in oil use will occur in 2026 with the retrofit of the kitchen air exchange heating.

Energy Production

Using a specific production factor of 1200 kWh/kWDC/yr the solar array was estimated to produce 801,600 kWh in its first year of operation. Actual production as measured by the internal monitoring system was 781,451 kWh (equivalent to a specific production factor of 1170 kWh/kWDC/yr) or 97% of the estimated.

2025 was a good year for solar production in Cape Breton due to extremely sunny summer months however, there has been an ongoing issue with a component failure in the array that has impacted the production. This is calculated to have resulted in a 7.2% loss in production over the year, see O&M for details. Assuming that loss in production the annual production would have been 837,716 kWh (equivalent to a specific production factor of 1278 kWh/kWDC/yr), exceeding the estimate by 7%.

Note that the annual solar production of 760,196 kWh used in the following sections is the metered energy sent to the NSPI grid. Some of the difference of 21,255 kWh (58 kWh/day) can be attributed to losses and self-consumption (energy used to run the system) but further investigation is required to fully understand the difference.

Net Energy

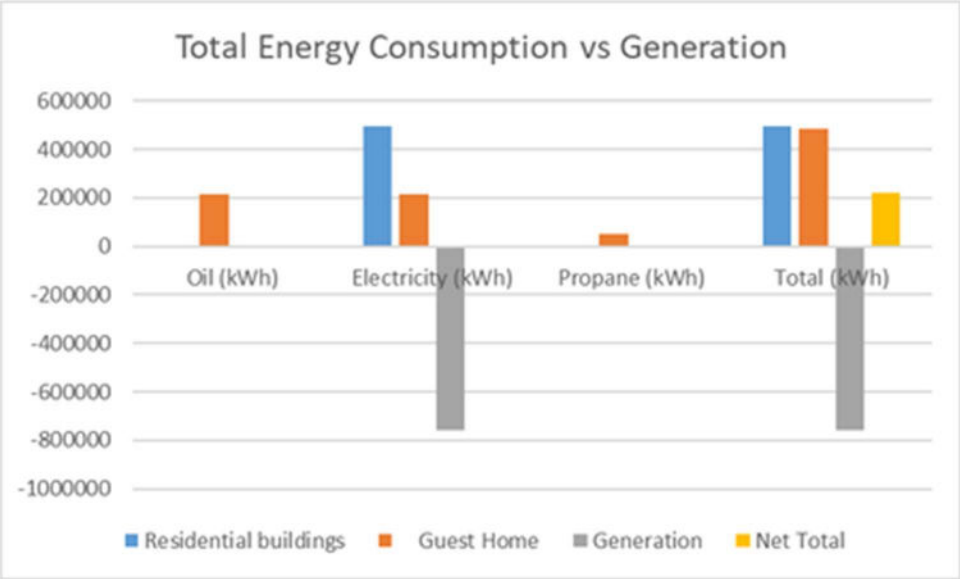
The goal of net-zero energy is achieved when the total energy generated by the solar array equals or exceeds the energy consumed by the Pine Tree Park facilities. To make this comparison with a mix of energy sources it is first necessary to convert them all to common energy units, kWh in this case. Fuel oil has a specific energy density of 10.8 kWh/litre and propane 7.0 kWh/litre.

Based on the 2025 consumption data the Pine Tree project has not yet achieved net-zero energy, see Table 3 & Figure 3.

Table 3: Total Energy Consumption vs Generation

Measure	Oil (litres)	Oil (kWh)	Electricity (kWh)	Propane (litres)	Propane (kWh)	Total (kWh)
Residential	0	0	498,243	0	0	**498,243**
Guest Home	20,073	216,515	213,917	7,471	52567	**483,000**
Generation			-760,196			**-760,196**
					Net Energy	**221,047**

Figure 3: Total Energy Consumption vs Generation



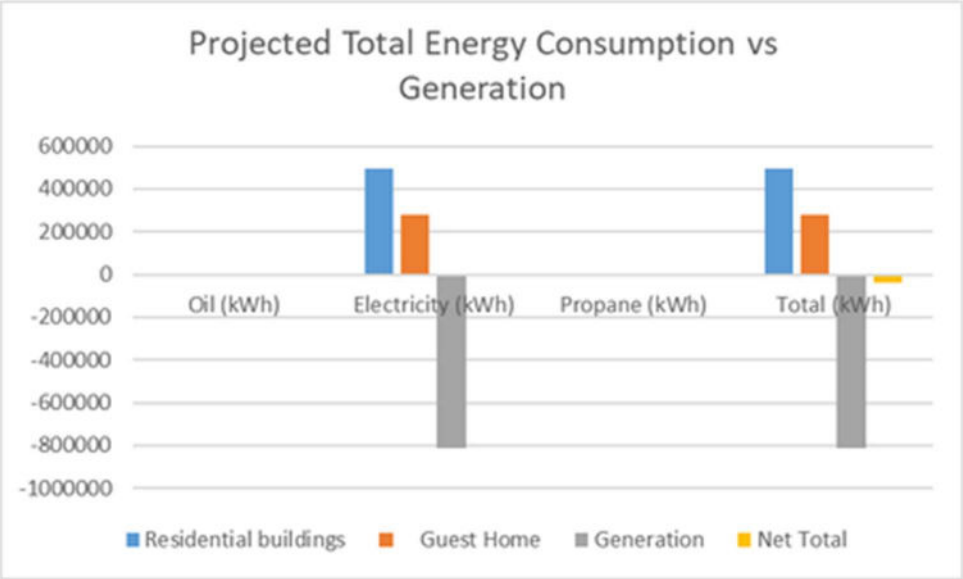
In the future with the solar array operating at full capacity and as further upgrades to the Guest Home are completed this will improve as the electrified solutions are much more efficient than the existing oil and propane equipment. Projected energy use shown in Table 4 and Figure 4, indicates that net-zero energy can be achieved.

Table 4: Projected Total Energy Consumption vs Generation

Measure	Oil (litres)	Oil (kWh)	Electricity (kWh)	Propane (litres)	Propane (kWh)	Total (kWh)
Residential	0	0	498,243	0	0	498,243
Guest Home	0	0	280,207	0	0	280,207
Generation*			-814,930			-814,930
					Net Energy	-34,480

**7.2% increase over 2025 assumed.*

Figure 4: Projected Total Energy Consumption vs Generation



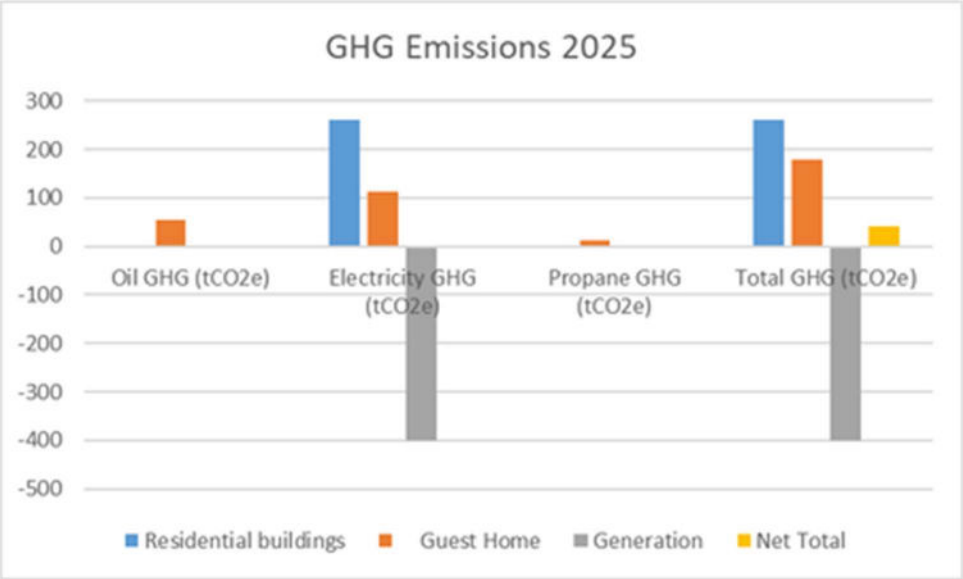
Net GHG Emissions

Pre-retrofits annual GHG emissions for all the facilities under consideration were estimated to be 296 tCO2e from heating oil, 199 from grid electricity, and 15 tCO2e from propane for a total of 510 tCO2e. There is still some fossil fuel use at Pine Tree Park so net-zero GHG emissions has not quite been achieved yet, see Table 5 and Figure 5.

Table 5: GHG Emissions 2025

Measure	Oil (litres)	Oil GHG (tCO2e)	Electricity (kWh)	Electricity GHG (tCO2e)	Propane (litres)	Propane GHG (tCO2e)	Total GHG (tCO2e)
Residential	0	0	498,263	263	0	0	**263**
Guest Home	20,073	55	213,917	113	7,471	12	**180**
Generation			-760,196	-401			**-401**
						Net Emissions	**42**

Figure 5: GHG Emissions 2025



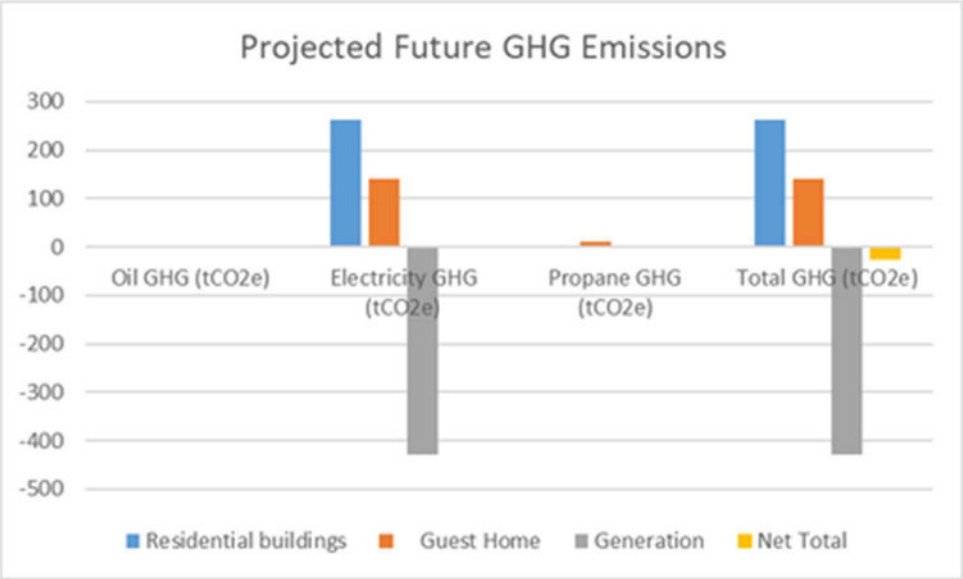
However, once the final retrofits are completed and the oil boilers are relegated to backup use only and the solar array is operating at full capacity the remaining emissions from the propane used for cooking should easily be offset by the solar production, see Table 5 and Figure 6.

Table 6: Projected Future GHG Emissions

Measure	Oil (litres)	Oil GHG (tCO2e)	Electricity (kWh)	Electricity GHG (tCO2e)	Propane (litres)	Propane GHG (tCO2e)	Total GHG (tCO2e)
Residential	0	0	498,243	263	0	0	**263**
Guest Home	0	0	264,437	139	7,471	12	**139**
Generation*			-814,930	-429			**-429**
						Net Emissions	**-27**

*7.2% increase over 2025 assumed.

Figure 6: Projected Future GHG Emissions



Other Impacts

Under the Nova Scotia Community Solar Program, the project owner receives a fixed amount per generated kWh agreed upon through a Power Purchase Agreement (PPA) and subscriber accounts receive a $0.02 Solar Credit for every kWh generated by their portion of the array. The project owner also pays a $0.003/kWh admin fee to Nova Scotia Power to cover the costs of account billing administration.

In this case New Dawn is both the project owner and account holder. The PPA price for the Pine Tree Park project is $0.12/kWh so for every kWh generated New Dawn receives $0.12 + $0.02 -.0003 = $0.137. In 2025 the total energy generated and sent to the grid was 760,196 kWh which resulted in $104,165.85 revenue to offset energy costs.

Operations and Maintenance

An Operations and Maintenance (O&M) contract was tendered to Natural Forces for the first year of operations with options to renew. The contract included the services shown in Table 7.

Table 7: O&M Contract Services

Service Options
Operations & Preventative Maintenance
24/7 Monitoring
Quarterly Performance Reporting
Public Dashboard
Remote Software Updates
Performance Analytics
Aerial Thermal Inspection
Annual Inspection and Maintenance
Corrective/Unscheduled Maintenance
Remote Analysis/Investigation
Priority Response Time
Procurement of Replacement Parts
Call Out/Troubleshooting of Failures (for warranty claims)
Warranty Management
Initiate Warranty Claims with OEM Remotely
Correspond and Manage Warranty Claims with OEM
Engage OEM on Extended Outages and Serial Failures

Although the array has been performing well there have been a few minor O&M issues.

1. Damaged panels - two damaged panels were noted in the first annual inspection performed in July 2025. Although the damage and the impact on production was minimal, replacement has been carried out.
2. Cooling Fan Failure Alarm - a cooling fan failure alarm on inverter 3 occurred several times a day particularly during times of high production. A warranty claim was filed with the inverter manufacturer, but as the alarm level is “Info” and it reset automatically it did not appear to be urgent. However, later detailed analysis of production data revealed that, particularly during times of full power production, the output of the faulty inverter dropped by ~60% during the time the alarm was active. By comparing the annual production of the individual inverters, which should produce the same on average, the loss was calculated to be 7.2% (58,675 kWh) of total annual production. Enough to power 3 or 4 homes.
3. Substandard service from O&M provider – working with Natural Forces over the course of the year required continuous follow up, communication was poor and the fan alarm issue was handled very poorly. The contract specifies 24/7 Monitoring and Performance Analytics services are to be provided however the impact of the fan alarm on production went unnoticed until it was discovered by the New Dawn Project Manager and brought to Natural Forces attention. Discussions with Natural Forces are ongoing to improve service.

O&M Costs

Operation and maintenance costs for year one are listed in Table 8.

Table 8: First Year O&M Costs

Item	Vendor	Cost
O&M contract for 1 year	Natural Forces	$5,785
Unscheduled Maintenance	Natural Forces	$1,910
Spare Modules	Natural Forces	$9,412

The unscheduled maintenance was the diagnosis of the inverter fan alarm and some string repairs. The spare module costs should be amortized over the array life or allocated as the spares are required.

Lessons Learned

The Pine Tree Park Solar Garden Project was a first of its kind for New Dawn, the VC, the contractors and the regulators, therefore there was much learning as it unfolded. The following lessons learned are intended to help guide future projects to success.

Spare Panels: No spare panels had been purchased during construction, and as the panels used had become obsolete (as panel designs improve rapidly old ones quickly become obsolete), Natural Forces was able to source replacements and spares are now in storage on site.

More Detailed RFP Scope: During construction there was some ambiguity of scope responsibility. A more detailed scope statement should be developed for future projects.

Additional Test Pits: Significant additional site preparation and foundations costs were incurred due to unanticipated near-surface bedrock. A greater number of test pits during geotechnical study could have mitigated this.

Construction - Internal Project Manager: Due to organizational restrictions at the VC and resource restrictions at New Dawn there was a lack of dedicated project management during the construction of the Pine Tree Park array resulting in delays and costs. For future solar array projects New Dawn should assign an internal project manager to oversee the tendering, contractor selection, and construction.

Internal O&M Management: In the future New Dawn should consider bringing Operations and Maintenance management in-house, especially if they construct additional arrays. This position would monitor array performance and schedule inspections, repairs and maintenance performed by

subcontractors. This would give New Dawn greater control over the O&M and reduce costs while supporting local contractors and building capacity in the area.

Community Solar Program: During development of the Pine Tree Park Net-Zero Community project the solar array was intended to operate under the Nova Scotia Net-Metering program. Under this program New Dawn would be compensated at full value for every kWh of energy produced up to an amount equal to the total annual consumption. During this time changes in the Net Metering program resulted in the project no longer being eligible for that program.

At the same time the Community Solar program was under development. New Dawn and the Verschuren Centre worked closely with the province in the development of the program and to ensure that the PTP array would be eligible. The resulting program, while having some advantages, only provides for compensation through a fixed PPA and a fixed solar credit. As a result, the financial benefits to New Dawn are lower and do not escalate over time, while the NSP rates and other costs will rise. Assuming 2% annual inflation over the next 25 years the savings will drop from ~70% in year 1 to less than 50% in year 25.

Energy Use Estimation: Ideally three years of post-retrofits energy use data would be averaged to establish a more accurate estimate of energy use and therefore solar array production requirement. In this case, with all the residential accounts being rental properties and the majority in the name of the tenant, that was not possible.

Conclusions

The Pine Tree Park Community Solar project was a first of its kind in Nova Scotia and possibly all of Canada. First envisioned in 2018 and completed in 2024 the project spanned the COVID pandemic and associated supply chain and logistic challenges which delayed the construction and increased costs. Despite these challenges, one year into operations the project is delivering clean renewable energy to the Nova Scotia grid and is close to achieving its original ambitious goals.

Once ongoing upgrades to the Guest Home are completed and with the array operating at full capacity, project net-zero goals will be met. At that time, a re-evaluation of the energy requirements of the Guest Home will be required and array allocations updated to better match that requirement.

Lessons learned through the planning and execution of the project will be applied in future New Dawn solar projects and be available to other organizations wishing to do the same.

Appendix A: Array Allocations

Table 9: Array Allocations – PTP Accounts

Address	NSP Meter Data (kWh/yr)	Subscription Allocation (kW)	Array Proportion
12 Military Rd	23,622	16	2.9%
14 C Levatte Cres	19,578	14	2.4%
16 C Levatte Cres	17,398	12	2.2%
16 Military Rd	19,137	13	2.4%
18 C Levatte Cres	16,251	11	2.0%
20 C Levatte Cres	16,414	11	2.0%
22 C Levatte Cres	23,609	16	2.9%
23 Dryden Ave	15,766	11	1.9%
23 Military Rd	18,519	13	2.3%
24 C Levatte Cres	18,097	13	2.3%
25 Dryden Ave	12,834	9	1.6%
26 C Levatte Cres	16,122	11	2.0%
27 Dryden Ave	22,530	16	2.8%
27 Military Rd	21,830	15	2.7%
28 C Levatte Cres	12,611	9	1.6%
29 Dryden Ave	12,507	9	1.5%
31 Dryden Ave	9,812	7	1.2%

33 Dryden Ave	10,597	7	1.3%
35 C Levatte Cres	15,011	10	1.8%
35 Dryden Ave	14,750	10	1.8%
37 C Levatte Cres	26,204	18	3.2%
37 Dryden Ave	16,418	11	2.0%
39 C Levatte Cres	10,813	8	1.4%
41 C Levatte Cres	14,972	10	1.8%
4A Dryden Ave	13,110	9	1.6%
4B Dryden Ave	9,307	7	1.2%
4C Dryden Ave	18,359	13	2.3%
4D Dryden Ave	13,910	10	1.7%
50 Military Rd - Guest Home	190,800	131	23.6%

Table 10: Array Allocations – Non-PTP Accounts

Address	NSP Meter Data (kWh/yr)	Subscription Allocation (kW)	Array Proportion
39 Sheriff Ave	10,961	8	1.4%
39 Sheriff Ave Apt #2	7,117	5	0.9%
39 Sheriff Ave Apt #3	15,021	10	1.8%
729 Upper Prince St Unit #1	8,884	6	1.1%
729 Upper Prince St Unit #2	5,612	4	0.7%
729 Upper Prince St Unit #3	16,862	12	2.1%
729 Upper Prince St Unit #4	11,526	8	1.4%
729 Upper Prince St Unit #5	4,444	3	0.5%
729 Upper Prince St House	12,957	9	1.6%
11 Eleventh St	5,256	4	0.6%
74 B Fairview St #2nd-Fl	24,701	17	3.1%
74 A Fairview St #1st-Fl	11,545	8	1.4%
72 A Fairview St	8,030	6	1.0%
72 B Fairview St	6,783	5	0.9%
138 George St	8,257	6	1.0%

Appendix B: 2025 Energy Use

Table 1: Pine Tree Park Accounts 2025 Energy Use

Address	Oil (litres)	Electricity (kWh)	Propane (litres)
12 Military Road		19,180	
14 C. Levatte Cr.		19,557	
16 C. Levatte Cr.		24,734	
16 Military Road		24,529	
18 C. Levatte Cr.		18,635	
20 C. Levatte Cr.		19,280	
22 C. Levatte Cr.		23,464	
23 Dryden Avenue		12,793	
23 Military Road		19,126	
24 C. Levatte		18,758	
25 Dryden Avenue		14,336	
26 C. Levatte		17,562	
27 Dryden Avenue		22,147	
27 Military Road		22,518	
28 C. Levatte Cr.		14,383	
29 Dryden Avenue		12,490	
31 Dryden Avenue		16,111	
33 Dryden Avenue		13,988	
35 C. Levatte		15,264	
35 Dryden Avenue		12,338	
37 C. Levatte Cr.		28,013	
37 Dryden Avenue		18,585	
39 C. Levatte Cr.		14,160	
41 C. Levatte Cr.		16,067	
4A Dryden		16,894	
4B Dryden		10,438	
4C Dryden		17,670	
4D Dryden		15,221	
50 Military Road	20,073	213,917	7,471
Total	**20,073**	**712,160**	**7,471**

Appendix C: Greenhouse Gas Emission Factors

Table 12: GHG Emission Factors for Energy Sources

Source	Quantity	Units
2025 NSP Grid	0.527	tCO2e/MWh
Light fuel oil	2.755	tCO2e/kilolitre
Propane	1.548	tCO2e/kilolitre