MICRO-GENERATION POLICY AND MICRO-GENERATION PRODUCTION INCENTIVE PROGRAM 2014 - 2016 REVIEW

Prepared by Energy branch
Energy, Mines and Resources, Government of Yukon

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Front Cover Photo:
Photovoltaic (PV) modules on *Habitat for Humanity* tri-plex near Whitehorse.

Credit: Government of Yukon

Table of Contents

Introduction

The 2009 *Energy Strategy for Yukon* provides broad policy and program direction to address key energy priorities in Yukon. The strategy includes several references to increasing use of renewable energy sources, and one of the priority actions is to "Increase renewable energy supply in Yukon by 20 per cent by 2020."

Another priority action is to develop a net metering policy. After extensive consultation with stakeholders, Cabinet approved a Micro-generation Policy in 2013 and the department of Energy, Mines and Resources (EMR) launched the Micro-generation Production Incentive Program in February 2014. This program provides incentives and support for individuals or businesses to install and grid-tie small-scale renewable energy systems, in order to meet their own electrical needs and to sell surplus energy to their local grid. The policy requires a review after two full years of implementation.

This report describes how the program is being delivered and measures its success in meeting the policy's objectives. Several recommendations for improving program delivery are presented for consideration.

Policy and Program Objectives

The Micro-generation Policy is designed to provide opportunities for Yukoners to produce electricity from renewable technologies for their own consumption and to be reimbursed for surplus generation, exported to the grid. The Micro-generation Production Incentive Program has been developed to implement the policy. Objectives of the program are to:

1. *Encourage the development and adoption of new individual renewable energy sources to reduce greenhouse gas emissions.*
2. *Support ongoing research and technology to diversify renewable energy sources.*
3. *Promote energy conservation and greater energy efficiency.*

Program Description

Program Interface with Clients – Website and Storefront

The Energy branch website provides background information about the program, explains the application process, and provides most relevant forms and contact information. Hard copies of all Energy branch program information and application forms, including materials pertinent to the micro-generation program are available through the Energy Solutions Centre storefront, where clients can meet with the program manager.

Program Management

The Energy branch provides logistical support, technical guidance, and expert advice to clients, from project initiation to the application stage and all the way through to connection with the grid.

The Energy branch's program manager works with clients to advance renewable energy system projects and meet program requirements. The program manager provides information to clients regarding the technical and economic considerations of their proposed projects. The program manager also serves as liaison with the utilities (Yukon Energy and ATCO Electric Yukon), and facilitates annual reimbursements to clients.

Project Implementation 2014-2016

To participate in the program, clients must complete a series of steps. Most of these steps can occur prior to meeting with Energy branch officials, although many clients seek out support early and throughout the process. The client is provided with the program guide and application package to submit to the utility for final approval. Steps are as follows:

1) Concept and basic research
2) Site and structural assessment (logistical reality of installation and communication with building inspectors)
3) Planning, design and materials purchase (typically the point at which the installer and/or electrician is brought into the process)
4) Permitting (building and electrical permits) and installation
5) Building and electrical inspections
6) Gathering and submission of documents required for program application including
    a. electrical diagram
    b. site plan
    c. protective device data (e.g., the inverter specifications sheet)
    d. final approved electrical inspection
    e. signed copy of the Micro-generation Interconnection and Operating Agreement (between utility and client)
7) Submission of application package to program manager who reviews and submits package for review and approval by utility officials.

Grid connection and Metering

Once the proposed project has been approved by a utility, the dual register meter is installed by the utility. The dual register meter is similar to a regular residential and demand meter, and tracks energy flow in both directions - the electricity consumed, and the electricity exported to the grid.

The system installation is configured so that it meets the client's demands first, with any surplus automatically exported to the grid. The exported electricity is tracked and clients are reimbursed for any surplus that is generated. Production incentive payouts under the program are calculated using financial principles described in the policy.

Client Reimbursement and Program Budget

Clients receive a reimbursement annually (from Energy branch), within 60 days after the last meter reading in January. The annual reimbursement is paid at the rate of $0.21 per kWh, if connected to the (predominantly hydro-powered) Yukon Integrated System. The rate is $0.30 per kWh for systems feeding into Yukon's diesel-powered community distribution systems (i.e. Watson Lake, Destruction Bay/Burwash Landing, Beaver Creek and Old Crow), owing to the higher cost of generating electricity with diesel. These rates were set in the micro-generation policy with input from both territorial utilities.

The cost of client reimbursement depends on the number of clients, the generating capacity of their systems and the site-generation-to-onsite consumption ratio. $5,000 was budgeted for each of the first two years of the operation of the program. Total program expenditures for 2014/2015 were $1,643.34 and $3,987.48 for 2015/2016. Energy branch has allocated 70 per cent of the program manager's full time position to implement the program.

Program Objectives and Results

Objective 1: Encourage the development and adoption of new individual renewable energy sources to reduce greenhouse gas emissions.

In measuring results, the Energy branch has looked at the number of participating communities and projects, energy generation, export and reimbursements, and reduction in greenhouse gas (GHG) emissions.

Participating Communities and Projects Implemented

As of the end of the second year of operation (i.e. March 31, 2016), there were 20 micro-generation systems installed in Whitehorse, Takhini River Subdivision, Tagish, Haines Junction, Burwash Landing and Old Crow. In the communities connected to the hydro grid, all clients were residential. In diesel-powered communities, all clients were

general service, First Nation-owned, had existed prior to the program and represent a total capacity of 19.8 kW, or 26 per cent of total program generating capacity. Most of the smaller residential developments have been in the Whitehorse area.

To date, all program clients have installed solar PV arrays, primarily in the Whitehorse area. There are 20 new systems, with an average of 3.85kW$_{\textbf{peak}}$ capacity. The total added capacity is almost 77kW. 16/20 of the new systems are powering residential demand and 17/20 projects are connected to hydro grids. Appendix 1 shows details of the 20 systems connected.

Figure 1 tracks project approval by month, up to March 2016. It shows steady growth in client participation since the February 2014 program launch. Ten systems, generating 28.05 kW were connected during 2014/15, and 10 systems generating 43.85 kW, were connected in 2015/16 (with two more showing since the export metering year is shorter than the fiscal or *program* year).

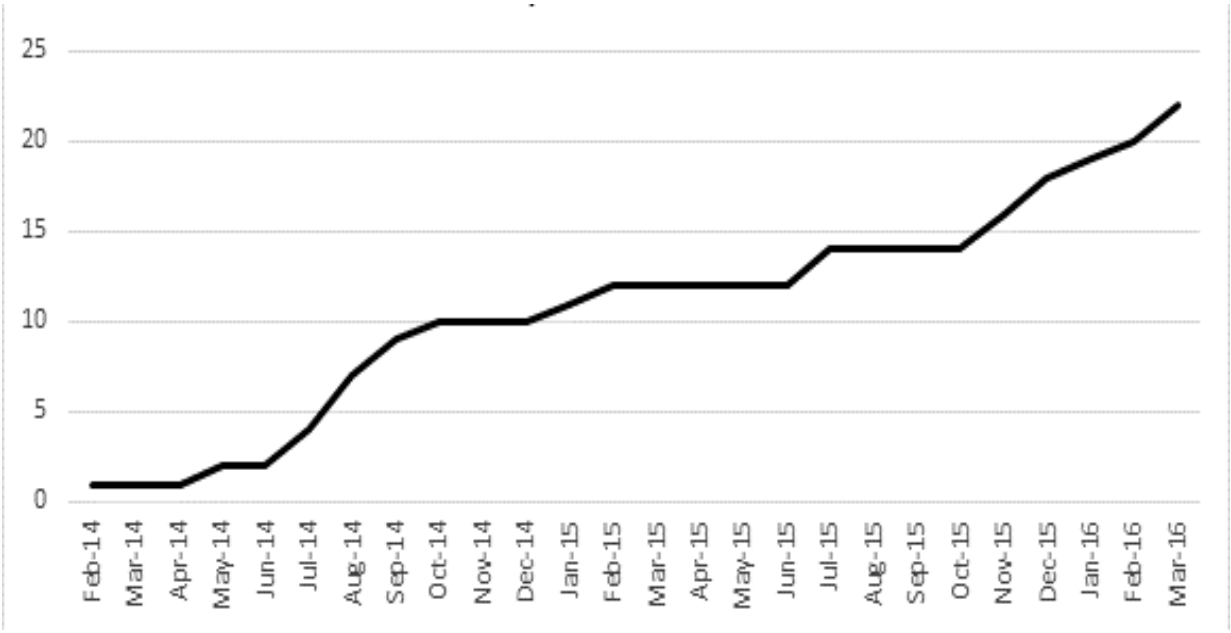

Figure 1: Number of systems online over

Energy generation, export and reimbursements

Table 1 shows a summary of energy generation and export for the first two years of the program.

Program Summary 2014-16					
Fiscal Year	Program Year	Program clients added	Capacity added (kW)	Exported energy (kWh)	Reimbursement total
2014/15	1	10	28.05	6223 [1]	$1,643.34
2015/16	2	10	43.85	537 + 16,903 = 17,440	$125.10 + $3,862.38 = $3,987.84
Total		20	76.90	23,663	$5,630.82

Table 1: Summary of first two years of generated and exported energy and reimbursements

Total capacity of the installed systems from the first and second program years is approximately 77kW. These systems are estimated to generate approximately 85 MWh of energy annually. Approximately 34 MWh of electricity has been generated by the first 10 systems connected with 16.9 MWh of that being exported, and an estimated 12 MWh has been generated by the second year (10) systems with only 537 kWh exported.

Reduction in GHG emissions:

In the first year of the program, 6,223 kWh was exported to the Yukon Integrated System and diesel distribution grids, and approximately 15,000 kWh was exported to the grids in the second year.

Export from the second year generation was very low due to most new systems being completed and approved late in the fiscal year, which is also at the lowest period of generation. All generation (i.e. both offset and export) on diesel grids offsets diesel consumption and associated GHGs, since every single kWh of electrical use in those

[1] Includes generation from one of the largest systems through a period of almost two years since that system was a pilot and had a dual register meter installed in 2013. This inflates payout and export numbers in the 1st year.

communities is generated by the diesel plants. Generation from first year clients in diesel communities was approximately 5,200 kWh and generation from second year clients was approximately 5,500 kWh.

This total of 10,700 kWh would have resulted in a savings of about 3,200 litres of diesel fuel and an associated 8,400 kg of GHGs for the second year of the program.

Also, for every future 1 kW of installed PV capacity on diesel grids, 1,100 kWh of annual generation can be expected, which will save roughly 330 litres of fuel and the associated 860 kg of GHG emissions.

Objective 2: Support ongoing research and technology to diversify renewable energy sources.

The production incentive to clients for their energy exports improves the economics of micro-generation installations, including those of experimental or research projects. One client (Triniti Technology, Solvest, Cold Climate Innovation Centre and YuKonstruct) installed a system that served the purpose of the program and also provided an opportunity for valuable research on how different PV modules perform in this climate and latitude.

The program incentive can also be applied to emerging renewable energy technologies, assuming the protective device, typically an inverter, meets grid connection requirements as per electrical inspection, Under Writers Laboratory of Canada (UL), Canadian Standards Association (CSA) and the Canadian Electrical Code. Several new technologies that generate heat as well as electricity are being considered for future applications to the program.

Objective 3: Promote energy conservation and greater energy efficiency.

The production incentive for contributing excess power to the grid encourages clients to maximize their own energy use efficiency and conservation, reducing their consumption to maximize their exported energy and achieve greater financial benefits.

Conclusions

Objective 1: Encourage the development and adoption of new individual renewable energy sources to reduce greenhouse gas emissions.

Implementation of the Micro-General Production Incentive Program has facilitated the development and use of new individual renewable energy sources, resulting in reduced greenhouse gas emissions and utility generation capacity requirements on Yukon grids, with a measurable reduction in diesel consumption.

Objective 2: Support ongoing research and technology to diversify renewable energy sources.

The Micro-generation Program has motivated Yukoners to develop and add renewable energy technology systems (usually PV) to the hydro (and in some cases diesel) grids, which is a clear step forward in diversification of Yukon's renewable energy sources.

Objective 3: Promote energy conservation and greater energy efficiency.

This synergy promotes increasing the energy efficiency of buildings and more conservative energy consumption behaviour.

Installations in diesel generation communities are beneficial to both system owners and communities, as clients receive a higher compensation for exported energy (as compared to hydro grid export), consume less fuel and emit fewer GHGs and particulates.

An important point to note is that while some export to the hydro grid may offset fossil fuelled generation, every kWh of generation in diesel-served communities (not only exported energy, but all generation by micro-generation systems), offsets fossil fuel consumption.

Through Energy branch online resources, the Energy Solutions Centre storefront, and by talking to program clients and potential clients, many members of the public have become increasingly aware of their potential to generate a portion of their own energy. As awareness of the possibilities of technology increases, more Yukoners are engaging in the program. Energy branch staff has observed that PV installations happen in proximity to one another: if one person installs a system, neighbours and friends tend to follow suit. This behaviour demonstrates that people are learning from each other and are shifting toward greater energy conservation.

Recommendations

Program data demonstrates that the Micro-generation Production Incentive Program has met or exceeded the policy and program objectives. The following are Energy branch recommendations that will support the continued success of this program, and the fulfillment of policy and program objectives.

Energy generation, export and reduction in greenhouse gas emissions

Despite the lack of available technical data, generation estimates are considered accurate (approximately 1,100 kWh/year can be expected for every 1 kW [of PV] installed). Values for exported energy can also be estimated but are less precise: based on 76.9 kW of installed capacity and an estimate of 25 per cent of annual generation

exported, Energy branch estimates there would be 21.3 MWh of PV generation exported to the grid in future years. Export estimates will continue to be based on the estimated generation of previous years, and the actual metered export will continue to be refined when dual register meters are read at the end of each January. Export is expected to average 20-30 per cent in future years.

An increase in the average size of PV systems being installed would increase the average export percentage and a larger, micro-hydro system brought into the program would significantly increase the export averages, because continuous generation would lead to a large generation–to-consumption ratio for that system.

Recommendation 1 – Continue the program, as results are positive: generation capacity is increasing, project proponents are realizing benefits and there is a measurable reduction in greenhouse gas emissions. These positive results are expected to continue.

Program budget

Production incentive reimbursements to clients for the first year of the Program (2014-15) should not be interpreted as typical. Anticipated uptake for the program was unknown, so the budget required for the first year of program operation was estimated at $5000, while the total cost was $1643.34. This reflects:

- the small number of systems that subscribed to the program in its first year;
- the duration of system operations, most of which were operating for under seven months including the three least-productive months (from the perspective of solar access);
- the number of systems developed in the Whitehorse area and on the Yukon Integrated System (lower reimbursement rate as compared to diesel grid-ties); and,
- the residential scale of most systems, which are typically under 5kW, and the lower export-to-consumption ratio.

Of the total paid out, $1,121.70 was issued to a single system. That system was installed on a diesel grid in December 2011, as a pilot to support PV systems development in Yukon. The dual register meter was installed in 2013 resulting in a reimbursement for this system calculated for 22 months.

The amount budgeted for the second year (2015-16) was also $5000 and the total paid out was $3,987.48.

Based on current data, Energy branch forecasts that at the end of year 3, the reimbursement for first year clients will be approximately $3,500, for second year clients

$4,700 and for third year partial generation of new third year clients $1,000. The total required will be approximately $9,000 in 2016-17.

Recommendation 2 – Determine a reasonable method for calculating an annual program budget, so that implementation continues smoothly from year to year. A proposed method is to budget $625 / year for every 10 kW of installed capacity. This assumes that 20 per cent of that capacity is added in diesel communities and 25 per cent of that and all other generation is exported to the grid.

Production incentive rates

Some current and potential program clients have expressed concerns about the reimbursement rates and would like to see these rates increased. The general feeling is that the rates are too low to make systems economical for the public. With paybacks now calculated at approximately 12 to 27 years, some potential clients may be deterred from advancing projects[2]. The reimbursement rates were originally set in the micro-generation policy with input from both territorial utilities.

Consideration of higher rates would certainly improve the economics for system owners, boost program popularity, and increase program participation. However, there has been some criticism that programs such as this serve only those that can afford it (at a cost to all tax and rate-payers) and that an increased reimbursement rate may be unnecessary and unfair, partly due to the fact that most generation added to the hydro grid at this time increases grid capacity when it is not as necessary, due to hydro surplus during times of best PV generation.

Recommendation 3 – In the short-term, Energy branch/EMR recommends continuing to use the rates set by the Micro-generation Policy. The rationale for setting the rates should be emphasized, as well as the fact that efficiencies will reduce payback time.

Reporting

For this reporting period (years one and two), there may appear to be some discrepancy in client numbers and generation capacity because generated electricity is not reported until clients have gone through the process of joining the program and connecting their systems to the grid. Some were connected for many months prior to becoming actual program clients, so initial export was not tracked.

Also relevant to potential reporting discrepancies is the variety of program-related dates at the program outset. Dates of policy release, program implementation, PV system

[2] Unrelated to the program incentive rate but relevant to system owner economics is that in the three years since the Micro-generation Policy was released, the cost per Watt installed has come down by about 40 per cent. This reduces simple payback by approximately two to seven years depending on system specifics.

installations preceding and during the program, program review period dates, utility meter reading cycles and the reimbursement period not directly corresponding to fiscal or calendar year-end dates, all complicated reporting this early in the program.

Recommendation 4 – The application review and approval processes have become more efficient and technical issues have been resolved, as the program is maturing. Reporting in future years will be more straightforward. No changes are required at this stage.

Legal aspects

The Micro-Generation Production Incentive Program is a Yukon government program, funded by EMR. However, program clients enter into an agreement (regarding interconnection and operation) exclusively with the relevant electrical utility (Yukon Energy Corporation or ATCO Electric Yukon), a copy of which is provided to the Yukon government. There is no written agreement in place between the Yukon government and the client.

Another issue has arisen with respect to the recipient of the annual generation/export reimbursement. The current payment arrangement is as follows.

The reimbursement is based on (meter reading) data for each client, which is provided annually to EMR Department of Finance by the utilities. The export data are 'tied' to the electrical account. Finance issues the annual reimbursement to the electrical account holder; however, the account holder is not always the system owner. Some system owners who do not hold the relevant account with the utility (typically a landlord) would like to receive the annual reimbursement for their system's power generation, despite the site tenant (a renter) holding the electrical account.

Recommendation 5 -
i) Yukon government should explore options for having reimbursement payments made to system owners regardless of who the utility account holder is.

ii) An agreement between the client and Yukon government should also be considered for development, outlining both parties' obligations.

Collaboration with utilities

Program management requires substantial communication between the Energy branch and the utilities (primarily ATCO Electric Yukon). There has been confusion about installation and approval dates, as well as the accuracy of shared program-related data. Furthermore, ATCO Electric Yukon has made it clear that if the program expands to such a degree that the time spent on micro-generation program applications and meter change-outs becomes significant, an increase for rate-payers may be required.

Recommendation 6 - To avoid confusion about installation and approval dates, and ensure accuracy of all shared program-related data, it is recommended that the Energy branch work with the utilities and with EMR Corporate Services to establish a formal information-sharing protocol that meets requirements of the *Access to Information and Protection of Privacy Act*.

Appendix 1 – Micro-generation Project Details

Table A lists the capacity, metered days, total generation and amount reimbursed for the active systems in 2014/15 – this is a summary of the payouts to the clients brought in to the program during the first year.

Table B lists the capacity, metered days, total generation and amount reimbursed for the active systems in both 2014/15 and 2015/16 – this is a summary of the payouts to the clients brought in to the program during the second year, along with the summary of first year clients and results of their first complete year of metered generation.

Table A: Generation and payment information for Year 1 (2014/15))

2014/15 Reimbursement summary			
System size (kW_p)	Days metered	Credited energy ('export') (kWh)	2014/15 payment ($)
3.50	196	534	112.14
2.58	182	787	165.27
2.58	197	408	85.68
5.00	145	540	113.40
2.11	39	000	-
2.58	147	093	19.53
2.00	123	001	0.21
2.00	139	120	25.20
1.00	118	001	0.21
4.70	682	3739	1,121.70
	Year 1 Totals:	6223	$ 1,643.34

Table B: Generation and payment information for Year 2 (2015/16)

2015/16 Reimbursement summary			
System size (kW_p)	Days metered	Credited energy ('export') (kWh)	2014/15 payment ($)
First year clients (2014/15)			
3.50	365	1886	396.06
2.58	365	2674	561.54
2.58	365	1563	328.23
5.00	365	3754	788.34
2.11	365	0	-
2.58	365	1407	295.47
2.00	365	1306	274.26
2.00	365	834	175.14
1.00	365	4	0.84
4.70	365	3475	1,042.50
	Sub-totals:	16903	$ 3,862.38
Second year clients (2015/16)			
2.58	247	109	22.89
11.80	185	137	41.10
5.30	72	67	14.07
5.30	65	48	10.08
5.00	61	0	-
3.33	64	0	-
4.10	13	0	-
5.30	Not available but <= 38	0	-
1.14	347	176	36.96
5.00	35	0	-
	Sub-totals:	537	125.10
	Year 2 Totals:	17,440	3,987.48
	Year 1 + Year 2 totals:	34,343	$ 5,630.82