Penguin Pilot Project

Assessing the acceptability of residential hot water tank timers

Results and evaluation report

Prepared

for Yukon Development Corporation

by Hicklin Consulting Service

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Yukon Development Corporation

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Cover photo: Explaining how the Penguin hot water tank control works. Photo by Peter Long

PENGUIN PILOT PROJECT IN THE YUKON

During the spring of 2000, the first steps were undertaken toward the Penguin Pilot Project, one component of Yukon Development Corporations' Energy Efficiency Initiative. The long-term goals of this initiative are overall load reduction and efficiency, and reduction of the Yukon's reliance on diesel fuel to produce electricity.

Hot water tanks contribute to the electrical load of a household based on hot water use. A thermostat, activated by cold incoming water, controls the operation of the hot water tank elements, turning them on to maintain a pre-set temperature. As soon as the elements are activated, load is created on the power supply system.

The electrical supply system serving the Whitehorse area (specifically Whitehorse, Haines Junction, Marsh Lake, Teslin, Carcross, Carmacks, Faro and Ross River) relies primarily upon reservoir and run-of-the-river for electricity production and diesel for winter peaking and reliability.

Here, the purpose of the Energy Efficiency Initiative is to find ways of reducing daily peak and seasonal demand on the power supply system so that generation needs can be met with available hydro resources over the medium and long term, even with an increase in the system load.

In diesel communities, the potential benefits of load shifting programs like the Penguin Pilot Project can be significant in terms of eliminating the need to engage additional generation equipment to meet peak loads.

This can extend the life of existing diesel generators and reduce capital costs for expanded capability. Utilities size community diesel capacity based on a multiplier that takes into account the peak load and the potential loss of the largest diesel engine.

Shifting the load to off-peak times can result in burning less fuel, reducing transportation of fuel to diesel plants, reducing operating stress on generation equipment and reducing diesel plant emissions. These benefits result in cost savings for the utility, and improved air quality for the community.

The main objective of the Penguin Pilot Project was to assess the acceptability of a particular "hard-wired" solution to address opportunities for daily load shifting. It was not a specific goal of the pilot project to realize a reduction in hot water heating costs for individual households. To keep project management simple and inexpensive, Whitehorse was chosen as the test community.

Characteristics of participating households included low (or no) daytime occupancy, and average hot water use in mornings and evenings.

EXAMPLES OF LOAD MANAGEMENT IN OTHER JURISDICTIONS

Research into details of objectives and design of similar programs in other jurisdictions involved telephone contact with Sam Costa of Princeton Light and Power (BC) and Grant Meadows of Optimum Energy. Hector Campbell (Director of Asset Planning) at Yukon Energy and Steve Savage (Manager, Customer Service) and Wendy Scramstad (Supervisor, Customer Service and Administration) of The Yukon Electrical Company Ltd. also provided valuable input.

These discussions revealed that there was no single "best" way to implement load management control programs for residential situations. In BC, Princeton Light and Power has implemented a "time of use" program for hot water tanks that involves a resident-controlled relay between the tank and the electrical panel.

To stage the peak load, residents are asked to turn on their tanks at varying times depending on the first letter of their surname (i.e., A-G turn on at 9 p.m., H-Z turn on at 9:30 p.m.). This type of program is working successfully in Princeton mainly because it is implemented by the utility that has solicited a great degree of resident awareness and participation.

In Hawaii, a hot water tank controller project offers program participants a free, larger hot water tank in conjunction with the installation of an off-peak Penguin timer to ensure adequate supply of hot water through peak periods.

Another approach to a off-peak hot water controls program involves the installation of digital controllers at the meter. The on-off cycles are managed entirely by the utility company, and completely independent of the residents.

LOAD MANAGEMENT EQUIPMENT – PILOT PROJECT

For the purpose of this pilot project, it was desirable to maintain maximum control of the programming schedule. At the same time, it was important to offer participants an opportunity to override the schedule should the need arise for extra hot water. Two 240-volt products were evaluated for their suitability for the pilot project.

See Appendix A, Penguin

The "Penguin" from Optimum Energy was assessed because it is electronically pre-programmable and tamper-proof, as well as offering considerable scheduling flexibility, easy installation and reasonable cost. The Penguin also has the ability to recover its schedule following a power failure.

See Appendix B, Little Grey Box

Intermatics' manual timer control known as the "Little Grey Box" (LGB) was installed in one participant's home to compare the effectiveness of this timer to the Penguin. Because the LGB requires resetting the clock after power outages and time changes it was considered to require excessive occupant involvement. It was therefore deemed unsuitable for this pilot project because of the need to have a consistent pre-programmed schedule for monitoring and evaluation.

The Penguin was chosen as the most suitable option for this pilot project. It has an internal battery with a 10-year life expectancy. Should the timer fail, the

system reverts to normal (pre-heating) operation controlled by the thermostat in the tank. It was also available with an override option. This feature, which allows residents to restore load for about an hour, introduces some degree of control over the availability of hot water.

PARTICIPANT CRITERIA AND SELECTION

Based on the program parameters, the next step was to find 50 suitable and willing households to participate in this program.

Criteria for participation were fairly simple. The household must be located in Whitehorse (to keep installation monitoring costs to a minimum) and must have an electric hot water tank. The household should be unoccupied during the day on weekdays as a general rule.

Since the issue was lack of occupancy on weekdays, the number of regular household occupants was irrelevant, however, those which included teenagers (high-end water users!) were discouraged from participating, as there was concern that they might be setting themselves up for a frustrating experience.

Pilot project participants self-identified by signing onto a list at the 2000 Lions Trade Show and Yukon Home Show, at which time they were asked a few basic questions regarding occupancy characteristics of the home. Suitable candidates were also solicited from the House Calls Pilot Project (previous project of the Energy Efficiency Initiative involving 100 Whitehorse households who self-selected in response to newspaper ads).

To encourage volunteers, the program provided incentives, including free hot water tank wraps (and installation) and a high quality, low-flow (2.5 gallons per minute) EarthShower showerhead made by Niagara Conservation, in conjunction with the installation of each Penguin. These products increase the potential for energy savings, which the Penguin alone does not. Also, the new showerhead contributed to the overall success of the pilot project, since a tank of hot water lasts longer with lowered use, thus interfering less with hot water demand.

See Appendix C, Penguin installations locations

Participating households represented eight geographically distinct subdivisions within the greater Whitehorse area.

DESIGNING THE PENGUIN SCHEDULE

The Penguin Hot Water Tank Timer is programmable for time of day (multiple cycles), day of the week, and month to month. This allowed flexibility in developing a schedule that would meet the goals of the project while maintaining household needs for hot water.

Tracking typical load peaks on the system involved a fairly detailed look at the energy use patterns on the Whitehorse-Aishihik-Faro (WAF) grid prior to designing the Penguin schedule. To eliminate inconsistency and to keep the test sample as large as possible, all pilot Penguins were programmed the same.

See Appendix D 24-hour load profile, WAF typical winter weekday

The following factors were considered during the design of the Penguin programming schedule.

- Due to out-of-household work and school commitments, residential energy use is fairly consistent from Monday through Friday.
- Household schedules tend to be less consistent during the summer months due to such factors as guests, family travel and children not in school.
- WAF peak system loads on weekends tend to be longer and less predictable than on weekdays.
- The WAF grid currently uses only hydropower to produce electricity during the summer months.
- During cold winter months on the Whitehorse area grid, diesel generators may be brought into service to meet peak loads and to support system reliability, or to meet winter loads during low water cycles such as those experienced around 1996-1998. Reliability issues could include emergencies or the creation of frazil ice which can form and block the intake to hydro turbines.

For the purpose of the pilot project, the Penguin schedule was activated on weekdays from fall through spring, and the schedule was set to ensure that timers turned off power to the tanks for the entirety of typical morning and afternoon peak periods.

Tank recovery time was calculated considering average household hot water use, and average tank capacity, insulation and thermostat setpoints to ensure that the schedule would maintain the availability of household hot water when it was needed the most. (Calculations provided by Robert Collins, P.Eng., Senior Energy Analyst, Department of Energy, Mines and Resources.) This work showed that during the shut-down times, the reserve capacity of the hot water tank would satisfy most household requirements for hot water.

The main objective of the pilot project was to assess the suitability of a technology that would help to reduce peak load on the electrical supply system. It was not the objective of the pilot project to realize a reduction in hot water heating costs for individual households.

All Penguins were programmed to turn off the power supply to the hot water tank from 8:30 a.m. to 12:30 p.m. and from 3:30 to 7 p.m., every weekday from October 1 through May 31. During weekends and the four summer months there was no program schedule, allowing tank thermostats to cycle power to the elements as needed.

INSTALLATION

Penguins are designed to be wired directly into the hot water tanks, which are in turn hard-wired into the electrical panel. For this reason it was necessary to contract a qualified electrician for their installation.

See Appendix E, Penguin installation tender

Rather than applying for an electrical permit for each individual home, the Yukon government electrical inspection department allowed a single permit to cover all 50 installations, provided the department received a listing with each Penguin address.

In May 2000, 50 identically programmed Penguin hot water tank timers were installed in Whitehorse residences. Operation of the Penguin was explained to participating residents and a program summary sticker including a Penguin service phone number was located near the main electrical panel.

See Appendix F, Penguin installation instructions

See Appendix G, Penguin operation sticker

It was assumed that participants would occasionally need to reset or override the Penguin schedule. An optional override switch was ordered on all 50 pilot project units. Participants were notified at the time of installation that if they should happen to run out of hot water, they could press the override switch on the side of the Penguin to supply power to the tank for about one hour. This is a suitable length of time to heat the entire tank of water to the pre-set temperature.

See Appendix F, Penguin installation instructions

The low-flow showerhead and hot water tank wrap that each participant received increased the likelihood of some actual energy savings to the household, which the Penguin alone did not. Additionally, the new showerhead could potentially have increased the overall success of the pilot project, since the tank of hot water would have lasted longer due to lowered use and would have therefore interfered less with occupant hot water demand.

With the exception of two cases, where the Penguins quickly proved incompatible with the household hot water demand, all Penguins remain installed in their original locations, even if the original occupants (at the time of Penguin installation) had changed since then. The two units which were not well-suited to the occupancy schedules of the residents were removed and re-installed in other homes. One unit was subsequently decommissioned as it was not suitable for the occupancy patterns of the home.

POTENTIAL DEMAND REDUCTION FROM PENGUIN PILOT PROJECT

Almost all of the pilot project hot water tanks were 40-gallon capacity. These tanks typically have two 3,000-watt elements, however, the internal thermostat control allows only one of these elements to operate at a time.

Since residential hot water use is a contributing factor to load peaks on the Whitehorse and area hydro system, one could assume that morning and afternoon use would be followed by a period of tank temperature recovery. Therefore, whenever all tanks are drawing power simultaneously, the 50 hot water tanks with Penguin timers represented a combined load of 150 kw. This

was assumed to be the maximum demand reduction on the system as a result of the pilot project.

SUMMARY OF PROJECT COSTS

The individual cost for each Penguin (including override switch) was $175, plus $100 for programming software and $50 shipping, for a total capital outlay of $8,900. The final installation contract for 50 residences came in at $4,180. Total value of hardware and installation for the pilot project is $13,080.

SURVEY QUESTIONNAIRE RESPONSES

In the spring of 2001, one year after installation, a one-page survey was mailed to all 50 pilot project participants. The package contained a self-addressed, stamped envelope for returning the completed survey. Since there was no need to know who was who, anonymity of respondents was assured by omitting the requirement for identification on the survey form.

See Appendix H, Survey questionnaire

Several participating households had changed occupancy by the time of the survey. Despite this, 41 people submitted a completed survey form, representing an impressive 82% survey response.

SUMMARY OF SURVEY RESULTS

The results of the survey are summarized in this section. Detailed results are tabulated on a spreadsheet at the end of this report.

See Appendix I, Survey results

The majority of households (over 73%) reported that they had not noticed any difference in the availability of hot water. Under half (44%) of the respondents reported that they had used the "reset" feature on the Penguin (which temporarily disables the schedule), but most of these had only used it a few times, when occupants were at home with illness or when houseguests were increasing the demand for hot water.

Penguin households received a good quality low-flow (2.5 gpm) showerhead (except those who already had one). Somewhat surprisingly, a full year later, 12% of program participants had not installed the showerhead. Of those who had, 78% liked it and 5% did not.

Almost everyone (95%) said they would endorse this program to others if it were expanded in the future. A majority (over 65%) of respondents provided names and contact phone numbers for people they thought would be good contacts for an expanded program. Some participants provided more than one name, for a total of 32 additional potential candidates.

Participants were asked to identify any changes in the household that might have affected hot water use over the test period. Two participants had installed a hot tub since the Penguin project started. Four participants had installed new kitchen or laundry appliances. Two teenagers had moved out of one residence. Most participants (66%) indicated that aside from visitors and houseguests, nothing significant had changed in their use of household hot water in the 12-month period.

CONCLUSIONS

The purpose of this project was to determine whether shutting off residential hot water tanks during winter peaks would interfere with daily hot water use. It is evident from this one-year pilot project that such a program causes minimal interference, but also that the schedule which was used for the Penguins is acceptable to most people. Specifically, the Penguin provided a reliable economic means of achieving the objectives of this program without compromise.

The results of this pilot project also suggest that hot water timer controls programmed to reduce peak loads are well-suited for households with low or no daytime occupancy. However, it is important to consider the occasional need to override the schedule in the event of guests or other factors that result in increased hot water demand.

For future residential efficiency programs, a hot water tank program could offer a utility significantly greater control over peak loads, since the demand (3,000 watts per unit) is higher than most other household appliances, and is likely to be in use during system peaks.

To achieve a significant decrease in peak demand on the hydro-electric system would require the installation of many more timer controls. For example, if Penguins were installed in 800 Whitehorse households (10% of total residential electrical accounts), the potential shifted load would be 2.4 MW. On a smaller remote system (such as in a Yukon diesel community), such a program could include all "suitable" residences and significantly reduce peak electricity demand.

As of the writing of this report, all 50 Penguins remain in the homes and (with one exception as noted in "Installation") continue to operate on their original schedule. Several of these homes are now occupied by new residents, some of whom may not even be aware of the job the Penguin is doing.

RECOMMENDATIONS

Potential savings resulting from a broader Penguin program should be explored further. Such a study should include a cost-benefit analysis of the Penguin approach compared to utility-managed controls and the recovery of installed Penguin costs in reduced utility load.

An additional assessment could include targeting maximum Penguin penetration in the Yukon market by specifying Penguins for new hot water tank installations or replacements, or retrofitting existing tanks with timers. Replacements and retrofits would be particularly well-suited to Watson Lake and Dawson City where corrosion from minerals in the water supply can necessitate hot water tank replacement every few years.

Program design for future hot water timer programs should take the following considerations from the Penguin Pilot Project into account:

- Penguin timer schedules have only been tested on weekdays.
- Penguin timer schedules were not tested during the months of June, July August and September.
- In-bulk benefits should not be overlooked during ordering (per unit cost) and installation (permits).
- Program participants will occasionally need to reset or override the Penguin schedule.
- Water heater blankets and low-flow showerheads should be part of the overall program.

APPENDIX A

Penguin

Optimum Energy Products, Penguin timer

http://www.optimumenergy.com/management/load.html

[What's New] [Downloads] [Main Menu]

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November 17, 103

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Load Management Timers

At last! Load control that saves money, installs easily and needs no upkeep!

A timer that...

- Never forgets, even after a power failure.
- Is *smarter* & *more reliable* than mechanical timers.
- Doesn't need costly repairs or hard-to-find parts.

Penguin
Load Management Timer

The Penguin timer is pre-wired.... attaches easily to any electrical device such as a water heater or lighting. You won't even notice it's there.

Tamper-proof enclosure allows meter seals to ensure security. Customers cannot change settings. Optional override switch available.

- **Eliminates need for radio transmitters or receivers.**
- **Requires a PC only to program the timer... nothing fancy.**
- **Cycles up to 4 times a day.**
- **Automatic summer & winter changeover.**
- **Works year after year without resetting.**

Set the timer in your office or shop. We provide a DOS diskette for this - all you need is a PC. Minimal computer expertise required.

Up to four cycle times per day, with weekday and weekend settings. Summer and winter schedules change automatically. *Special random cycle start times avoid lashback!*

Penguin can control your water heaters, air conditioners, therma storage units or other devices for maximum reduction of peak demand loads. You can also use Penguin in conjunction with an off-peak or TOU rate to move KW use to off peak.

The Penguin Load Management Timer avoids peak demand. Yo will see *immediate* on-peak load reductions from your very first installation!

Features & Benefits

LED - Two color LEDs indicate when controller has loac turned on or off.
Ten Years of Accumulated Carryover During Power Outage No batteries required. Real-time clock/RAM module with integral zero-maintenance battery retains all control functions following any power loss. Ten-year guaranteed data retention/timekeeping operation upon los of power.
Four Time Settings - Loads can be controlled during peak hours, morning and/or afternoon.
Winter-Summer Settings - Different schedules availab for winter and summer, with automatic seasonal changeover.
Weekday Control Choices - Allows different control strategies, including load-on, load-off or load-duty cycle. You have **maximum** flexibility to meet load management requirements.
Weekend Settings - Saturday and/or Sunday may be c off or controlled similar to the weekday schedule.
Daylight Savings Time Adjustment and Leap Year Correction Occurs automatically and updates from year t year.
Real-Time Clock - Has 100-year calendar.
Flexible Cycle Times - Duty cycle times can run from to 99 minutes.
Anti-"Lashback" Feature - The controller can be programmed with a randomized or fixed time-delay cycle start time to avoid lashback among the controllers in service. Fixed time delays are selectable from 0 minutes (no time delay) to 99 minutes.
OFF Time Guarantee - Minimum off time can run from to 99 minutes. This ensures delay protection for A/C compressors.
Industry Standard - UL and C-UL (Canada) listed ener management equipment Standard 916. FCC certified clas B Part 15 Subpart J.
Optional Override Switch - Allows customer to restore load for up to 99 minutes.
No User Programming Required - Programming is do by utility using an IBM PC or compatible computer with serial port.
DOS Friendly - Single-screen DOS software lets programmer upload and download configurations to timer using one button. Settings are easily confirmed at a glance. Configurations can be saved to disk and read fro

Simple Interface - Four-wire programming cable is provided by Brayden Automation Corporation.
Simple Wiring - Module is pre-wired with 18" leads to simplify installation.
Controlled Access - Tamper-proof design is programmable only by utility, not by customers.

Two types of Penguin timers are available: the standard
model, shown at right with cover opened, and the model with optional override switch.

The Penguin Load Timer is an electronic time control designed for use with utility load management of time-of-use programs. Operating on a weekly schedule, the controller accommodates different schedules for summer and winter.

Once programmed, it will operate perpetually without requiring updating. The timer consists of a microcontroller, a real-time clock module, support circuitry, an RS-232 interface and a 35-amp power relay.

Electrical

Device Circuitry Designation - Class 1
Input Power - 120VAC @ .1 Amp or 240VAC @ .05 Amp
Power Consumption - 12 Watts
Relays - 1 Single-Pole Power Relay SPST-NC-DB (1Form Y)
Relay Contact Rating - Single Pole Relay - 35 Amps @ 300VAC

Mechanical

Enclosure Rating - NEMA 1
Enclosure Dimensions - Approx. 6" x 4" x 2,25"
Enclosure Material - LEXAN (polycarbonate) housing meets UL 94V-1 flammability rating.
Operating Temperature Range - 0 to +70 C
Shipping Weight - Approx. 1 lb.

Penguin
Load Management Timer

Low cost & easy installation

Order A Special Priced Demo Kit NOW.

All Specifications are subject to change without notice.

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Tel: Toll Free (877) 766-5412 Fax: (403) 256-3431
Email: info@optimumenergy.com

APPENDIX B

Little Grey Box

Intermatic, Little Grey Box

http://www.intermatic.com/?action=subcat&sid=83

INTERMATIC

These time switches provide automatic control for electric water heaters. They provide to-the-minute accuracy in programming and time-keeping. The time switches can be programmed for repeat daily scheduling, 5-day working week scheduling, weekend scheduling or any individual day scheduling. Timers can be scheduled for operation during the lowest time-of-day rates or to switch off the electric heater during period of utilities peak power usage. The time switch can be set to operate for up to 6 on/off operations daily for a maximum of 42 on/off operations weekly. Both models provide a convenient external override switch and LED load indicator for ease in scheduling hot water as required for extra hot water demands. The timers include a battery carryover which protects both time keeping and program information for a minimum of 3 years.

Model	Switch	Clock Motor Volts 60 Hz	Watts	External Switch	Amps/pole
EH10SPST		120	3600	Yes	30
EH40DPST		240	7200	Yes	30

Sample Specifications
Select the text below with your mouse cursor, choose EDIT>COPY from your browser's main menu and then choose EDIT>PASTE in your word processing or text layout application to copy the specifications into your document.

The time switch shall be a digital 7-day type capable of permitting up to 6 ON/OFF operations each day or 42 ON/OFF operations each week. The time switch shall provide a minimum ON or OFF time of 1 minute. The time switch to be powered by _____ (120), (240) volt AC, 50/60 Hz power supply. The time switch shall provide a feature for programming all 7 days, 5 week days only, two weekend days only or each day independently.

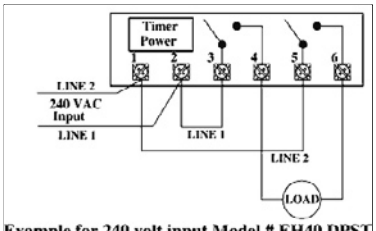
The time switch mechanism shall be a snap-in design to provide ease of mechanism removal for mounting the enclosure. The time switch enclosure shall be a NEMA 1 lockable steel enclosure which shall be painted with an electrostatic painting process to eliminate the potential for corrosion. The time switch shall include an external override to allow overriding of the time switch without opening the cover and to provide override capability when the cover is padlocked. A load indicator (LED) shall be provided in the time switch and shall be visible through a clear display window for viewing the load status without opening the time switch cover. The time switch enclosure shall provide a minimum of 31 cubic inches of wiring space and shall provide a non-removable cover which shall swing open a full 180 degrees. The time switch shall provide clear terminal identification on a see-through non-curling terminal insulator.

Terminal connections shall be made using teeter type terminal screws to provide secure connections for wire sizes up to #10 AWG. Switch configuration shall be _____ (SPST), (DPST) with a UL listed switch rating of:

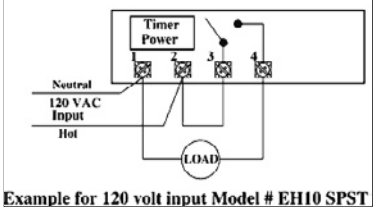
- 30 amps per pole resistive, inductive, 120/240 volts AC
- 1/2 HP, 120 volts AC
- 1-1/2 HP, 240 volts AC
- 5 amps tungsten, 120/240 volts AC

Time switch shall be UL listed under UL category 916 Energy Management Equipment and shall be Intermatic Model _____.

Wiring Diagrams
Save these images to your hard drive by clicking and holding on each image below while pressing your right mouse button. Select "save image as..." and name the image to use later in your specification document.



Example for 240 volt input Model # EH40 DPST



Example for 120 volt input Model # EH10 SPST

APPENDIX C

Penguin installation locations

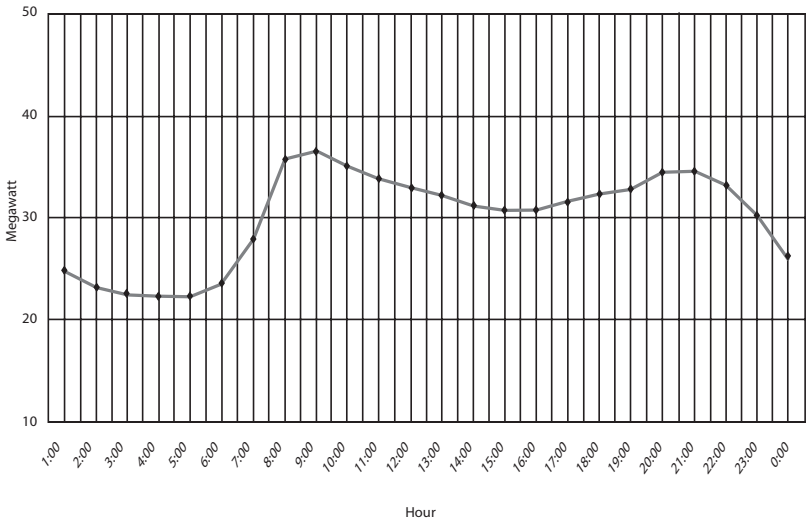
Copper Ridge	
47 Garnet Cr	Y1A 5R3
73 Tigereye	Y1A 6G9
Crestview	
116 Crag Rd	Y1A 5C1
Downtown	
7170-7 Ave	Y1A 1R1
Granger	
4B Williams Place	Y1A 5R2
65 Wilson Dr	Y1A 5R2
7 Hayes Place	Y1A 5R2
Hillcrest	
14-156 Hillcrest Dr	Y1A 4N4
140 Dalton Trail	Y1A 3G1
5 Sunset Dr N.	Y1A 4M7
57 Kluane	Y1A 3G7
7 Chalet	Y1A 3H1
Logan	
117 Falcon Dr	Y1A 6C7
54 Finch Cr	Y1A 5X5
Mary Lake	
8 Sage Place	Y1A 5H4
Porter Creek	
1011 Pine St.	Y1A 5E5
123 Ponderosa	Y1A 5K8
25 Juniper	Y1A 4W8
3 Mulberry	Y1A 4X5
35 Tamarack	Y1A 4W3
37-13th Ave	Y1A 5Z8
528 Grove	Y1A 5J7
539 Grove	Y1A 5J9
73 Ponderosa	Y1A 5C5
77 Tamarack	Y1A 4Y7
Riverdale	
12 Koidern	Y1A 3N8
19 Liard	Y1A 3L3
21-5 Klondike	Y1A 3L7
25 Aishihik	Y1A 3R6
27 Tagish Rd	Y1A 3P4
29-5 Klondike	Y1A 3L7
44 Firth	Y1A 4R6
44 Pelly	Y1A 4M1
72 Boswell	Y1A 4T3
87-100 Lewes Blvd	Y1A 3W1
Takhini	
120 Falaise Rd	Y1A 3B2
165 Falaise Rd	Y1A 3C8
28 Dieppe Dr	Y1A 3A9
30 Dieppe Dr	Y1A 3A9
32 Dieppe Dr	Y1A 3A9
45 Dieppe Dr	Y1A 3A9
4B Arleux Pl	Y1A 5T3
7 Vimy Place	Y1A 3A9
Valleyview	
118 Valleyview	Y1A 3C9
126 Valleyview	Y1A 2B3
146 Valleyview	Y1A 3C9
160 Valleyview	Y1A 3C9
391 Valleyview	Y1A 3C9
403 Valleyview	Y1A 3C9
Wolf Creek	
34 Cronkite	Y1A 5S9

APPENDIX D

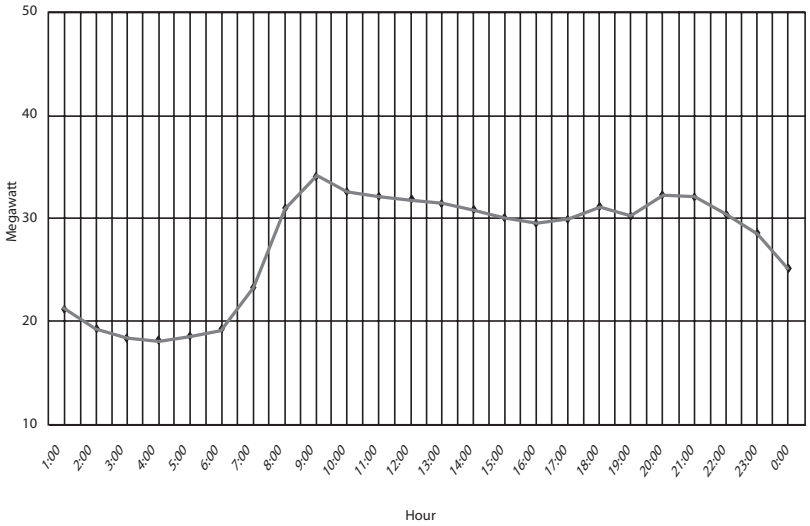
24-hour load profile, WAF typical winter weekday

These charts show the amount of electricity produced to meet demand over the course of three "typical" days. Weekday peaks occur from about 7 a.m. to 11 a.m. and 5 p.m. to 10 p.m. During winter months, with low water levels, these are the times of day when diesel generators may be brought into use on the Whitehorse-area grid electrical.

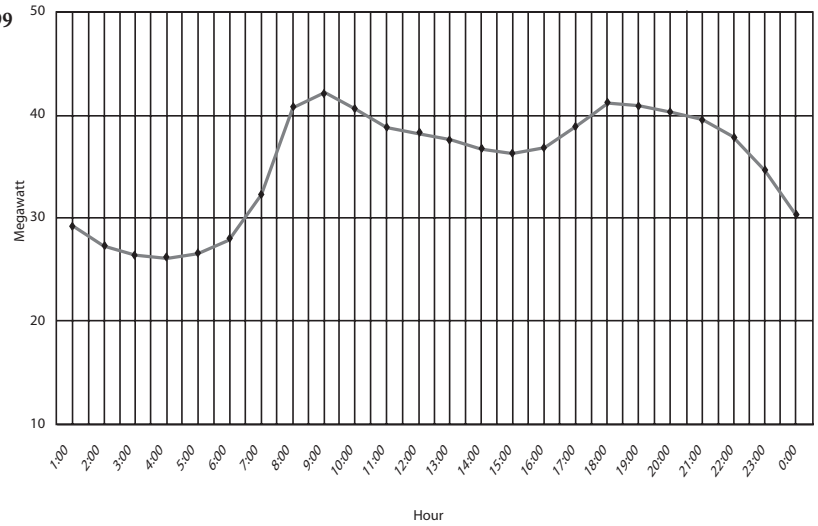
March 10, 1999



October 13, 1999



December 8, 1999



APPENDIX E

Penguin installation tender

Public tender for installation of water heater timers

This project calls for a certified (bonded) electrician to install up to 50 load management timers for domestic hot water heaters in Whitehorse homes by March 31, 2000. Pre-programmed timers will be supplied. For information on project specifications contact Craig Olsen at 668-5234 or 633-3972.

Submit tenders to Colleen Johnston, Yukon Energy by 4 p.m., February 25, 2000.

Project specifications for installation of water heater timers

1. Requires certified (bonded) electrician to install up to 50 load management timers for domestic hot water heaters in Whitehorse homes.

2. Project implementation to start in February with completion by no later than March 31, 2000.

3. For estimating purposes, expect all houses to be between Crestview and Riverdale in Whitehorse. Many of the installations will need to be during evening or weekend hours. Please submit a block price for installation of 50 timers. Manufacturer indicates ½ hr per installation. Price should include travel time and mileage.

3. Pre-programmed 'Penguins' timers will be supplied. See attachment for timer details.

4. This tender is for the installation only of the water timers. A project coordinator will work in conjunction with the electrician to complete the project. The project coordinator will be responsible for the following:
    - scheduling the timer installation appointments,
    - obtaining required government permits, and
    - coordinating the installation of whole house meters.

5. This is a pilot project intended to assess feasibility of using hot water tank timers to shift electrical loads and to determine actual savings. By deferring the hot water recharge times to non-peak load times, there will be a decrease in demand for diesel generated electricity. To measure actual changes in demand we will be using whole house meters separately supplied and installed.

    As part of the Yukon government investment in energy efficiency, the Yukon Conservation Society, Yukon Energy and YECL are working together to reduce electrical energy demands and thereby also reduce greenhouse gas emissions responsible for climate change.

6. For information on project specifications contact Craig Olsen at 668-5234 or 633-3972. Messages will be responded to as soon as possible.

APPENDIX F

Penguin installation instructions

Penguin MODEL 930A Load Management Timer

Installation Instructions

Penguin Kit Contents

Each Penguin Load Management Timer kit includes the following:

1 Penguin timer 230VAC ..... **PN#** FG930A-001

3 mounting screws ..... **PN#** 2520-1102

1 Instruction Sheet ..... **PN#** 00930-94100A

Parts You'll Need (not included)

- Appropriately sized wire nuts for line and load connections.
- Additional #18AWG wire for power supply connections.
- Additional #10AWG wire for high voltage load connections.
- Appropriate flexible or rigid conduit as required.

Mounting

1. Using flexible or rigid conduit or direct mounting, attach the Penguin to an electrical enclosure, a load center or to the appliance itself.
2. Run the Penguin's wires into the electrical enclosure. The electrical connections must not be made inside the timer enclosure.
3. Using the three screws provided, secure the Penguin onto a flat surface. This surface should be adjacent to the load to be controlled, next to the load center where loads breaker is located, or in another suitable or convenient location.

Power Supply Connections

The timer is equipped with a 230VAC input but can also be operated from 208VAC. It is intended to be wired on the same breaker with the load to be controlled, such as a water heater.

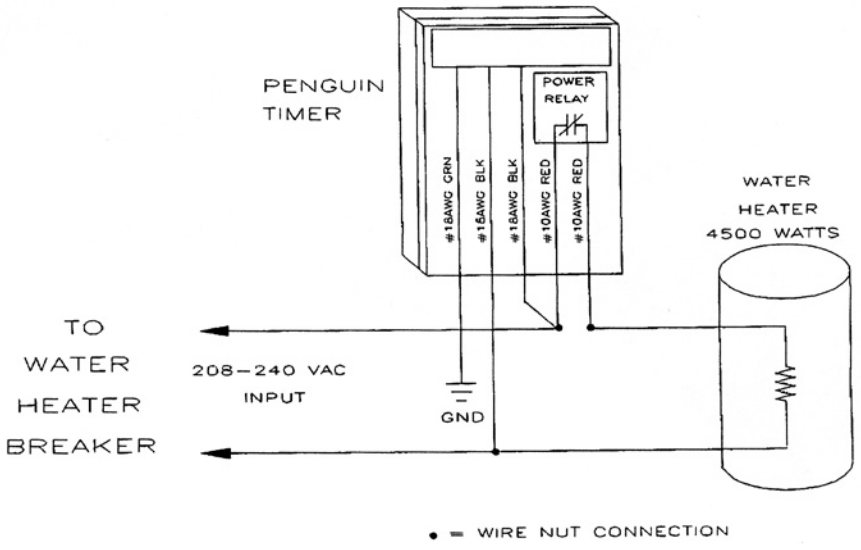
1. Connect the two black #18AWG wires to the supply wires for the controlled load. Make sure that the two black wires are connected ***before*** the load's relay contact, as shown in **wiring diagram below.**

   Connect the green 18AWG wire to ground.
2. Secure the wires with appropriately sized wire nuts.

Load Connections

Line Voltage Load 354

1. Insert the ~~30Amp~~ relay contact in **series** with the line voltage load as shown in the wiring diagram below making sure the relay contacts are installed ***after*** the Penguin's power supply connections (black wires).
2. Secure the relay contact's wires with appropriately sized wire nuts.



APPENDIX G

Penguin operation sticker

Please post this card close to your electrical panel for easy reference.

PROFESSOR ENERSTEIN IS PROUD TO INTRODUCE THE PENGUIN PILOT PROJECT

The Penguin Pilot Project is helping to reduce electricity use during peak times of day, especially in the winter, when diesel generators are in use to meet peak demand. Your Penguin is programmed to maintain the availability of household hot water when you need it most, in the mornings and evenings on weekdays, and all the time on weekends and during the summer months.

Specifically, the Penguin is pre-programmed as follows:

off: 8 a.m. - 12:30 p.m., weekdays on: 12:30 p.m. - 3:30 p.m. weekdays
off: 3:30 p.m. - 7 p.m. weekdays on: 7 p.m. - 8 a.m.
on: continuously, weekends and summer months

The reserve capacity of the hot water tank should satisfy most household requirements for hot water.

The Penguin is not affected by power outages and has an internal battery with a 10-year life expectancy. Should the timer fail, the water tank will remain continuously on as normal. If you do run out of hot water, press the override switch on the side of the Penguin to supply power to the tank for one hour. It won't take long get hot.

The Penguin is the property of Yukon Energy Corporation and may be removed after the pilot project ends.

If you have any questions or problems with your Penguin, please leave a message at Yukon Energy, 393-5300. We look forward to your feedback to make this project a success!

Yukon Government · Yukon Development Corporation · YUKON ENERGY · YUKON ELECTRICAL An ATCO Company

This project is part of the Yukon government's investment in energy efficiency.

May 19, 2000

The Penguin Project
Box 5920
Whitehorse Yukon
Y1A 5L6
Ph. 668-5234

To Penguin Project Participant:

The penguins are now all installed on people's hot water tanks. On the reverse of this sheet is an updated information sheet on the penguin. The on off times are slightly different than stated on the sheet you received when the penguin was installed. Please post this sheet in a location such as your electrical panel box for future reference. I am also including a sticker showing on off times to stick onto the penguin for easy future reference. Apologies that this material wasn't ready earlier.

The penguin will go into summer mode (always on) on June 1 and will remain that way until October 1. We will be contacting people some time after October 1 for feedback.

Thank you, your feedback is important to this project

Craig Olsen
Penguin Coordinator

APPENDIX H

Survey questionnaire

Penguin Pilot Project, Update April, 2001

First of all, from all of us and Professor Enerstein, a big "Thank You!" to everyone who is participating in the Penguin Pilot Project….and a small request. Can you help us evaluate the first year of the project?

Last spring, fifty Penguins (timer controls) were installed on hot water tanks in Whitehorse. The Penguins turn off power to the tank during morning and afternoon "peak energy times" during the winter months. All participating households received a free hot water tank wrap and a low flow showerhead. (some of these were installed at a later time, so if you didn't receive one, please let us know!)

Although you can expect energy savings from the tank wrap and the showerhead, the purpose of the Penguin is not to lower household energy costs, but to gather information about whether managing hot water tanks is a sensible way to help reduce peak electricity loads during the winter. We need feedback on how this worked in your household to help us assess the benefits of an expanded program for managing hot water tanks.

Now is your chance to tell us how the Penguin works for you and your family!

Please take a few moments and answer the following questions, then return this page in the self-addressed, self-stamped envelope provided.

1. Since the Penguin was installed, do you notice any difference in hot water availability? YES ___ NO ___

2. Do you ever need to use the "Reset" feature on your Penguin? YES ___ NO ___

3. If you answered yes to Question 2, how often?_____

4. Have there been any major changes in your household since the Penguin was installed (in the spring of 2000) for example, new appliances or people moving in or out?

   _____

5. Would you be willing to endorse the program (recommend to others) if we decide to expand it in the future? YES ___ NO ___

6. If you answered yes to Question #5, can you give us the name of one person (in Whitehorse) that you would recommend to participate in an expanded program?

   Name _____ Phone number_____

7. Do you like the new low flow showerhead? YES ___ NO ___

If you have any questions about the program or this survey, call Craig at 668-5234.

Thank you for your help and feedback!!!

APPENDIX I

Survey results

	Notice difference in water availability? YES	Did you use the reset option? YES	How often? Number of times?	Major changes in household?	Like the new showerhead? YES	NO	Endorse the program?
	✔		0	✔	✔		n/a
2		✔	6	new occupants in home	✔		✔
3			0	✔	n/a		✔
4		✔	+	✔	✔		✔
5		✔	✔	✔	✔		✔
6		✔	2	✔	✔		✔
7	✔		0	new clothes washer	✔		✔
8			0	✔	✔		✔
9			0	✔	✔		✔
10			0	increase in showers, laundry	✔		✔
11			0	long-term guests	✔		✔
12	✔	✔	2	all new major appliances	✔		✔
13	✔		0	✔	✔		✔
14			0	✔		✔	✔
15			0	teens gone, 2 less showers/day	✔		✔
16	✔	✔	2	new hot tub	✔		✔
17			0	new bathroom	✔		✔
18	✔	✔	6	✔	✔		✔
19			0	✔	✔		✔
20			0	✔	✔		✔
21			0	new domestic hot water tank	✔		✔
22		✔	6	✔	n/a		✔
23			0	✔	✔		✔
24			0	✔	✔		✔
25	✔	✔	3	yes	n/a		✔
26	✔	✔	6	2 less people	✔		✔
27		✔	2	✔	n/a		✔
28	✔	✔	2	✔	✔		✔
29	✔	✔	6	new hot tub	✔		✔
30		✔	✔	✔	✔		✔
31		✔	4	✔	✔		✔
32	✔	✔	6	✔	✔		✔
33			0	✔	✔		✔
34			0	✔	✔		✔
35		✔	6	✔	n/a		✔
36			0	✔	✔		✔
37			0	✔	✔		✔
38			0	humidifier on all winter	don't have one		✔
39			0	✔	n/a		no comment
40		✔	?	✔	didn't get one		✔
41				major insulation upgrade	✔	✔	✔

SUMMARY

Notice difference in water availability?
11 or 26.8%

Did you use the reset option?
18 or 43.9%

How often? Number of times?
61

Major changes in household?
27 or 65.9%

Like the new showerhead?
32 or 78%

Endorse?
39 or 95.1%