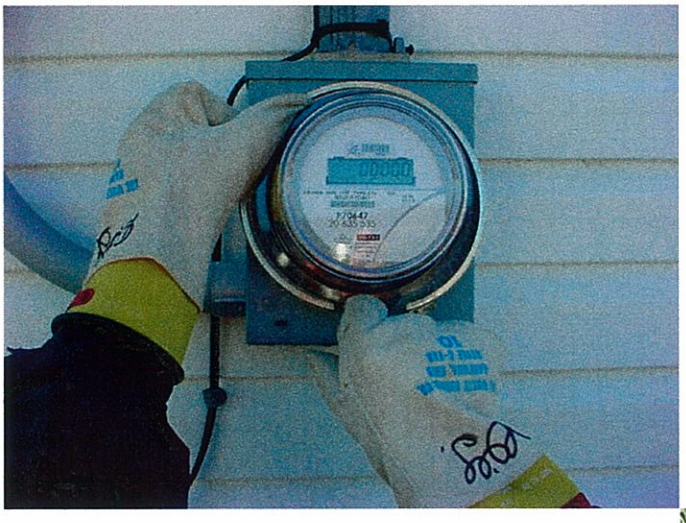
B-71 Automatic Meter Reading, $695,000

Q. Provide a copy of the report on the AMR pilot program implemented in the St. Brendan's service area in 2003/2004.

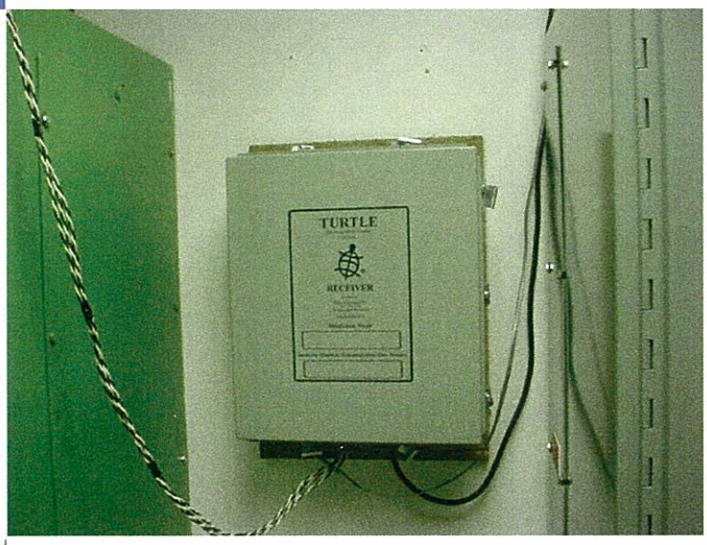
A. Attached is a copy of the St. Brendan's Pilot Project Report.

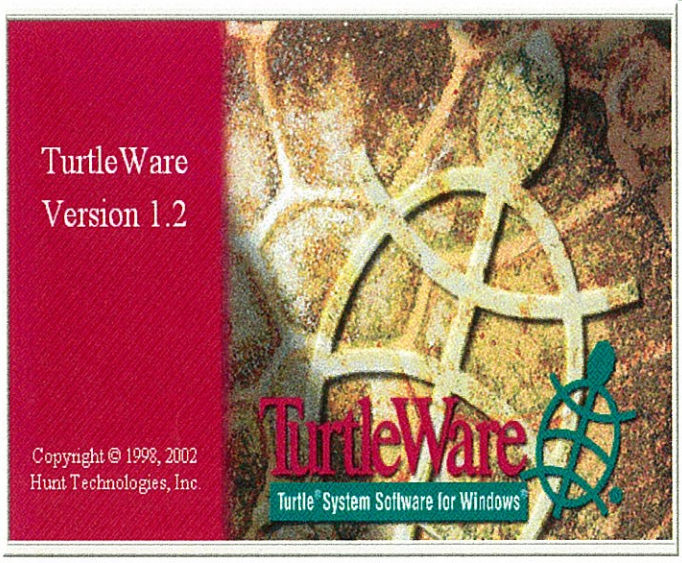
HYDRO
THE POWER OF COMMITMENT



Automatic Meter Reading Pilot Project

St. Brendan's





Prepared: May 2004

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Appendices:

Executive Summary

In 2003 Customer Services undertook an Automated Meter Reading (AMR) Pilot Project on the St. Brendan's Distribution System using Power Line Carrier Technology. Of the 142 meters in St. Brendan's, 133 were replaced with AMR equipped Centron Electronic Meters and two existing electromechanical meters were retrofitted with AMR transmitters. A data receiver was set up at the diesel plant in St. Brendan's and the Hunt Turtle AMR Management System was set up at Head Office.

In January 2004, the System was activated for all meters and data transfers began. Data is transferred every 27.2 hours from each meter to the receiver. Once per day the Turtle Management System dials the receiver and uploads the information into the Turtle database and produces a results report. This whole process is done automatically without any manual intervention.

In January, February and March, the AMR meter reading process was run in parallel to the existing Radix meter reading process. Meter readings were successfully uploaded to the J.D. Edwards billing system and customer bills were successfully produced without problem. With three parallel runs complete, the following activities tested successfully:

- ✓ Transmission of data from meters to receiver
- ✓ Transmission of data from receiver to AMR Management System
- ✓ Building of Meter History
- ✓ Merger of JDE & AMR files
- ✓ Upload of data to JDE Billing System
- ✓ Actual customer billing

A number of issues and concerns were identified during the pilot project, all of which are outlined in this report. Many of these were addressed during the pilot, however others were identified to be addressed during preparation of a Business Case. None of the issues or concerns were deemed as major but will require resolution to ensure an efficient operation in a live environment.

The AMR Pilot has verified the Hunt Power Line Carrier AMR Technology and the compatibility of Turtle AMR Management System with Hydro's Utility Customer Information System. In conclusion, AMR has potential to improve the efficiency of the meter reading process and produce significant savings in meter reading costs.

The next step in this process is to prepare a Business Case for use of AMR Technology in all Hydro service areas. This step will be conducted in conjunction with an assessment of Hydro's Meter Reading requirements beyond 2005. (Hydro's current Radix System will no longer be supported beyond 2005)

Introduction

What is AMR?

Automatic Meter Reading (AMR) is the remote collection of consumption data from customers' utility meters using telephone, radio frequency, power-line and satellite communications technologies. AMR provides water, gas and electric utility-service companies the opportunity to increase operational efficiency, improve customer service, reduce data-collection costs and quickly gather critical information that provides insight to company decision-makers.

Source: AMRA Website

In 2002, as part of it's Business Process Improvement Initiatives, Customer Services submitted a Capital Budget proposal to conduct an Automated Meter Reading (AMR) Pilot Project. The proposal was approved for 2003 and a Project Team was set up to oversee the Pilot Project.

The St. Brendan's Isolated Diesel System was selected as the site for the pilot based on it's size, close proximity to Head Office, availability of a secure location for the receiver, and on site staff (DSR's).

The Hunt Technologies Power Line Carrier System was selected due to its suitability to long radial systems and its current use by one Canadian Utility - Northwest Territories Power. (See e-mail from Mr. Bill Deans in Appendix D). Hunt currently has over 3.5 million endpoints (will exceed 4,000,000 by years end) deployed across North America. The Hunt system has been proven reliable and dependable on 450+ distribution networks.

For the pilot project the latest technology was selected, which is a solid-state transmitter board designed for the Centron Electronic Meter. This decision was, in part, based on a recommendation from Northwest Territories Power who had experienced some difficulties with the electro-mechanical transmitter. The solid-state transmitter board in a Centro Electronic Meter is approved by Measurement Canada for kilowatt-hour billing. (Measurement Canada Approvals are found in Appendix C.)

Purpose of Study

The purpose of the AMR Pilot Project was to verify the functionality and reliability of Turtle Technology and test the compatibility of the Turtle software with Hydro's JDE software to ensure a full customer billing could be complete.

Hunt Technologies: Power Line Carrier Based AMR Components

Turtle AMR/Energy Management System

Turtle System Overview

The Turtle System provides all the meter data activity needed for accurate and timely billing. Plus, it stores usage profiles to solve billing disputes, report power outages, and maintain the entire power system - all from every customer, every day. The Turtle System uses innovative long-range Power Line Carrier (PLC) communication to provide continuous data reporting from Turtle transmitters, located within your customer's meter, and voltage monitoring equipment to Turtle receivers. (Sample screens and reports from the Turtle System are found in Appendix G.)

Hunt Technologies' patented Ultra Narrow Bandwidth (UNB) technology in conjunction with PLC, provides each Turtle transmitter with its own unique frequency allowing all Turtle transmitters in your system to transmit simultaneously.

Because UNB relies on current rather than voltage, the transmission of data is not affected by line length or line conditioning devices, such as transformers and capacitors.

The Turtle receiver, typically located in the substation, collects and stores the transmitted information in data packets. The data packets are then sent from the receiver to the host computer modem using various communication technologies, such as, telephone, cell phone, SCADA (System Control and Data Acquisition), or satellite. Once the data packets are collected in the database, the information is disseminated into various reports, using TurtleWare software, unleashing the power of the data beyond Automatic Meter Reading.

The unique structure of the Turtle System allows it to meet the needs of all utility organizations, from small cooperatives to municipals to investor-owned utilities.

TurtleWare Software

TurtleWare host software is a Windows-based software used to maintain the Turtle System database, program Turtle transmitters, and communicate with Turtle receivers. TurtleWare software uses industry-standard hardware, software, and database platforms. It is easy to install and operate on standard computers. The system interfaces easily with other software and is designed to allow for future system growth and ongoing enhancements including programming and diagnostics. The information generated using TurtleWare can be used for billing, customer service, operations, and virtually every aspect of utility system management. The software also includes wizards to guide you through the database management process and make it simple to unleash the power of the Turtle System into your organization.

Centron Turtle Transmitter

The Centron Turtle transmitter is designed to accommodate the Schlumberger Sema CENTRON meter for use on residential and light industrial services. It monitors power consumption using the energy pulse signal from the meter. The transmitter monitors kilowatt-hours, records peak and minimum demand, reports momentary and permanent outages and time stamps the data to be transmitted across the utility's own power lines via the Turtle System. With simple installation and programming, utilities may elect to retrofit existing meters or purchase meters with transmitters already installed. Non-detent and detent programming options allow the detection of forward and reverse power flow. The CENTRON Turtle transmitter allows utilities to move forward with deployment of solid state meters and take advantage of the benefits delivered by the Turtle System.

Standard Turtle Transmitter

The Standard Turtle® transmitter is designed to fit inside most 25 electromechanical meter types. It monitors kilowatt—hours and records peak and minimum demand. The data is time—stamped and transmitted across the utility's own power lines. Each transmitter is assigned a unique frequency and continuously transmits data. The Turtle System can even identify on which phase of the distribution system the transmitter is installed. Usage readings are received daily at the utility office. The Turtle transmitter can provide a count of short outages (blinks) and detection in the event of a permanent outage. The Standard Turtle transmitter can be programmed to return one of eight different data transmission options, allowing the utility to select the meter data that is of most use to-their organization:

Turtle Receiver

The Turtle receiver is the data collection point for the Turtle System. A Turtle receiver can easily be installed in a substation with minimal labor. The receiver uses the existing CTs, in the substation, to gather data. Therefore, no line disconnects or power outages are required for installation. Each Turtle receiver can monitor 2,880 meters simultaneously. Multiple receivers may be installed in a substation to accommodate a larger number of meters. Also, each receiver card stores up to 30 readings for each meter and retains the data, without power, for a minimum of 5 days.

See Appendix B for more information on these components

Pilot Project Schedule & Results

October 2003

- Business Case completed and approved (see Appendix A)

November 2003

- Turtle receiver installed in St. Brendan's Diesel Plant

December 2003

- Turtle Software installed on computer at Hydro Place
- Receiver added to Turtle Management System
- Two electromechanical test meters retrofitted with transmitters and installed on two General Service customers in St. Brendan's
- Test meters set up and activated in Turtle Management System and data transmission to Receiver started
- Receipt of data by receiver confirmed
- Data uploaded to Turtle Software at Head Office
- History Records built for the two meters
- Bill cycle set up and assigned meters for purposes of billing
- Billing Extract Group created and assigned to bill cycle
- History filtered to show any possible bad data
- Master File spreadsheet developed to house merged JDE and Turtle information
- Strategy Query developed to download required JDE information and copied into Master File
- Spreadsheet sorted in ascending order by meter number
- Meter readings extracted from Turtle and copied into Master file
- Upload Master File spreadsheet created which contains merged data
- Upload text file created, which contains data, formatted for upload to JDE
- Data uploaded into JDE using Client Access

January 2004

- 141Meters installed in St. Brendan's
- All meters set up in Turtle Management System
- Automated scheduler set up to transmit and download data directly to the Turtle Management System on a daily basis and produce a summary report of all transactions
- Meter reading data successfully uploaded to JDE
- Billing successfully simulated in JDE development using AMR technology and comparison done to billing in JDE Production System using the Radix System (See Sample AMR bill in Appendix F)
- On site verification of set up and training by representative from Hunt Technologies

February 2004

- Second meter reading upload and billing successfully simulated in JDE development

March 2004

- Third meter reading upload and billing successfully simulated in JDE development

April 2004

- Two double meter bases were installed on 2 commercial customers to allow for a parallel run on demand
- 11 meters were replaced with Centron meters activated to transmit demand
- Successfully tested system following an unscheduled power outage on the St. Brendan's Distribution System
- Successfully retrieved all data after a two-week communications line outage. (Telephone line to Receiver out of service).

Issues / Concerns

* **# 1**
Demand metering on Centron meters not yet approved by Measurement Canada.

This was not a problem for the pilot project because the data was not used for billing. Hunt is currently working with Measurement Canada on approval for demand metering on Centron meters and is confident this issue will be resolved in 2004. Demand billing is already approved for AMR use on the electro-mechanical meters.

 # 2
There were 4 two-wire services found during installation. (Most two-wire services are unknown as to their location.)

Meters would have had to be retrofitted to accommodate these services therefore they were omitted from the pilot. As the location of most two wire services is unknown, a pre-installation inspection of all meters is recommended in any location where AMR is being considered.

 # 3
One customer meter base was found to be in poor condition and in need of repair.

This service was omitted from the pilot. A pre-installation inspection of all customer meter bases is recommended in any location where AMR is being considered.

* **# 4**
Two of the Centron AMR meters never reported to the receiver following initial activation.

Due to lack of troubleshooting knowledge at the time the first meter was replaced and the new meter reported when activated. When a problem was incurred with the second meter further investigation determined that the signal had to be reset in the System. This was done and the meter then reported.

 # 5
Receiver communication line was accidentally unplugged at the plant on two occasions. This was done by the DSR to unload Radix.

DSR was informed of the situation and was able to use a second line in the plant for downloading. In a live production environment dedicated and secure lines will have to be used for data transmission.

 # 6
The Modem at head office used for data upload from the receiver failed

The modem failure caused a delay in the upload of information from the receiver. The data was not affected but the failure could have delayed a billing had we been in live

production. A more reliable data transmission system will be required for a live environment.

 # 7

Meters with Voltage Amps (VA) as the demand unit of measure were not tested.

VA meters were not utilized in St. Brendan's System and as such were excluded from the pilot. Problems with this type of meter are not anticipated. Testing would have been for verification and conversion purposes only, however testing is recommended prior to accepting AMR as a meter reading alternative

 # 8

A parallel run for demand readings was not performed as part of this pilot. As a result Turtle Demand readings could not be confirmed.

None of the meters on the St. Brendan's System currently display demand at the meter therefore demands could not be read for a parallel run. Two double meter base installations were installed in April to allow parallel runs for demand readings. We are not anticipating any variations in the demand readings. This step is being taken for verification purpose only.

 # 9

Verification of Standard 3 Phase Turtle Transmitter

As there are no 3-phase customers on the St. Brendan's Distribution System we were unable to verify the Standard 3 Phase Turtle Transmitter. This device however is approved by Measurement Canada for revenue metering and is currently being used by North West Territories Power. Testing is recommended prior to accepting AMR as a meter reading alternative. More detail on this device is available in Appendix B under Hunt Technologies Product Data Sheets

 # 10

The Turtle Management Software does not contain all data required (e.g. service address) to upload meter-reading data into JDE.

This issue was resolved for the pilot project by extracting the data that JDE requires, but Turtle does not provide, using a Showcase Query to an Excel spreadsheet. This was then combined with the Turtle extract to create an acceptable file for upload into JDE. For a production system a more robust interface between Turtle and the JDE Billing System will be required.

 # 11

Demand readings in Turtle are reported in decimal format, up to 3 decimal places. The JDE upload will not accept any records with a decimal. In addition, JDE will actually enter a decimal in the uploaded data, to one decimal place.

This issue was resolved by including a formula in the merged file to eliminate the decimal from the Turtle data. This is a requirement for the live interface.

 # 12

In addition to the development of a JDE – Turtle interface, changes will or may be required to accommodate the Automatic Meter Reading Process in a live AMR environment. These are as follows:

- Addition of a Meter Reading Source User Defined Code
- Addition of a new Meter Upload Format Program version
- Addition of a new Meter Reading Upload Processing version
- Creation of a new menu option for users to accommodate the new versions of the Meter Upload Format Program and the Meter Reading Upload Process.
- Inclusion of Meter Frequency on the JDE Meter Master. This is a potential change, as business necessity has not yet been determined. The information currently is stored in the Turtle database.
- Addition of a code to the JDE Meter Master to tag meters as AMR transmitters. This will support reporting requirements, as well as categorize meters for meter change work orders.
- Addition of a code to the JDE Meter Position to tag Service Types as automatic meters. This is a potential change, which may support reporting requirements.
- Creation of new Meter Change model work order for meters with AMR transmitters. This is a potential change. Alternatively, a code on the current meter change work order may suffice.

 # 13

Database Server – Microsoft Access vs. Microsoft SQL Server

The Turtle Management System currently runs using a Microsoft Access Database System. This posed a number of problems including the running of the application from a dedicated workstation, backing up the data and use of the data by multiple people. This issue will be resolved in 2004 with the release by Hunt Technologies of a product called Command Centre 2.0 that is SQL based.

 # 14

Data transmission following a power interruption

A short unplanned power interruption did occur on March 29, 2004. A review of the Turtle System following this outage showed normal operation.

 # 15
Data backup

The existing Radix System is backed up daily using ADSM. A similar backup process will be required for AMR. During the pilot a manual backup system was used.

 # 16
What if any power line equipment or power line system configuration may impede the transmission of data along a power line?

Response provided by Hunt Technologies

The normal operation of an electric distribution system does not impede the upstream flow of data from the endpoint to the receiver. However, it is possible to have an unusual event such as a cracked insulator or lightning arrestor that may need replacement or repair to mitigate any significant noise conditions being generated in order for the endpoint signal to be heard at the receiver.

One of the benefits of Hunt's 'Always On'® connectivity with each endpoint is when these conditions do occur it may be possible to identify them by evaluating the signal to noise (S/N) ratio generated by each endpoint. I call this monitoring the System Performance Characteristics of the distribution network.

Currently when a distribution device is approaching a failure mode the utility is usually not aware that a device might have experienced damage until it completely fails to operate. With deployment of the Hunt application it is possible under certain conditions to analyze low S/N ratios from specific groups of endpoints to pinpoint or target the line segment, pole or device on the distribution grid for field investigation.

One additional point of clarification, a low signal to noise ratio does not mean the billable consumption data is not getting through to the receiver, it is merely an indication of increased noise levels which may warrant further investigation.

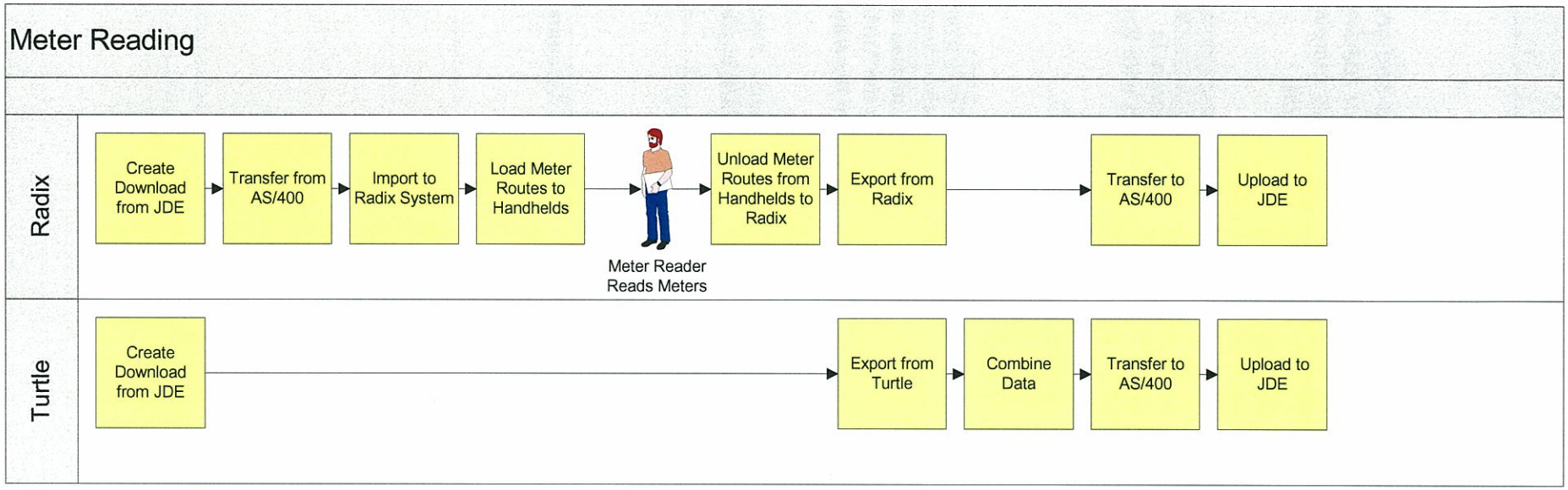
While these conditions are certainly the exception to the rule for most clients, Hunt stands ready to assist NLH throughout its deployment in identification and formulation of a solution if required.

Comparison of the Radix System to the Turtle System

Note: The comparison has assumed that all meters and billing cycles and groups have already been set up in the Turtle system prior to requirement for meter readings, and the Extract has been created. It also assumes that the download from receivers and Build History Records has been set up to automatically occur overnight.

	RADIX		*TURTLE*
1.	**Export meter routes from JDE.** *a) Retrieve schedule.* *b) Purge old routes.* *c) Re-sequence routes.* *d) Create download.* *e) Transfer to AS/400.*	**1.**	**Run the Filter History program in Turtle to report any meters with Bad Data.**
2.	**Import meter routes to Radix.** *a) Import routes to Radix.*	**2.**	**Run Billing Extract in Turtle to generate billing file.** An error file is also created.
3.	**Load meter routes to handheld.** *a) Load route in Radix* *b) Book routes if necessary (more then one route per meter reader per cycle)* *c) Assign routes* *d) Split routes* *e) Load route to Handheld*	**3.**	**Download JDE meter information using Strategy and combine with the Turtle Billing Extract Information to create the upload file.** *Note: This is for pilot purposes. A proper interface will be created if AMR is adopted following pilot.*
4.	**Physical Reading of Meters**	**4.**	**Upload readings in JDE.** *a) Transfer to As/400.* *b) Upload Readings to JDE* *c) Run Upload Error Report*
5.	**Unload meter routes from handheld.** *a) Unload route from handheld to Radix.* *b) Print 3 reports* *c) Re-sequence routes.*	**5.**	**Post readings to Customer Accounts.**
6.	**Upload readings to JDE.** *a) Export routes from Radix.* *b) Re-sequence in JDE.* *c) Transfer to AS/400.* *d) Upload readings from Radix.* *e) Run Upload Error Report.* *f) Estimate readings where required.* *g) Issue read verification/meter change work orders where required.*		
7.	**Post readings to Customer Accounts.**		

Workflow Chart



Pros and Cons of Automatic Meter Reading

Pros

1. Daily readings
2. Elimination of meter reading errors
3. Elimination of read verification work orders
4. Elimination of estimated reads
5. Reduced customer complaints due to more accurate readings and the elimination of estimated reads
6. Availability of daily usage patterns, which will aid in high consumption complaints by highlighting days where consumption was above normal (See appendix G)
7. Daily notification of meter failures
8. Daily notification of interruptions to the meter
9. Daily meter history
10. Potential to reduce number of billing cycles
11. Notification of zero usage, same or similar readings, and exceptional readings
12. End of line voltage monitoring & reporting
13. A fully automated meter reading process reducing process cycle time
14. Savings due to the elimination of physical meter readings and read verification work orders

Cons

1. Reduction in personal contact with customers
2. May reduce recall time for meters
3. Dual data entry will be required - - JDE & Turtle Software

Conclusions

Customer Services, in conjunction with the Meter Shop and IS&T, tested the Hunt Technologies Power Line Carrier Based AMR System on the St. Brendan's distribution system for the past three months. With the exception of some minor initial problems, the pilot was a success. For the January, February and March billing periods, all the AMR meters recorded and reported accurately. A comparison to the manual readings confirmed the data (see Appendix E). It was not possible to exactly match the manual read times and the electronic read times, however, the reads were kept to the same day where possible and were within an acceptable variance.

From a business prospective, the biggest benefit of AMR is the reduction in labour costs. Labour is the largest portion of Hydro's approximately $1.1 million annual Meter Reading costs. Other significant benefits include more accurate and frequent meter readings and fewer customer disputes and concerns. Each of these benefits result in a smoother billing process, and a more effective and efficient meter reading process.

Next Steps

1. Prepare a cost feasibility study for use of Power Line Carrier AMR in all Hydro service areas.

2. Include Power Line Carrier AMR as an option when assessing Hydro's Meter Reading requirements beyond 2005. (Hydro's current Radix System will no longer be supported beyond 2005.)

3. Further investigate the functionality provided within the Turtle software both within and outside the meter reading process scope. (ie. monitoring line voltage)

Appendices

Appendix A

AMR Business Case

BUSINESS CASE

Automatic Meter Reading (AMR) Pilot Project

Prepared: October, 2003

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The Automatic Meter Reading Pilot Project is the next step in the continuing review of the Meter Reading Business Process. In 2001, the cost for Meter Reading Services was approximately $1,209,000 or $34.60 per meter, most of which is direct salaries and benefits. The "read" only part of this cost, based on time coded to the Meter Reading Work Order – 1801, was approximately $653,000 or $18.67 per meter. Implementation of the cost saving options identified in the Meter Route Optimization Report will reduce this overall cost by approximately $125,000 to &135,000 annually and will be fully realized in 2004.

The AMR pilot project will provide the necessary information and data to determine if Powerline AMR can be a feasible alternative to the current manual meter reading process. Should this be a feasible alternative future benefits include:

- Reduction in meter reading costs
- Improved availability and accuracy of meter readings
- More efficient, effective and timely meter reading process

The St. Brendan's Distribution System will be used as the data source for the pilot project. 141 meters will be outfitted with electronic transmitters and installed in all homes and businesses. The data will be transmitted from the meters via the power lines to a collections center where the data will be uploaded to a database at head office using "Turtle" software.

During the period of the pilot project each meter will continue to be read on a monthly basis and customers will be billed based on these readings as is currently done. The readings that will be collected electronically will be used for a parallel billing to be run in a training or development environment.

If the results of the AMR pilot project support this technology as a feasible alternative for meter reading a comprehensive report and plan will follow for implementation across Hydro's service areas.

2. PROJECT DEFINITION

2.1 Purpose

The purpose of the AMR Pilot Project is to verify the functionality of the power line carrier technology, and to determine if the data from each meter can be successfully collected and transmitted to Hydro's UCIS system and billed. It will also verify the use of AMR for final reads and read verifications.

2.2 Objectives

The objectives of the Project are:

- To replace all meters on the St. Brendan's Distribution System with transmitted equipped meters
- To set up a central collector unit in the diesel plant at St. Brendan's and verify accurate collection of meter data (Electronic readings vs manual readings)
- To transmit data from the collector unit to Hydro's billing system

- To determine the scope of change required to the JDE UCIS Billing System
- To perform a test billing of customers using transmitted data and verify the results against the actual billing.

2.3 Scope/Major Deliverables

Included

- Delivery & installation of 141 meters on the St. Brendan's Diesel System, equipped with "Turtle" transmitters
- Delivery & installation of a collector unit at the St. Brendan's Diesel Plant
- Delivery & installation of the "Turtle" software
- On site verification of setup by Hunt Technologies personnel
- Collections of 6 months of customer data
- Production of six months of test bills
- Cost analysis (Pilot project only)
- Summary report on the project including conclusion and recommendations

Not included

- A cost benefit analysis for all metering reading
- Meters outside the St. Brendan's Diesel System
- A multi-year conversion plan

2.4 Quality Specifications

As this is a pilot project customers will not be impacted in any way other than to have their current meter replaced. The information collected will not be used for billing purposes but for comparison only to the current billing process.

2.5 Assumptions

- The transmitter units to be installed in the meters will be approved by Measurement Canada for revenue metering purposes
- The pilot project will provide the information required to further assess the use of AMR as a meter reading option in some or all of Hydro's read areas.
- The Turtle software will interface with Hydro's UCIS Billing System.

2.6 Constraints

Constraints on the Project are as follows:

- Fixed capital budget
- The pilot is being conducted during the same period that Rate Hearing and other BPI initiatives are ongoing therefore some resource availability may be interrupted. This could affect the time allocation for the project.
- Do to absence of demand billing in St. Brendan's a complete parallel run with Radix/JDE will not be possible.

2.7 Prerequisites

- Delivery and installation of transmitter equipped meters, collector unit, and Turtle software.

- Safe & secure location in the St. Brendan's Diesel Plant for collector unit
- Phone line at the St. Brendan's Diesel Plant to transmit data
- Desktop computer at Head Office to which to upload data
- Interface between Turtle software and JDE
- Turtle software setup
- Availability of UCIS Development and/or Training environment in which to produce bills

3.0 STRATEGIC ALIGNMENT

3.1 Specific Strategic Initiatives

This project supports the corporate mission statement to provide electrical power and energy, on behalf of the people of the province, at the lowest cost consistent with reliable service. AMR has potential to significantly improve the efficiency and effectiveness of the meter reading process, which will result in the reduction of costs associated with meter reading.

3.2 Project Stakeholders

Project Stakeholders include the following:

- Residential and General Service Customers on the St. Brendan's Distribution System
- Customer Service Management and Staff
- Meter Readers
- Meter Shop Staff
- IS&T Project Delivery
- IS&T Corporate Systems
- Public Utilities Board
- Newfoundland Power

3.3 IT Alignment

There are 2 issues with the Hunt Technologies solution from an IT alignment perspective:

- The Hunt Database is a file sharing system. Ideally meter readings would be written to a SQL Server Database. A SQL Server DB would automatically provide for security and backup.
- Implementation of the Hunt Technologies system without the elimination of the Radix System, will mean that IS&T will have to support two methods of meter data collection, instead of the present single method (Radix)

4.0 APPROACHES

Two alternative approaches have been considered for this analysis

4.1 Identify Alternatives

Option 1 – Perform a Pilot Test of AMR utilizing AMR technology only in Development environment and then move over to production.
Option 2 – Perform Pilot Test of AMR in parallel with current meter reading and billing process.

4.2 Comparison of Alternatives

Option 1

Risky in the sense that if the AMR technology does not work, then a meter reader will have to be sent in to read the meters and the issuance of customers' bills may be delayed. However if, the technology were successful it would eliminate the need to perform double processing of the meter reads.

Option 2

Requires the double processing of meter readings, however in the case that the AMR technology fails actual meter readings will also exist so as to not delay the billing. This option will also provide a basis for which to determine the accuracy of the new technology.

4.3 Recommended Alternative

The recommended alternative is to perform the Pilot Test of AMR in parallel with current meter reading and billing process, option 2.

5.0 RESOURCE REQUIREMENTS

5.1 Human Resource Requirements

Name	Role	Responsibility	Time Commitment	Duration	Source (internal, external)
Sam Banfield	Project Sponsor	Insure Objectives are met	Minimal		
Al Ballard	Project Mgr	Oversee project	Regular		Internal
Ern Barbour	Steering Comm.	Monitor progress of project	Variable		Internal
Glenn Mitchell	Steering	Monitor progress	Variable		Internal

	Comm.	of project			
Jan Kenny	Steering Comm	Monitor progress of project	Variable		Internal
John Nicholl	Steering Comm	Monitor progress of project	Variable		Internal
Dave Jarvis	Working Comm	Oversee meter changeouts & meter O&M	Variable		Internal
Dennis O'Grady	Working Comm	Oversee meter changeouts & meter O&M	Variable		Internal
Bill Walker	Working Comm	Oversee data transfer & billing process	Variable		Internal
Donna Smith	Working Comm	Oversee data transfer & billing process	Variable		Internal
Kim Andrews	Working Comm.	Oversee data transfer & billing process	Variable		
Corporate Systems	Support	Create parallel environment	Minimal		Internal
Hunts Technologies Rep	Supplier	Verify Turtle hardware & software is working properly	Set up phase only		External

5.2 Material/Equipment Procurement

To complete the pilot project the following material/equipment is required:

- 160, 240 volt, 200amp, 3-wire meters
- 160 transmitters
- data collection receiver
- computer software
- miscellaneous communications hardware(ie. cables, test boards)
- desktop computer and modem for head office (initial 10 month requirement)

All materials/equipment with the exception of the meters and desktop computer and modem will be included as part of the Hunt Technologies Turtle System that will be used for the pilot. The meters will purchased by Hydro's Metering Department as part of the regular inventory replacement for 2003.

Delivery dates for the Hunt Technologies Turtle System is a follows:

- Material/equipment excluding transmitters - July 15, 2003
- Transmitters (delivery to Schlumbuger plant) – August 30, 2003
- Meters & transmitters (delivery to Hydro) – October 15, 2003

5.3 Information Requirements

Stakeholder	Report Requirements	Frequency
Customer Services Staff	Meter Readings	Monthly

6.0 COSTS AND BENEFITS (if appropriate)

6.1 Preliminary Budget/Cost Estimate

Preliminary Budget / Cost Estimate
AMR Pilot Project

	US$	Exchange		C$
Total Capital Budget				$51,900
Materials				
Standard Receiver	$5,250	1766		$7,016
Turtleware Software	$7,500	2522		$10,022
160 Endpoint Transmitters	$10,400	4160		$14,560
Installation Services / Training	$5,000	2000		$7,000
Opto Wand	$200	67		$267
Test Kit	$145	49		$194
Freight	$119	40		$159
Subtotal	$28,614	$10,604		$39,218
Corporate Overhead				$900
Labour - Internal				$11,782
Total Capital Budget				$51,900

6.2 Benefits

- The pilot project will provide us with the necessary information and data to determine if Powerline AMR can be a feasible alternative to the current manual meter reading process in some or all Hydro's service areas.
- Reduction in meter reading costs
- Improved availability and accuracy of meter readings
- More efficient, effective and timely meter reading process

7.0 BUSINESS IMPACT

7.1 Changes to the Business Process

The new process will include:

- Upload of automatic meter readings from data collector unit.
- Transfer of automatic readings to JDE.

7.2 New Staff Training Needs

This is dependent on the new process. Staff will have to be trained in the use of the new Turtle Software.

7.3 Changes to Organizational Structure

For the pilot project, no organizational structure changes are required. However, if successful, there will be a reduction in the number of meter readers within the organization.

7.4 Changes with Stakeholders

Customers should receive more accurate readings, thereby reducing the need for read verifications and cancel/rebill situations. In general they should receive better customer service. There will be a reduction in the need for meter readers, thereby reducing operating costs. This is consistent with our mission for delivering least cost power, consistent with reliable service. Hydro should see increased cash flow and process efficiency.

8.0 RISK MANAGEMENT

8.1 Major Overall Risks

Risk Event	Probability	Impact	Duration	Risk Strategy
Measurement Canada Non-Approval of Required Transmitter	*<10%*	*Defer Pilot*	*2 year*	*Re-submit pilot for 2005 budget*

9.0 PRODUCTS AND DELIVERABLES

Deliverable, Event, Support…	Individual/Group Responsible	Team Owner
Meters / Transmitters	Schlumbuger / Meter Shop	
Collector Unit	Schlumbuger / Meter Shop	
Turtle Software	Hunt Technologies / IS&T	
Test Data (6 months)	Working Committies	
Cost Analysis	Project Manager	
Summary Report	Project Manager	

10. IMPLEMENTATION STRATEGY

As this is a pilot project there is some flexibility in implementation. Key to the implementation date will be delivery of the meters, which is now scheduled for October 15.

11. RECOMMENDATIONS

Perform Parallel Pilot test for AMR for meters in the St. Brendan's area for a period of six months.

12. APPROVALS

PROJECT AGREEMENT APPROVAL FORM		
Project Name: Automatic Meter Reading I have reviewed the information contained in the Business Case dated Oct. 2003. I agree to the baseline commitments specified in it.		
Al Ballard, Project Manager	Signature A Ballard	Date Oct. 21, 2003.
Sam Banfield, Project Sponsor	Signature SD Banfield	Date Oct 22/2003

Appendix B

Hunt Technologies Product Data Sheets

The Turtle System®

TS1 SYSTEM OVERVIEW

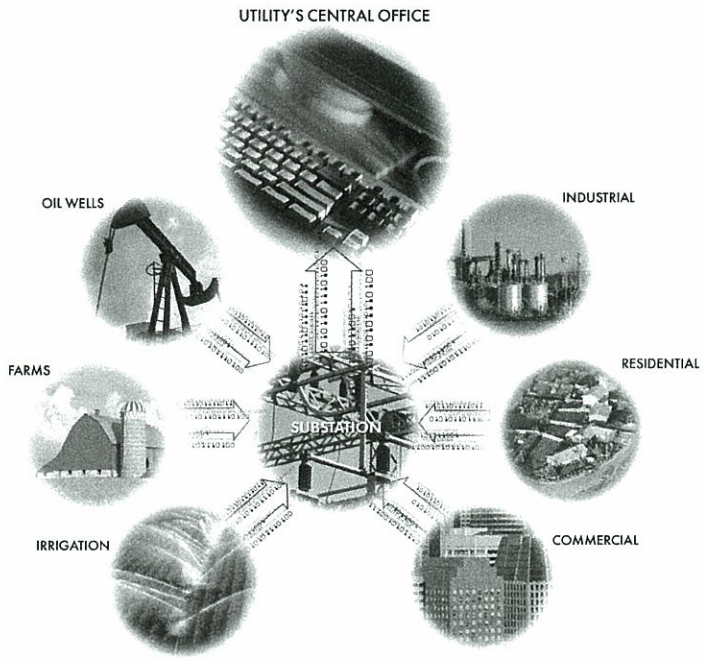
The Turtle® System provides all the meter data activity needed for accurate and timely billing. Plus, it stores usage profiles to solve billing disputes, report power outages, and maintain the entire power system —all from every customer, every day. The Turtle System uses innovative long-range Power Line Carrier (PLC) communication to provide continuous data reporting from Turtle transmitters, located within your customer's meter, and voltage monitoring equipment to Turtle receivers.

Hunt Technologies' patented Ultra Narrow Bandwidth (UNB) technology, in conjunction with PLC, provides each Turtle transmitter with its own unique frequency, allowing all Turtle transmitters in your system to transmit simultaneously.

Because UNB relies on current rather than voltage, the transmission of data is not affected by line length or line conditioning devices, such as transformers and capacitors.

The Turtle receiver, typically located in the substation, collects and stores the transmitted information in data packets. The data packets are then sent from the receiver to the host computer by modem using various communication technologies, such as, telephone, cell phone, SCADA, or satellite. Once the data packets are collected in the database, the information is disseminated into various reports, using TurtleWare® software, unleashing the power of the data beyond Automatic Meter Reading.

The unique structure of the Turtle System allows it to meet the needs of all utility organizations, from small cooperatives to municipals to investor-owned utilities.



TURTLE® SYSTEM COMPONENTS

- Endpoint transmitter
- Turtle receiver
- TurtleWare® software
- Polyphase endpoints:
  - External Turtle transmitter
  - GE V6 Turtle transmitter
- Handheld Programmer
- Water Turtle transmitter
- Additional endpoints:
  - End-of-Line Voltage Monitor (EOLVM)

See specific Product Data Sheets for detailed information pertaining to the Turtle System components. If you would like more information, please contact your Regional Sales Manager, Field Technical Sales Support Representative, or call 1-800-828-4055.

ACCESSORIES

Opto Wand	A communication link between a computer (host or laptop) and a Turtle transmitter used to program Turtle transmitters.
Opto Wand Holders	Are used to secure the Opto Wand to either the Standard or External Turtle transmitter during programming or updating.
Filter Capacitor	Used to filter noise to the Turtle transmitter by connecting it between the two meter bus bars on the supply side of the meter.
Step Up/Down Transformer	Used with the External Turtle transmitter when available service voltages do not match the transmitter voltages. A transformer is required for certain wiring procedures.
Programming Station	Used when programming Turtle transmitters in the meter shop. It is a stand alone box with a 120V socket that can be plugged into an outlet.
Receiver Card	Used to expand the capacity of a standard receiver by 480 frequencies.
Current Transformers (CTs)	Needed when adding additional receiver cards to a receiver.
Pulse Board	Used when installing an External Turtle transmitter in a GE M90 meter if a GE factory KYZ board is not already installed.
Paint Mask	Used to mask off a section of the meter disk which is not to be painted. There are different types of masks for different types and models of meters.

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The Turtle System®

TURTLEWARE® SOFTWARE

TurtleWare® host software is a Windows®-based software used to maintain the Turtle System database, program Turtle transmitters, and communicate with Turtle receivers. TurtleWare software uses industry-standard hardware, software, and database platforms. It is easy to install and operate on standard computers. The system interfaces easily with other software and is designed to allow for future system growth and ongoing enhancements including programming and diagnostics. The information generated using TurtleWare can be used for billing, customer service, operations, and virtually every aspect of utility system management. The software also includes wizards to guide you through the database management process and make it simple to unleash the power of the Turtle System into your organization.

KEY FEATURES

- Uses industry-standard hardware, software, and database platforms.
- Programs all Turtle transmitters.
- Facilitates frequency sharing between substations.
- Provides powerfail information for individual Turtle transmitters.
- Provides automated download capability.
- Generates standard reports for simple review of information.
- Offers easy-to-use help screens.
- Enables viewing of current and historical information for use by multiple departments.
- Extracts billing information to ASCII format.
- Includes software wizards to guide you through database management.
- Serves as a platform for future system growth, additional functions, and ongoing program enhancements.
- Industry standard database easily interfaces with other software to act as a link between customer and AMR data, giving information that goes beyond meter reading.
- Provides enhanced diagnostic reporting capabilities.

MINIMUM SYSTEM REQUIREMENTS

- Computer/Processor: 300 MHz or higher Pentium-compatible CPU
- Memory: 128 MB RAM minimum (256 MB recommended)
- Hard Disk: 4 GB hard drive (8 GB recommended)
- Operating System: Windows NT Professional 4 SP6a
  Windows 2000 Professional SP2
  Windows XP Professional
- 2X CD-ROM drive
- 3.5" floppy drive
- 256-color SVGA monitor (800 x 600 resolution)
- Modem
- Available serial port
- Internet Explorer 5.0 or newer
- Backup system

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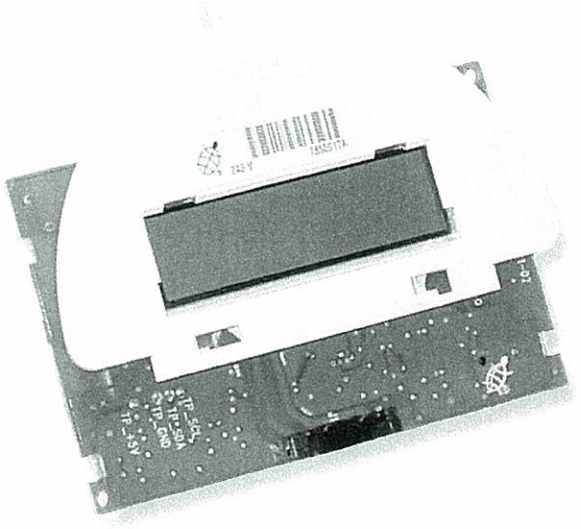
The Turtle System®

CENTRON® TURTLE® TRANSMITTER

The CENTRON® Turtle® transmitter is designed to accommodate the SchlumbergerSema CENTRON meter for use on residential and light industrial services. It monitors power consumption using the energy pulse signal from the meter. The transmitter monitors kilowatt-hours, records peak and minimum demand, reports momentary and permanent outages and time stamps the data to be transmitted across the utility's own power lines via the Turtle System. With simple installation and programming, utilities may elect to retrofit existing meters or purchase meters with transmitters already installed. Non-detent and detent programming options allow the detection of forward and reverse power flow.

The CENTRON Turtle transmitter allows utilities to move forward with deployment of solid state meters and take advantage of the benefits delivered by the Turtle System.



CENTRON Turtle transmitter and CENTRON meter face.

KEY FEATURES

- Monitors pulse signals generated from the solid state CENTRON meter.
- No loss of data during power outages.
- Momentary outage (blink) count.
- Outage detection.
- Sends information reliably from the meter to the Turtle receiver over existing power lines.
- The Turtle receiver continuously monitors all Turtle transmitters in a system.
- Simple to program.
- Economically scalable to meet your needs.
- 4x1, 5x1, and 4x10 programmable display options.
- Detent and non-detent programming options.

PRODUCT SPECIFICATIONS

CENTRON® Turtle® Transmitter

Part Number:	See chart below
Size:	4.325 x 3.625 x 1.250 inches (109.9 x 92.1 x 31.8 mm) Turtle transmitter only
Weight:	2.88 ounces (0.08 kg) typical Turtle transmitter only
Operating Temperature:	-40° F to +185° F (-40° C to +85° C)
Operating Voltage:	240 VAC ±20% *Note: Hunt Technologies now specifies ±10%, ANSI specifies ±10%, SchlumbergerSema specifies ±20%.*
Power Consumption:	1 watt nominal, 2 watts maximum. Capacitive load is 80 VA rms average, 150 VA rms maximum
Programming and Setup Method:	TurtleWare® Turtle System Software, TS1 Mobile Administration Software

STANDARDS COMPLIANCE

ANSI C12.1–1995	Metering Standard *Note: Although the Turtle transmitter is not classified as a meter, all of the tests in ANSI C12.1 that apply to the AMR device have been successfully completed.*
ANSI C12.10–1997	
ANSI C12.20 (Class 0.5)–1998	
ANSI C37.90.1–1989	
ANSI C62.45–1992	
IEC 61000-4-4	Electrical Fast Transient/Burst Immunity
IEC 61000-4-2	Electrostatic Discharge Immunity
FCC Part 15, Subpart B, Class B	Radiated and Conducted Emissions

CENTRON Turtle Transmitter Compatibility

Meter Type	Transmitter Part Number
Form 2S CL200 240V	FASY-0584-0002
Form 1S CL100 120V	FASY-0584-0001
Form 12S CL200 120V	FASY-0584-0001
Form 25S CL200 120V	FASY-0584-0001
Form 2S CL320 240V	FASY-0584-0002
Form 3S CL20 120V	FASY-0584-0001
Form 3S CL20 240V	FASY-0584-0002
Form 4S CL20 240V	FASY-0584-0002

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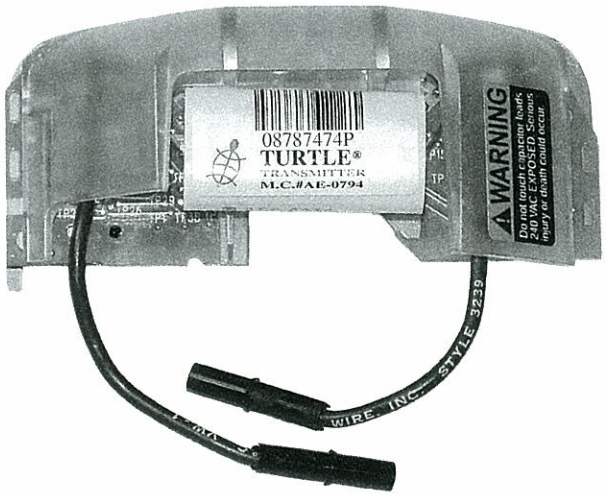
Endpoint
Transmitter

The Turtle System®

STANDARD TURTLE® TRANSMITTER

The Standard Turtle® transmitter is designed to fit inside most 2S electromechanical meter types. It monitors kilowatt–hours and records peak and minimum demand. The data is time–stamped and transmitted across the utility's own power lines. Each transmitter is assigned a unique frequency and continuously transmits data. The Turtle System can even identify on which phase of the distribution system the transmitter is installed. Usage readings are received daily at the utility office. The Turtle transmitter can provide a count of short outages (blinks) and detection in the event of a permanent outage. The Standard Turtle transmitter can be programmed to return one of eight different data transmission options, allowing the utility to select the meter data that is of most use to their organization.



KEY FEATURES

- Optical sensor monitors meter disk revolutions.
- Optical serial data port allows easy field programming.
- No loss of data during power outages.
- Momentary outage (blink) count.
- Outage detection.
- Various user–configurable data transmission options, including:
  - kWh meter reading.
  - kWh meter reading, minimum demand, and time of minimum.
  - kWh meter reading, peak demand, time of peak and power outage count.
  - Identification on power up.
- Sends information reliably from the meter to the Turtle receiver over existing power lines.
- All Turtle transmitters in a system are continuously monitored by the Turtle receiver.
- Simple to program.
- Economically scalable to meet your needs.

PRODUCT SPECIFICATIONS

Product Part Number:	See table below
Size:	1.8 x 4.4 x 1.9 inches (45.7 x 111.8 x 48.3 mm) without mounting bracket
Weight:	2.5 ounces (0.07 kg), typical
Operating Temperature:	-40˚F to 185˚F (-40˚C to 85˚C)
Operating Voltage:	240 VAC ± 10% at 50/60 Hz, may be programmed at 120 VAC
Power Consumption:	2 Watts real power. Capacitive load is 75 VA rms average, 150 VA rms maximum
Programming and Setup Method:	TurtleWare® Turtle System Software

STANDARDS COMPLIANCE

Standard	Brief Description
FCC CFR Title 47 (Part 15, Subpart B)	Radiated and Conducted Emissions
CISPR 22 (EN60555-2):	Radiated and Conducted Emissions
ANSI C12.1 - 1995	Metering Standard Note: Although the Turtle transmitter is not classified as a meter, all of the tests in ANSI C12.1 that apply to the AMR device have been performed.
CE compliant for EMC Directive	
IEC 61000-4-2	Electrostatic Discharge Immunity
IEC 61000-4-3	Radiated, Radio Frequency, and EMF Field Immunity
IEC 61000-4-4	Electrical Fast Transient/Burst Immunity
IEC 61000-4-5	Surge Immunity
IEC 61000-4-6	Conducted Radio Frequency Noise Immunity
IEC 61000-4-8	Power Frequency Magnetic Field Immunity
IEC 61000-4-9	Pulse Magnetic Field Immunity
IEC 61000-4-11	Voltage Dips and Short Interruptions Immunity
IEC 61000-4-12	Surge (100 kHz Ring Wave)
ANSI/IPC-A-610 Class 2	Workmanship Standard for Electronic Assemblies

MODEL NUMBERS

Meter Brand	Meter Type	Transmitter Part Number
ABB	D5S, AB1	0333-AAD
General Electric	I-70-S	0333-AAD
Siemens/Landis & Gyr	MS, MX	0333-AAD
Sangamo	K2S	0333-AAJ
Schlumberger	J5S	0333-AAF
Schlumberger	J4S*	0333-J4S
Westinghouse	D4S, D5S	0333-AAD

**Some J4S type meters have small tapered covers which will not fit over the transmitter components. In this case, it will be neccessary to replace the cover with either a newer model cover or an after-market replacement.*

LEAD TYPES

Various lead types are available which make Turtle transmitters adaptable to all major brands of meters.

Lead Product Number	Lead Type
0333-039	Alligator clip
0333-040	Quick disconnect
0333-025	Spring clip
0333-026	Fuse clip

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The Turtle System®

TURTLE® RECEIVER

The Turtle® receiver is the data collection point for the Turtle System. A Turtle receiver can easily be installed in a substation with minimal labor. The receiver uses the existing CTs, in the substation, to gather data. Therefore, no line disconnects or power outages are required for installation. Each Turtle receiver can monitor 2,880 meters simultaneously. Multiple receivers may be installed in a substation to accommodate a larger number of meters. Also, each receiver card stores up to 30 readings for each meter and retains the data, without power, for a minimum of 5 days.

KEY FEATURES

- Continuous reception from all Turtle transmitters.
- Field-maintainable "hot" board replacement.
- Non–intrusive substation installation.
- Modem interface.
- Operates in outdoor environments.
- Customer data is available to download into host computer at anytime.
- Power outage detector.
- Minimal labor resources needed for installation.
- Remote diagnostic support and tuning.
- Digital Signal Processor (DSP) based data collection device.

PRODUCT SPECIFICATIONS

Specifications	Expandable Receiver	Non-Expandable Receiver
Product Part Number:	0344-001 (with 3 receiver cards) 0464-001 (with 6 receiver cards) 0323-001 (additional receiver cards)	0351-001
Size:	20 x 15 x 7 inches (508 x 381 x 177.8 mm)	15 x 14 x 7 inches (381 x 355.6 x 177.8 mm)
Weight:	30 pounds (13.6 kg)	22 pounds (10.0 kg)
Enclosure Type:	NEMA 4 Rated	Steel, weather resistant
Operating Temperature:	-22°F to 176°F (-30°C to 80°C)	-22°F to 176°F (-30°C to 80°C)
Humidity:	0 to 90% non–condensing	0 to 90% non–condensing
Power Input:	120 VAC or 240 VAC ± 15% at 50/60 Hz	120 VAC or 240 VAC ± 15% at 50/60 Hz
Power Consumption:	20 watts maximum	10 watts maximum
Memory Capacity:	30 packets per channel	30 packets per channel
Memory Retention:	More than 120 hours after mainpower loss	More than 120 hours after mainpower loss
Channel Capability:	Up to 960 per phase (2880 total)	Up to 480 per phase (1440 total)
Expansion Capability:	Yes, up to six cards	No
Linking Capability (modem):	Yes	Yes
Internal Modem:	1200 to 14400 BPS	1200 to 14400 BPS

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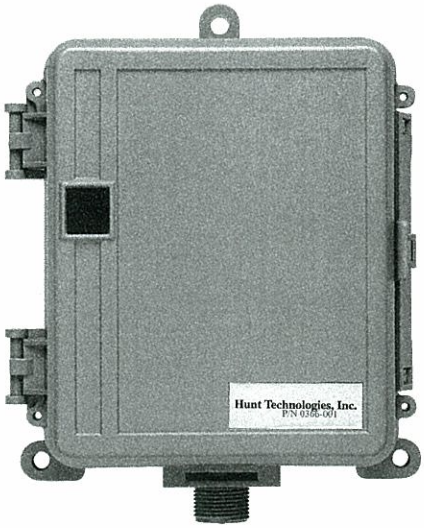
The Turtle System®

END-OF-LINE VOLTAGE MONITOR



The End-of-Line Voltage Monitor (EOLVM) is a Turtle transmitter designed to monitor and report power line voltage. It reads the power line voltage once per second, recording the maximum, minimum, and average voltage with an accuracy of ±1 volt.

An EOLVM is configured slightly differently than a Turtle transmitter which allows it to generate a complete data packet every 2.7 hours at 60 Hz (3.2 hours at 50Hz) or approximately ten times faster than a Turtle transmitter. This means up to nine data packets per day, are sent to the receiver. The data is then stored in the receiver's non-volatile memory until it is downloaded to the host computer. The data can then be used by operations personnel to improve power quality, and ultimately, customer satisfaction.

KEY FEATURES

- Reports maximum, minimum, and average voltage.
- Each reading is time-stamped.
- Provides count of high and low voltage limits being exceeded.
- Reports count of momentary outages (blinks).
- Enables utility personnel to view power line voltage from the utility office.
- Aids in phase balancing.
- Automates voltage regulator monitoring and failure identification.

PRODUCT SPECIFICATIONS

Product Part Number:	0366-001
Size:	7.3 x 9.5 x 3.0 inches (185.4 x 241.3 x 76.2 mm)
Weight:	27 ounces (0.77 kg)
Operating Temperature:	-40°F to 150°F (-40°C to 65.6°C)
Power Supply:	240 VAC
Operating Voltage:	196 to 260 VAC
	May be programmed at 120 or 240 VAC
Power Consumption:	4 watts real power
	Capacitive load is 330 VA rms, 465 VA rms maximum
AC Measurement Method*:	Averaging
Resolution:	0.25 volt
Accuracy:	±1 volt
Out-of-Tolerance Count Voltage Hysteresis:	5 volts
Time Stamp Resolution:	15 minutes
Programming and Setup Method:	TurtleWare® Turtle System Software
Number of Frequencies Occupied:	11 (16.5 mHz vs. 1.5 mHz occupied by one Turtle transmitter)

*Note: All measurements scaled as if the transmitter is connected to 120 volts.

TIME CONSTANTS

Peak Voltage:	60 seconds
Peak Clear:	Resets after being sent four times
Minimum Voltage:	60 seconds
Minimum Clear:	Resets after being sent three times
Average Voltage:	Since last report 2.8 hours
High Voltage Count:	One second
Low Voltage Count:	One second

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Appendix C

Measurement Canada Approvals

APPROVAL No. - N° D'APPROBATION
AE-0794 Rev.2

NOTICE OF APPROVAL

Issued by statutory authority of the Minister of Industry for:

AVIS D'APPROBATION

Émis en vertu du pouvoir statutaire du ministre de l'Industrie pour:

TYPE OF DEVICE

Electricity Meter: Remote Reading Attachment

TYPE D'APPAREIL

Accessoire de télémesurage de compteur d'électricité

APPLICANT

Hunt Technologies Inc.
HC2 Box 17H
Pequot Lakes, Minnesota, 56472
USA

REQUÉRANT

MANUFACTURER

Hunt Technologies Inc.
HC2 Box 17H
Pequot Lakes, Minnesota, 56472
USA

FABRICANT

MODEL(S)/MODÈLE(S)

Turtle 0333
Turtle 0354

RATING/ CLASSEMENT

N/A

NOTE: This approval applies only to meters, the design, composition, construction and performance of which are, in every material respect, identical to that described in the material submitted, and that are typified by samples submitted by the applicant for evaluation for approval in accordance with sections 13 and 14 of the Electricity and Gas Inspection Regulations. The following is a summary of the principal features only.

REMARQUE: Cette approbation ne vise que les compteurs dont la conception, la composition, la construction et le rendement sont identiques, en tout point, à ceux qui sont décrits dans la documentation reçue et pour lesquels des échantillons représentatifs ont été fournis par le requérant aux fins d'évaluation, conformément aux articles 13 et 14 du Règlement sur l'inspection de l'électricité et du gaz. Ce qui suit est une brève description de leurs principales caractéristiques.

SUMMARY DESCRIPTION:

The Turtle automated remote reading attachment is a solid state device for retrofit to the following approved electromechanical energy meters:

- General Electric I-70 , V-62S (network)
- Schlumberger K2 and J5S
- Landis & Gyr MS, and MX
- ABB D5 and AB1.

The device counts disc revolutions and provides remote reading of kW·h/kW data through power line carrier communication. The kW demand is approved for sliding window demand interval.

Time-of-use metering is not approved.

DESCRIPTION SOMMAIRE:

L'accessoire de télémesurage automatisé Turtle est un dispositif à semiconducteurs pour installation sur compteurs d'énergie électromécaniques approuvés suivants :
- General Electric I-70, V-62S (réseau)
- Schlumberger K2 et J5S
- Landis & Gyr MS et MX
- ABB D5 et AB1.

Ce dispositif compte les révolutions du disque et permet le télémesurage des données kW·h/kW grâce à la communication par porteuse sur ligne de transport. Le maximum kW est approuvé pour le mesurage à fenêtre mobile de maximum.

Le dispositif n'est pas approuvé pour le mesurage à tarif horaire.

PHYSICAL DESCRIPTION

The Turtle consists of circuit board mounted below the host meter's nameplate.

The 240 V (ac) supply connection for the Turtle is taken from the line connections within the meter. The two wires carry both the supply current and the power line communication signal. The wires do not extend beyond the meter body.

DESCRIPTION MATÉRIELLE

Le Turtle se compose d'une carte imprimée montée au-dessous de la plaque signalétique du compteur hôte.

L'alimentation 240 V (c.a.) du Turtle est dérivée des connexions de ligne à l'intérieur du compteur. Les deux fils portent tant le courant d'alimentation que le signal de communication sur ligne de transport. Les fils ne dépassent pas du corps du compteur.

APPROVAL No. - N° D'APPROBATION
AE-0815 Rev. 2

NOTICE OF APPROVAL

Issued by statutory authority of the Minister of Industry for:

AVIS D'APPROBATION

Émis en vertu du pouvoir statutaire du ministre de l'Industrie pour:

TYPE OF DEVICE

Pulse Device: Recorder

TYPE D'APPAREIL

Générateur d'impulsions: enregistreur

APPLICANT

Hunt Technologies Inc.
HC2 Box 17H
Pequot Lakes, Minnesota, 56472
USA

REQUÉRANT

MANUFACTURER

Hunt Technologies Inc.
HC2 Box 17H
Pequot Lakes, Minnesota, 56472
USA

FABRICANT

MODEL(S)/MODÈLE(S)

TURTLE 0379
0445

RATING/ CLASSEMENT

3 pulses per second / 3 impulsions par seconde

NOTE: This approval applies only to meters, the design, composition, construction and performance of which are, in every material respect, identical to that described in the material submitted, and that are typified by samples submitted by the applicant for evaluation for approval in accordance with sections 13 and 14 of the Electricity and Gas Inspection Regulations. The following is a summary of the principal features only.

REMARQUE: Cette approbation ne vise que les compteurs dont la conception, la composition, la construction et le rendement sont identiques, en tout point, à ceux qui sont décrits dans la documentation reçue et pour lesquels des échantillons représentatifs ont été fournis par le requérant aux fins d'évaluation, conformément aux articles 13 et 14 du Règlement sur l'inspection de l'électricité et du gaz. Ce qui suit est une brève description de leurs principales caractéristiques.

SUMMARY DESCRIPTION:

The Turtle pulse device is approved for totalizing a form A pulse input from approved metering devices.

The Turtle automated remote reading capabilities are done via power line carrier.

A sliding window demand interval (kW) is approved.

DESCRIPTION SOMMAIRE:

Le générateur d'impulsions Turtle est approuvé pour totaliser les entrées de forme A de compteurs approuvés.

La lecture à distance automatique du Turtle est effectuée par l'entremise de lignes porteuses.

Le mesurage à fenêtre mobile de maximum (kW) est approuvée.

DESCRIPTION

The device consists of a solid state circuit board mounted in a rectangular plastic case. The (red, yellow) wires are designated for pulse inputs. The other 3 wires (green, black and white) are for the ac power supply.

DESCRIPTION

L'appareil comporte une carte à circuits imprimés à semi-conducteurs montée dans un étui rectangulaire de plastique. Les fils rouge et jaune correspondent aux impulsions d'entrée et les 3 fils (vert, noir et blanc) servent à l'alimentation en c.a.

THEORY OF OPERATION

The Turtle 0379 and 0445 receive form A pulses and provide remote reading of kW·h and kW data through power line carrier communication.

The sliding window demand (kW) is calculated from the energy reading (kW•h).

Time-of-use metering is not approved.

THÉORIE DE FONCTIONNEMENT

Le modèle Turtle 0379 reçoit des impulsions de forme A et fournit des lectures à distance en kW·h et kW par l'entremise de lignes porteuses de communication.

La fenêtre mobile de maximum (kW) est calculé à partir de la lecture de l'énergie (kW•h).

La mesure selon l'heure d'utilisation n'est pas approuvée

Measurement Canada
An agency of Industry Canada

Mesures Canada
Un organisme d'Industrie Canada

APPROVAL No. - N° D'APPROBATION
AE-1263

NOTICE OF APPROVAL

Issued by statutory authority of the Minister of Industry for:

AVIS D'APPROBATION

Émis en vertu du pouvoir statutaire du ministre de l'Industrie pour :

TYPE OF DEVICE

Electricity Meter: Remote Reading Attachment

TYPE D'APPAREIL

Accessoire de téléreport de compteur d'électricité

APPLICANT

Hunt Technologies Inc.
HC2 Box 17H
Pequot Lakes, Minnesota, 56472
USA

REQUÉRANT

MANUFACTURER

Hunt Technologies Inc.
HC2 Box 17H
Pequot Lakes, Minnesota, 56472
USA

FABRICANT

MODEL(S) / MODÈLE(S)

Turtle 0584

RATING / CLASSEMENT

120, 240 V(ac) / V(c.a.)
0.2-20, 1-100, 2-200 amperes / ampères
1 element, 2 wire single-phase /1 élément, 2 fils, monophasé
1.5 element, 3 wire, single-phase / 1,5 élément, 3 fils, monophasé
2 element, 3wire, network / 2 éléments, 3 fils, réseau

NOTE: This approval applies only to meters, the design, composition, construction and performance of which are, in every material respect, identical to that described in the material submitted, and that are typified by samples submitted by the applicant for evaluation for approval in accordance with sections 13 and 14 of the Electricity and Gas Inspection Regulations. The following is a summary of the principal features only.

REMARQUE: Cette approbation ne vise que les compteurs dont la conception, la composition, la construction et le rendement sont identiques, en tout point, à ceux qui sont décrits dans la documentation reçue et pour lesquels des échantillons représentatifs ont été fournis par le requérant aux fins d'évaluation, conformément aux articles 13 et 14 du Règlement sur l'inspection de l'électricité et du gaz. Ce qui suit est une brève description de leurs principales caractéristiques.

SUMMARY DESCRIPTION:

The Turtle automated remote reading attachment is a solid state device for retrofit to the Schlumberger Centron meter approved pursuant to AE-0920.

The device counts solid state pulses and provides remote reading of kW·h data through power line carrier communication.

DESCRIPTION SOMMAIRE:

L'accessoire de téléreport automatisé Turtle est un dispositif à semi-conducteurs visant à moderniser le compteur Schlumberger Centron approuvé selon l'avis AE-0920.

Cet appareil compte les impulsions du dispositif à semi-conducteurs et permet le téléreport des données kWh grâce au système de transmission à courant porteur sur ligne de transport.

PHYSICAL DESCRIPTION

The Turtle consists of circuit board mounted below the host meter's nameplate.

The, 240 V (ac) supply connection for the Turtle is taken from the line connections within the meter. The two wires carry both the supply current and the power line communication signal. The wires do not extend beyond the meter body.

A portable "Opto Wand" may be used with a PC for reading and programming of the Turtle0584. The Turtle will communicate with the "Opto Wand" via optic LEDs located on the circuit board.

DESCRIPTION MATÉRIELLE

Le Turtle se compose d'une carte de circuits imprimés montée au-dessous de la plaque signalétique du compteur hôte.

L'alimentation 240 V (c.a.) du Turtle est fournie par le compteur. Les deux fils portent à la fois le courant d'alimentation et le signal de communication sur ligne de transport. Les fils ne dépassent pas le corps du compteur.

Un dispositif «Opto Wand» portable peut être utilisé avec un PC pour effectuer la lecture et la programmation du Turtle0584. Ce dernier communiquera avec le «Opto Wand» par l'entremise des DÉL situées sur la carte de circuits imprimés.

THEORY OF OPERATION

The Turtle's processor receives energy pulses from the Centron's metrology board and transfers the kW·h reading from the transmitter microprocessor to the display microprocessor.

PRINCIPE DE FONCTIONNEMENT

Le processeur Turtle reçoit les impulsions énergétiques de la carte métrologique Centron, puis transfère la: lecture des kWh du microprocesseur émetteur au microprocesseur d'affichage.

Appendix D

E-mail from Northwest Territories Power

E:mail from Bill Deans, Northwest Territories Power

David,

We have been using the Hunt Technology 'Turtle' AMR system since 1998. We have approximately 2,500 meters installed with the turtle transmitter.

Our utility supplies power to about 30 remote communities scattered throughout the N.W.T. and has a metering contract with Nunavut Power for their approximately 30 sites. The majority are isolated diesel generating sites, but we have two hydro sites at Yellowknife & Fort Smith.

Currently, the turtle system is installed in Inuvik at the mouth of the Mackenzie River {1,750 meters}, in Rae/Edzo near Yellowknife {550 meters}, and one Nunavut Power site at Qikiqtarjuaq {215 meters}. The Rae/Edzo site is the only one on hydro.

The Inuvik system has five mini receivers on each of the feeders which collect the readings from the transmitters. The Rae/Edzo & Qikiqtarjuaq sites have a standard receiver each with six cards, so that two feeders can be done with one receiver. The receivers are easy to install. They need a 120 volt outlet for power, a standard telephone connection and three split core CT's which clip over the secondaries of the feeder CT's.

We are using the latest software release called Turtleware 1.2 on a host computer at the meter shop to call each of the receivers to download the readings, manage transmitter programming and to produce the billing file.

We upload the readings once a month from the host to our billing computer {an IBM AS/400}. The Hunt billing file is a text file {coma delimited} that can be easily imported into billing applications.

The amount of time between readings depends on the features you program into the transmitter. It takes between 14 & 27 hours for one reading to be sent to the receiver. Each mini receiver can communicate with 1,440 meters, and one standard receiver with six cards can accommodate 2,880 meters. One advantage to the turtle is that you can have an energy meter equipped with a turtle, and have the turtle sealed with the demand reading approved. So you can buy a less expensive meter and still get KW demand.

I personally think the turtle is an excellent AMR system. The software works great, the transmitters send in their readings faithfully, and all their equipment works. However, they have one important flaw. On some of the meters the LED's that read the disk rotation have a nasty habit of degrading light level over time. This means that eventually the turtle stops counting disk revs. Since meters in Canada have to be sealed by Measurement Canada, this means a trip to the meter shop to have the turtle

replaced and the meter resealed. For us this has been a major problem, shipping meters from the isolated places at high shipping rates, plus shipping meter south for sealing. We have decided this year not to use LED equipped turtles, and have switched to the Schlumberger Centron meter which has a Hunt personality board. This meter should have MC approval by the end of June 2003. A CGE meter will be ready by the end of the year. We have been using the CGE V6 meter for network and 3 phase as they have the turtle under the cover receiving pulses from the meter. This meter has worked very well. For 4 wire delta services, 600 volt self contained services, we have used a pulse meter with an external turtle.

Although this LED was a significant problem at first, Hunt have taken measures to reduce this problem, and we are experiencing it less and less. The transmitters can be programmed to sent an LED optic value for mins & maxs every 20 readings, so you can watch for failing LED's. Their software has reports with which you can quickly determine a problem before it affects billing. Hunt have also replaced all LED failures with a new transmitter under warranty, and still replace ones at no charge which we purchased in 1998. Their customer support for us has been excellent.

My advice to you is to use the Centron for single phase & network metering, and the CGE V6 for three phase, and you should have a successful pilot project.

Hunt Technologies can be reached at 1-800-828-4055.

Regards,
Bill.

Bill Deans
Meter Technician
#1 Jackfish Road
Box 2250, Yellowknife, NT, X1A 2P7
Phone # 867-669-3339
Fax # 867-669-3320
Email: bdeans@ntpc.com

Appendix E

Monthly Readings: AMR vs. Radix

AMR Pilot Results: Manual vs. Automatic Reads - January

Meter #	Automatic Read				Manual Read				KWh Variance	%	Peak Variance	%
	KWh	Time	Date	Peak	KWh	Time	Date	Peak				
P 60433	5042	3:07:04	01/27/2004	9.25	5068	101345	01/27/2004	0	-26	-0.51%	9.25	100%
P 66625	8992	3:08:44	01/27/2004	18.75	8853	112551	01/26/2004	0	139	1.57%	18.75	100%
P 70647	180	13:59:28	01/26/2004	0	180	94208	01/26/2004	0	0	0.00%	0	0
P 70648	356	14:06:08	01/26/2004	0	351	94258	01/26/2004	0	5	1.42%	0	0
P 70649	206	14:12:48	01/26/2004	0	201	94334	01/26/2004	0	5	2.49%	0	0
P 70650	575	13:59:32	01/26/2004	0	561	94036	01/26/2004	0	14	2.50%	0	0
P 70651	5	13:26:12	01/26/2004	0	5	93126	01/26/2004	0	0	0.00%	0	0
P 70652	61	13:39:32	01/26/2004	0	60	93839	01/26/2004	0	1	1.67%	0	0
P 70653	11	13:32:52	01/26/2004	0	10	93331	01/26/2004	0	1	10.00%	0	0
P 70654	110	13:19:36	01/26/2004	0	109	93031	01/26/2004	0	1	0.92%	0	0
P 70655	85	23:34:36	01/26/2004	0	81	135343	01/26/2004	0	4	4.94%	0	0
P 70656	214	23:39:36	01/26/2004	0	205	135505	01/26/2004	0	9	4.39%	0	0
P 70657	337	23:48:00	01/26/2004	0	329	135857	01/26/2004	0	8	2.43%	0	0
P 70658	269	23:52:56	01/26/2004	0	248	140021	01/26/2004	0	21	8.47%	0	0
P 70659	461	0:46:20	01/27/2004	0	468	93737	01/27/2004	0	-7	-1.50%	0	0
P 70660	0	0:54:40	01/27/2004	0	0	93959	01/27/2004	0	0	0.00%	0	0
P 70661	3	1:01:20	01/27/2004	0	3	95058	01/27/2004	0	0	0.00%	0	0
P 70662	423	0:48:04	01/27/2004	0	436	93818	01/27/2004	0	-13	-2.98%	0	0
P 70663	38	6:13:04	01/26/2004	0	39	133322	01/26/2004	0	-1	-2.56%	0	0
P 70664	0	6:14:44	01/26/2004	0	0	133344	01/26/2004	0	0	0.00%	0	0
P 70665	20	6:33:04	01/26/2004	0	20	133554	01/26/2004	0	0	0.00%	0	0
P 70666	409	6:28:08	01/26/2004	0	420	134234	01/26/2004	0	-11	-2.62%	0	0
P 70667	121	19:13:08	01/26/2004	0	120	104345	01/26/2004	0	1	0.83%	0	0
P 70668	122	19:28:08	01/26/2004	0	123	104839	01/26/2004	0	-1	-0.81%	0	0
P 70669	290	19:33:08	01/26/2004	0	279	110232	01/26/2004	0	11	3.94%	0	0
P 70670	2	19:06:28	01/26/2004	0	2	104118	01/26/2004	0	0	0.00%	0	0
P 70671	410	7:14:52	01/26/2004	0	439	155835	01/26/2004	0	-29	-6.61%	0	0
P 70672	497	6:59:52	01/26/2004	0	514	155617	01/26/2004	0	-17	-3.31%	0	0
P 70673	INVENTORY				INVENTORY							
P 70674	476	7:06:36	01/26/2004	0	492	155745	01/26/2004	0	-16	-3.25%	0	0
P 70675	180	6:13:16	01/26/2004	0	186	153511	01/26/2004	0	-6	-3.23%	0	0

P	70676	323	6:01:36	01/26/2004	0	342	153044	01/26/2004	0	-19	-5.56%	0	0
P	70677	191	6:08:16	01/26/2004	0	205	153204	01/26/2004	0	-14	-6.83%	0	0
P	70678	75	6:08:16	01/26/2004	0	77	153431	01/26/2004	0	-2	-2.60%	0	0
P	70679	423	17:01:40	01/26/2004	0	412	101347	01/26/2004	0	11	2.67%	0	0
P	70680	362	17:20:00	01/26/2004	0	356	101833	01/26/2004	0	6	1.69%	0	0
P	70681	0	17:15:00	01/26/2004	0	0	101649	01/26/2004	0	0	0.00%	0	0
P	70682	339	17:13:20	01/26/2004	0	327	101617	01/26/2004	0	12	3.67%	0	0
P	70683	249	18:00:04	01/26/2004	0	241	105328	01/26/2004	0	8	3.32%	0	0
P	70684	5	20:46:44	01/26/2004	0	5	110452	01/26/2004	0	0	0.00%	0	0
P	70685	8	20:13:24	01/26/2004	0	7	105445	01/26/2004	0	1	14.29%	0	0
P	70686	237	18:08:24	01/26/2004	0	229	105104	01/26/2004	0	8	3.49%	0	0
P	70687	237	19:40:08	01/26/2004	0	229	110209	01/26/2004	0	8	3.49%	0	0
P	70688	479	20:01:48	01/26/2004	0	459	105712	01/26/2004	0	20	4.36%	0	0
P	70689	357	19:40:08	01/26/2004	0	345	105919	01/26/2004	0	12	3.48%	0	0
P	70690	0	19:48:28	01/26/2004	0	0	110014	01/26/2004	0	0	0.00%	0	0
P	70691	5	18:53:28	01/26/2004	0	5	104004	01/26/2004	0	0	0.00%	0	0
P	70692	472	18:06:52	01/26/2004	0	456	103247	01/26/2004	0	16	3.51%	0	0
P	70693	50	18:08:32	01/26/2004	0	49	103223	01/26/2004	0	1	2.04%	0	0
P	70694	623	18:20:12	01/26/2004	0	598	103455	01/26/2004	0	25	4.18%	0	0
P	70695	391	8:48:32	01/26/2004	0	400	160410	01/26/2004	0	-9	-2.25%	0	0
P	70696	357	3:21:56	01/27/2004	0	363	100227	01/27/2004	0	-6	-1.65%	0	0
P	70697	INVENTORY				INVENTORY							
P	70698	INVENTORY				INVENTORY							
P	70699	206	21:06:56	01/26/2004	0	203	142905	01/26/2004	0	3	1.48%	0	0
P	70700	435	20:55:20	01/26/2004	0	419	143433	01/26/2004	0	16	3.82%	0	0
P	70701	72	21:15:20	01/26/2004	0	72	144549	01/26/2004	0	0	0.00%	0	0
P	70702	478	21:08:40	01/26/2004	0	463	141807	01/26/2004	0	15	3.24%	0	0
P	70703	307	21:20:20	01/26/2004	0	300	141623	01/26/2004	0	7	2.33%	0	0
P	70704	639	21:28:40	01/26/2004	0	626	141715	01/26/2004	0	13	2.08%	0	0
P	70705	426	21:40:24	01/26/2004	0	412	140453	01/26/2004	0	14	3.40%	0	0
P	70706	INVENTORY				INVENTORY							
P	70707	238	7:20:24	01/26/2004	0	247	160308	01/26/2004	0	-9	-3.64%	0	0
P	70708	378	7:28:44	01/26/2004	0	395	155402	01/26/2004	0	-17	-4.30%	0	0
P	70709	249	7:33:48	01/26/2004	0	253	155305	01/26/2004	0	-4	-1.58%	0	0
P	70710	388	7:27:08	01/26/2004	0	397	155445	01/26/2004	0	-9	-2.27%	0	0
P	70711	352	6:07:08	01/26/2004	0	361	133253	01/26/2004	0	-9	-2.49%	0	0
P	70712	400	6:00:28	01/26/2004	0	406	133001	01/26/2004	0	-6	-1.48%	0	0

P	70713	398	5:47:08	01/26/2004	0	410	132740	01/26/2004	0	-12	-2.93%	0	0
P	70714	0	23:58:20	01/26/2004	0	0	145212	01/26/2004	0	0	0.00%	0	0
P	70715	145	17:35:32	01/26/2004	0	142	102135	01/26/2004	0	3	2.11%	0	0
P	70716	3	17:28:52	01/26/2004	0	4	102016	01/26/2004	0	-1	-25.00%	0	0
P	70717	729	17:27:12	01/26/2004	0	708	102106	01/26/2004	0	21	2.97%	0	0
P	70718	432	17:42:16	01/26/2004	0	421	102325	01/26/2004	0	11	2.61%	0	0
P	70719	0	15:42:16	01/26/2004	0	0	100722	01/26/2004	0	0	0.00%	0	0
P	70720	102	15:53:56	01/26/2004	0	100	101102	01/26/2004	0	2	2.00%	0	0
P	70721	342	17:02:16	01/26/2004	0	333	101250	01/26/2004	0	9	2.70%	0	0
P	70722	470	15:53:56	01/26/2004	0	464	101206	01/26/2004	0	6	1.29%	0	0
P	70723	17	1:47:20	01/27/2004	0	17	94634	01/27/2004	0	0	0.00%	0	0
P	70724	243	1:29:00	01/27/2004	0	247	95555	01/27/2004	0	-4	-1.62%	0	0
P	70725	351	1:35:52	01/27/2004	0	358	95518	01/27/2004	0	-7	-1.96%	0	0
P	70726	333	1:40:56	01/27/2004	0	337	94236	01/27/2004	0	-4	-1.19%	0	0
P	70727	INVENTORY				INVENTORY							
P	70728	INVENTORY				INVENTORY							
P	70729	INVENTORY				INVENTORY							
P	70730	INVENTORY				INVENTORY							
P	70731	444	21:54:04	01/26/2004	0	432	141144	01/26/2004	0	12	2.78%	0	0
P	70732	389	23:00:44	01/26/2004	0	373	134437	01/26/2004	0	16	4.29%	0	0
P	70733	703	22:00:56	01/26/2004	0	688	144832	01/26/2004	0	15	2.18%	0	0
P	70734	296	21:42:24	01/26/2004	0	294	140652	01/26/2004	0	2	0.68%	0	0
P	70735	517	14:54:08	01/26/2004	0	506	94722	01/26/2004	0	11	2.17%	0	0
P	70736	262	15:00:44	01/26/2004	0	261	94816	01/26/2004	0	1	0.38%	0	0
P	70737	497	15:07:28	01/26/2004	0	482	94432	01/26/2004	0	15	3.11%	0	0
P	70738	2	15:14:08	01/26/2004	0	2	100150	01/26/2004	0	0	0.00%	0	0
P	70739	2	20:40:48	01/26/2004	0	2	143853	01/26/2004	0	0	0.00%	0	0
P	70740	35	20:40:48	01/26/2004	0	35	143732	01/26/2004	0	0	0.00%	0	0
P	70741	867	20:34:12	01/26/2004	0	840	144325	01/26/2004	0	27	3.21%	0	0
P	70742	325	20:52:28	01/26/2004	0	315	143317	01/26/2004	0	10	3.17%	0	0
P	70743	333	1:54:08	01/27/2004	0	340	100156	01/27/2004	0	-7	-2.06%	0	0
P	70744	287	2:07:32	01/27/2004	0	291	100304	01/27/2004	0	-4	-1.37%	0	0
P	70745	0	2:14:08	01/27/2004	0	0	100505	01/27/2004	0	0	0.00%	0	0
P	70746	2	2:07:32	01/27/2004	0	2	100332	01/27/2004	0	0	0.00%	0	0
P	70747	626	17:46:04	01/26/2004	0	612	102558	01/26/2004	0	14	2.29%	0	0
P	70748	2	17:51:00	01/26/2004	0	2	102917	01/26/2004	0	0	0.00%	0	0
P	70749	349	17:59:24	01/26/2004	0	344	102955	01/26/2004	0	5	1.45%	0	0

P	70750	439	18:04:28	01/26/2004	0	424	103030	01/26/2004	0	15	3.54%	0	0
P	70751	298	3:39:32	01/27/2004	0	313	100600	01/27/2004	0	-15	-4.79%	0	0
P	70752	366	2:24:32	01/27/2004	0	369	100627	01/27/2004	0	-3	-0.81%	0	0
P	70753	2	2:37:56	01/27/2004	0	2	101506	01/27/2004	0	0	0.00%	0	0
P	70754	2	2:38:00	01/27/2004	0	2	101520	01/27/2004	0	0	0.00%	0	0
P	70755	305	2:19:40	01/27/2004	0	308	92920	01/27/2004	0	-3	-0.97%	0	0
P	70756	584	1:59:40	01/27/2004	0	594	102618	01/27/2004	0	-10	-1.68%	0	0
P	70757	491	2:06:24	01/27/2004	0	496	93153	01/27/2004	0	-5	-1.01%	0	0
P	70758	224	2:24:44	01/27/2004	0	227	93028	01/27/2004	0	-3	-1.32%	0	0
P	70759	177	23:11:28	01/26/2004	0	170	134541	01/26/2004	0	7	4.12%	0	0
P	70760	2	23:24:52	01/26/2004	0	2	135114	01/26/2004	0	0	0.00%	0	0
P	70761	8	23:31:32	01/26/2004	0	8	135146	01/26/2004	0	0	0.00%	0	0
P	70762	11	23:11:36	01/26/2004	0	10	134508	01/26/2004	0	1	10.00%	0	0
P	70763		INVENTORY				INVENTORY						
P	70764		INVENTORY				INVENTORY						
P	70765		INVENTORY				INVENTORY						
P	70766		INVENTORY				INVENTORY						
P	70767	3	6:16:16	01/24/2004	0	0	142336	01/23/2004	0	3	100.00%	0	0
P	70768		INVENTORY				INVENTORY						
P	70769		INVENTORY				INVENTORY						
P	70770		INVENTORY				INVENTORY						
P	70771	294	12:58:28	01/26/2004	0	290	92751	01/26/2004	0	4	1.38%	0	0
P	70772	346	13:06:52	01/26/2004	0	344	92607	01/26/2004	0	2	0.58%	0	0
P	70773	179	12:46:52	01/26/2004	0	177	92526	01/26/2004	0	2	1.13%	0	0
P	70774	237	13:11:52	01/26/2004	0	233	92643	01/26/2004	0	4	1.72%	0	0
P	70775	9	18:13:32	01/26/2004	0	10	110833	01/26/2004	0	-1	-10.00%	0	0
P	70776	1114	18:38:36	01/26/2004	0	1102	151732	01/26/2004	0	12	1.09%	0	0
P	70777	163	18:25:16	01/26/2004	0	158	112312	01/26/2004	0	5	3.16%	0	0
P	70778	95	18:33:36	01/26/2004	0	94	112134	01/26/2004	0	1	1.06%	0	0
P	70779	186	18:47:00	01/26/2004	0	182	111828	01/26/2004	0	4	2.20%	0	0
P	70780	760	18:45:20	01/26/2004	0	745	111942	01/26/2004	0	15	2.01%	0	0
P	70781	475	20:25:20	01/26/2004	0	466	144118	01/26/2004	0	9	1.93%	0	0
P	70782	400	18:58:44	01/26/2004	0	384	112754	01/26/2004	0	16	4.17%	0	0
P	70783	323	1:25:24	01/27/2004	0	328	95634	01/27/2004	0	-5	-1.52%	0	0
P	70784	304	1:20:24	01/27/2004	0	307	100055	01/27/2004	0	-3	-0.98%	0	0
P	70785	2	1:05:24	01/27/2004	0	1	94918	01/27/2004	0	1	100.00%	0	0
P	70786	717	7:29:04	01/27/2004	0	689	94939	01/27/2004	0	28	4.06%	0	0

P	70787		INVENTORY				INVENTORY						
P	70788		INVENTORY				INVENTORY						
P	70789		INVENTORY				INVENTORY						
P	70790		INVENTORY				INVENTORY						
P	70791		INVENTORY				INVENTORY						
P	70792		INVENTORY				INVENTORY						
P	70793		INVENTORY				INVENTORY						
P	70794		INVENTORY				INVENTORY						
P	70795	371	5:45:36	01/26/2004	0	390	154104	01/26/2004	0	-19	-4.87%	0	0
P	70796	385	5:47:16	01/26/2004	0	394	153852	01/26/2004	0	-9	-2.28%	0	0
P	70797	327	5:52:16	01/26/2004	0	339	152955	01/26/2004	0	-12	-3.54%	0	0
P	70798	2	5:52:20	01/26/2004	0	1	152934	01/26/2004	0	1	100.00%	0	0
P	70799	508	15:19:00	01/26/2004	0	499	100208	01/26/2004	0	9	1.80%	0	0
P	70800	3	15:27:20	01/26/2004	0	3	100241	01/26/2004	0	0	0.00%	0	0
P	70801	232	15:39:00	01/26/2004	0	228	100555	01/26/2004	0	4	1.75%	0	0
P	70802	533	15:34:04	01/26/2004	0	525	100318	01/26/2004	0	8	1.52%	0	0
P	70803		INVENTORY				INVENTORY						
P	70804		INVENTORY				INVENTORY						
P	70805		INVENTORY				INVENTORY						
P	70806		INVENTORY				INVENTORY						
							AVG.			3.187817	2.20%		

AMR Pilot Results: Manual vs. Automatic Reads - February

Meter #	Automatic Read				Manual Read				KWh Variance	%	Peak Variance	%
	KWh	Time	Date	Peak	KWh	Time	Date	Peak				
P 60433	8264	5:22:04	02/27/2004	9.5	8297	140733	02/27/2004	0	-33	-0.40%	9.5	0.00%
P 66625	14981	21:22:04	02/27/2004	19.75	14094	112551	02/27/2004	0	887	6.29%	19.75	0.00%
P 70647	731	16:01:08	02/27/2004	0	726	95236	02/27/2004	0	5	0.69%	0	0
P 70648	1169	16:06:08	02/27/2004	0	1163	95320	02/27/2004	0	6	0.52%	0	0
P 70649	690	16:14:28	02/27/2004	0	688	95347	02/27/2004	0	2	0.29%	0	0
P 70650	1819	15:54:32	02/27/2004	0	1806	95057	02/27/2004	0	13	0.72%	0	0
P 70651	5	15:26:12	02/27/2004	0	5	94454	02/27/2004	0	0	0.00%	0	0
P 70652	188	15:41:12	02/27/2004	0	186	94844	02/27/2004	0	2	1.08%	0	0
P 70653	11	15:32:52	02/27/2004	0	10	94627	02/27/2004	0	1	10.00%	0	0
P 70654	436	15:19:36	02/27/2004	0	434	94418	02/27/2004	0	2	0.46%	0	0
P 70655	256	7:14:36	02/27/2004	0	257	113000	02/27/2004	0	-1	-0.39%	0	0
P 70656	505	7:21:16	02/27/2004	0	506	113024	02/27/2004	0	-1	-0.20%	0	0
P 70657	1099	7:28:00	02/27/2004	0	1102	113150	02/27/2004	0	-3	-0.27%	0	0
P 70658	880	7:32:56	02/27/2004	0	885	113301	02/27/2004	0	-5	-0.56%	0	0
P 70659	1717	8:19:40	02/27/2004	0	1727	134425	02/27/2004	0	-10	-0.58%	0	0
P 70660	0	8:34:40	02/27/2004	0	0	134554	02/27/2004	0	0	0.00%	0	0
P 70661	3	8:34:40	02/27/2004	0	3	135304	02/27/2004	0	0	0.00%	0	0
P 70662	1389	8:26:24	02/27/2004	0	1399	134455	02/27/2004	0	-10	-0.71%	0	0
P 70663	116	8:14:44	02/27/2004	0	117	111140	02/27/2004	0	-1	-0.85%	0	0
P 70664	0	8:14:44	02/27/2004	0	0	111156	02/27/2004	0	0	0.00%	0	0
P 70665	60	8:33:04	02/27/2004	0	60	111343	02/27/2004	0	0	0.00%	0	0
P 70666	1631	8:26:28	02/27/2004	0	1638	111817	02/27/2004	0	-7	-0.43%	0	0
P 70667	156	21:08:08	02/27/2004	0	155	103811	02/27/2004	0	1	0.65%	0	0
P 70668	139	21:26:28	02/27/2004	0	138	104109	02/27/2004	0	1	0.72%	0	0
P 70669	906	21:33:08	02/27/2004	0	899	105005	02/27/2004	0	7	0.78%	0	0
P 70670	2	21:06:28	02/27/2004	0	2	103551	02/27/2004	0	0	0.00%	0	0
P 70671	1472	9:14:52	02/27/2004	0	1480	133550	02/27/2004	0	-8	-0.54%	0	0
P 70672	1727	8:59:52	02/27/2004	0	1737	133413	02/27/2004	0	-10	-0.58%	0	0
P 70673	INVENTORY				INVENTORY							
P 70674	1619	9:08:16	02/27/2004	0	1629	133512	02/27/2004	0	-10	-0.61%	0	0
P 70675	679	8:13:16	02/27/2004	0	682	132637	02/27/2004	0	-3	-0.44%	0	0

P	70676	757	7:59:56	02/27/2004	0	757	132455	02/27/2004	0	0	0.00%	0	0
P	70677	671	8:08:16	02/27/2004	0	673	132537	02/27/2004	0	-2	-0.30%	0	0
P	70678	249	8:13:16	02/27/2004	0	250	132611	02/27/2004	0	-1	-0.40%	0	0
P	70679	1413	19:06:40	02/27/2004	0	1399	101209	02/27/2004	0	14	1.00%	0	0
P	70680	1114	19:20:00	02/27/2004	0	1101	101510	02/27/2004	0	13	1.18%	0	0
P	70681	0	19:15:00	02/27/2004	0	0	101404	02/27/2004	0	0	0.00%	0	0
P	70682	1138	19:06:40	02/27/2004	0	1128	101337	02/27/2004	0	10	0.89%	0	0
P	70683	781	20:01:44	02/27/2004	0	776	104333	02/27/2004	0	5	0.64%	0	0
P	70684	5	22:46:44	02/27/2004	0	5	105150	02/27/2004	0	0	0.00%	0	0
P	70685	8	22:13:24	02/27/2004	0	7	104447	02/27/2004	0	1	14.29%	0	0
P	70686	868	20:08:24	02/27/2004	0	857	104235	02/27/2004	0	11	1.28%	0	0
P	70687	781	8:13:28	02/27/2004	0	783	104940	02/27/2004	0	-2	-0.26%	0	0
P	70688	1636	22:06:48	02/27/2004	0	1610	104635	02/27/2004	0	26	1.61%	0	0
P	70689	1134	21:35:08	02/27/2004	0	1114	104809	02/27/2004	0	20	1.80%	0	0
P	70690	0	21:48:28	02/27/2004	0	0	104857	02/27/2004	0	0	0.00%	0	0
P	70691	5	21:00:08	02/27/2004	0	5	103543	02/27/2004	0	0	0.00%	0	0
P	70692	1415	20:06:52	02/27/2004	0	1412	102416	02/27/2004	0	3	0.21%	0	0
P	70693	204	20:13:32	02/27/2004	0	202	102443	02/27/2004	0	2	0.99%	0	0
P	70694	1962	20:21:52	02/27/2004	0	1951	102537	02/27/2004	0	11	0.56%	0	0
P	70695	1283	10:48:32	02/27/2004	0	1287	133920	02/27/2004	0	-4	-0.31%	0	0
P	70696	1338	11:00:16	02/27/2004	0	1346	135904	02/27/2004	0	-8	-0.59%	0	0
P	70697	INVENTORY				INVENTORY							
P	70698	INVENTORY				INVENTORY							
P	70699	690	23:01:56	02/27/2004	0	680	114636	02/27/2004	0	10	1.47%	0	0
P	70700	1483	23:00:20	02/27/2004	0	1464	114906	02/27/2004	0	19	1.30%	0	0
P	70701	323	23:13:40	02/27/2004	0	319	115723	02/27/2004	0	4	1.25%	0	0
P	70702	1407	23:15:20	02/27/2004	0	1399	114605	02/27/2004	0	8	0.57%	0	0
P	70703	1027	23:20:20	02/27/2004	0	1017	114500	02/27/2004	0	10	0.98%	0	0
P	70704	2061	23:28:40	02/27/2004	0	2046	114532	02/27/2004	0	15	0.73%	0	0
P	70705	1508	23:40:24	02/27/2004	0	1489	113703	02/27/2004	0	19	1.28%	0	0
P	70706	INVENTORY				INVENTORY							
P	70707	766	9:22:04	02/27/2004	0	768	133838	02/27/2004	0	-2	-0.26%	0	0
P	70708	1329	9:33:44	02/27/2004	0	1337	133253	02/27/2004	0	-8	-0.60%	0	0
P	70709	961	9:35:28	02/27/2004	0	964	133201	02/27/2004	0	-3	-0.31%	0	0
P	70710	1903	9:28:48	02/27/2004	0	1909	133337	02/27/2004	0	-6	-0.31%	0	0
P	70711	1215	8:07:08	02/27/2004	0	1220	111120	02/27/2004	0	-5	-0.41%	0	0
P	70712	1328	8:00:28	02/27/2004	0	1332	110933	02/27/2004	0	-4	-0.30%	0	0

P	70713	1370	6:00:28	02/27/2004	0	1375	110811	02/27/2004	0	-5	-0.36%	0	0
P	70714	0	7:38:20	02/27/2004	0	0	120316	02/27/2004	0	0	0.00%	0	0
P	70715	459	19:33:52	02/27/2004	0	456	101717	02/27/2004	0	3	0.66%	0	0
P	70716	3	19:28:52	02/27/2004	0	4	101613	02/27/2004	0	-1	-25.00%	0	0
P	70717	2293	19:28:52	02/27/2004	0	2271	101647	02/27/2004	0	22	0.97%	0	0
P	70718	1535	19:40:36	02/27/2004	0	1519	101911	02/27/2004	0	16	1.05%	0	0
P	70719	0	17:42:16	02/27/2004	0	0	100153	02/27/2004	0	0	0.00%	0	0
P	70720	574	17:47:16	02/27/2004	0	569	100706	02/27/2004	0	5	0.88%	0	0
P	70721	1103	19:00:36	02/27/2004	0	1094	101114	02/27/2004	0	9	0.82%	0	0
P	70722	1329	17:55:36	02/27/2004	0	1307	100825	02/27/2004	0	22	1.68%	0	0
P	70723	53	9:27:20	02/27/2004	0	54	134927	02/27/2004	0	-1	-1.85%	0	0
P	70724	810	9:09:00	02/27/2004	0	813	135515	02/27/2004	0	-3	-0.37%	0	0
P	70725	1120	9:15:52	02/27/2004	0	1131	135445	02/27/2004	0	-11	-0.97%	0	0
P	70726	1209	9:20:56	02/27/2004	0	1213	134735	02/27/2004	0	-4	-0.33%	0	0
P	70727			INVENTORY				INVENTORY					
P	70728			INVENTORY				INVENTORY					
P	70729			INVENTORY				INVENTORY					
P	70730			INVENTORY				INVENTORY					
P	70731	1511	23:55:44	02/27/2004	0	1494	114140	02/27/2004	0	17	1.14%	0	0
P	70732	1302	6:40:44	02/27/2004	0	1309	112430	02/27/2004	0	-7	-0.53%	0	0
P	70733	2210	23:55:56	02/27/2004	0	2182	115941	02/27/2004	0	28	1.28%	0	0
P	70734	1132	23:42:24	02/27/2004	0	1105	113732	02/27/2004	0	27	2.44%	0	0
P	70735	1695	16:52:28	02/27/2004	0	1687	95603	02/27/2004	0	8	0.47%	0	0
P	70736	685	17:02:24	02/27/2004	0	683	95659	02/27/2004	0	2	0.29%	0	0
P	70737	1570	17:09:08	02/27/2004	0	1556	95432	02/27/2004	0	14	0.90%	0	0
P	70738	2	17:14:08	02/27/2004	0	2	95837	02/27/2004	0	0	0.00%	0	0
P	70739	2	22:40:48	02/27/2004	0	2	115133	02/27/2004	0	0	0.00%	0	0
P	70740	93	22:40:48	02/27/2004	0	93	115155	02/27/2004	0	0	0.00%	0	0
P	70741	2698	22:34:12	02/27/2004	0	2676	115508	02/27/2004	0	22	0.82%	0	0
P	70742	1118	22:54:08	02/27/2004	0	1105	114800	02/27/2004	0	13	1.18%	0	0
P	70743	1450	9:34:08	02/27/2004	0	1452	135839	02/27/2004	0	-2	-0.14%	0	0
P	70744	1039	9:42:32	02/27/2004	0	1044	135938	02/27/2004	0	-5	-0.48%	0	0
P	70745	0	9:54:08	02/27/2004	0	0	140234	02/27/2004	0	0	0.00%	0	0
P	70746	2	9:47:32	02/27/2004	0	2	140007	02/27/2004	0	0	0.00%	0	0
P	70747	1741	19:46:04	02/27/2004	0	1723	102111	02/27/2004	0	18	1.04%	0	0
P	70748	2	19:51:00	02/27/2004	0	2	102244	02/27/2004	0	0	0.00%	0	0
P	70749	1111	19:57:44	02/27/2004	0	1094	102321	02/27/2004	0	17	1.55%	0	0

P	70750	1405	20:06:08	02/27/2004	0	1395	102354	02/27/2004	0	10	0.72%	0	0
P	70751	2058	11:17:52	02/27/2004	0	2063	140334	02/27/2004	0	-5	-0.24%	0	0
P	70752	967	10:04:32	02/27/2004	0	975	140343	02/27/2004	0	-8	-0.82%	0	0
P	70753	2	10:17:56	02/27/2004	0	2	140841	02/27/2004	0	0	0.00%	0	0
P	70754	2	10:18:00	02/27/2004	0	2	140859	02/27/2004	0	0	0.00%	0	0
P	70755	858	9:59:40	02/27/2004	0	858	134001	02/27/2004	0	0	0.00%	0	0
P	70756	1845	9:44:40	02/27/2004	0	1854	133102	02/27/2004	0	-9	-0.49%	0	0
P	70757	1590	9:46:24	02/27/2004	0	1597	134207	02/27/2004	0	-7	-0.44%	0	0
P	70758	710	10:04:44	02/27/2004	0	712	134103	02/27/2004	0	-2	-0.28%	0	0
P	70759	581	6:51:28	02/27/2004	0	584	112520	02/27/2004	0	-3	-0.51%	0	0
P	70760	2	7:04:52	02/27/2004	0	2	112846	02/27/2004	0	0	0.00%	0	0
P	70761	18	7:06:32	02/27/2004	0	19	112913	02/27/2004	0	-1	-5.26%	0	0
P	70762	32	6:44:56	02/27/2004	0	33	112456	02/27/2004	0	-1	-3.03%	0	0
P	70763		INVENTORY				INVENTORY						
P	70764		INVENTORY				INVENTORY						
P	70765		INVENTORY				INVENTORY						
P	70766		INVENTORY				INVENTORY						
P	70767	78	8:54:36	02/27/2004	0	79	111253	02/27/2004	0	-1	-1.27%	0	0
P	70768		INVENTORY				INVENTORY						
P	70769		INVENTORY				INVENTORY						
P	70770		INVENTORY				INVENTORY						
P	70771	977	14:58:28	02/27/2004	0	971	94215	02/27/2004	0	6	0.62%	0	0
P	70772	1083	15:05:12	02/27/2004	0	1082	94252	02/27/2004	0	1	0.09%	0	0
P	70773	514	14:51:52	02/27/2004	0	512	94132	02/27/2004	0	2	0.39%	0	0
P	70774	603	15:11:52	02/27/2004	0	602	94315	02/27/2004	0	1	0.17%	0	0
P	70775	29	20:11:52	02/27/2004	0	30	105425	02/27/2004	0	-1	-3.33%	0	0
P	70776	3760	20:38:36	02/27/2004	0	3733	131835	02/27/2004	0	27	0.72%	0	0
P	70777	533	20:26:56	02/27/2004	0	527	110329	02/27/2004	0	6	1.14%	0	0
P	70778	198	20:33:36	02/27/2004	0	196	110217	02/27/2004	0	2	1.02%	0	0
P	70779	685	20:52:00	02/27/2004	0	679	110019	02/27/2004	0	6	0.88%	0	0
P	70780	2437	20:45:20	02/27/2004	0	2421	110107	02/27/2004	0	16	0.66%	0	0
P	70781	1465	22:25:20	02/27/2004	0	1446	115332	02/27/2004	0	19	1.31%	0	0
P	70782	1645	20:53:44	02/27/2004	0	1622	105854	02/27/2004	0	23	1.42%	0	0
P	70783	1035	9:07:04	02/27/2004	0	1056	135600	02/27/2004	0	-21	-1.99%	0	0
P	70784	1006	9:00:24	02/27/2004	0	1019	135756	02/27/2004	0	-13	-1.28%	0	0
P	70785	2	8:38:44	02/27/2004	0	1	135158	02/27/2004	0	1	100.00%	0	0
P	70786	2046	8:49:04	02/27/2004	0	2060	135221	02/27/2004	0	-14	-0.68%	0	0

P	70787	INVENTORY				INVENTORY						
P	70788	INVENTORY				INVENTORY						
P	70789	INVENTORY				INVENTORY						
P	70790	INVENTORY				INVENTORY						
P	70791	INVENTORY				INVENTORY						
P	70792	INVENTORY				INVENTORY						
P	70793	INVENTORY				INVENTORY						
P	70794	INVENTORY				INVENTORY						
P	70795	1363	7:40:36	02/27/2004	0	1368	132811	02/27/2004	0	-5	-0.37%	0	0
P	70796	1324	7:47:16	02/27/2004	0	1239	132717	02/27/2004	0	85	6.86%	0	0
P	70797	1331	7:52:16	02/27/2004	0	1341	132426	02/27/2004	0	-10	-0.75%	0	0
P	70798	2	7:52:20	02/27/2004	0	1	132407	02/27/2004	0	1	100.00%	0	0
P	70799	1457	17:20:40	02/27/2004	0	1454	95859	02/27/2004	0	3	0.21%	0	0
P	70800	3	17:27:20	02/27/2004	0	3	95928	02/27/2004	0	0	0.00%	0	0
P	70801	1222	17:39:00	02/27/2004	0	1218	100519	02/27/2004	0	4	0.33%	0	0
P	70802	1752	17:32:24	02/27/2004	0	1742	100005	02/27/2004	0	10	0.57%	0	0
P	70803	INVENTORY				INVENTORY							
P	70804	INVENTORY				INVENTORY							
P	70805	INVENTORY				INVENTORY							
P	70806	INVENTORY				INVENTORY							

AVG: **9.681481** **1.68%**

Note:

1 27 meters in inventory.

2 Average variance attributed to time differences between AMR read and Radix read.

3 Meter P66625 has an estimated Manual Reading.

AMR Pilot Results: Manual vs. Automatic Reads - March

		Manual Read				Automatic Read							
Meter #		KWh	Time	Date	Peak	KWh	Time	Date	Peak	KWh Variance	%	Peak Variance	%
P	60433	11970	143930	03/29/2004	0	11226	41344	03/23/2004	7	744	6.63%	7	100
P	66625	20311	105149	03/29/2004	0	20191	9:07:04	03/28/2004	18.5	120	0.59%	18.5	100
P	70647	1318	94457	03/29/2004	0	1295	13:01:08	03/28/2004	0	23	1.78%	0	0
P	70648	1927	94607	03/29/2004	0	1904	13:14:28	03/28/2004	0	23	1.21%	0	0
P	70649	1287	95447	03/29/2004	0	1253	13:52:48	03/28/2004	0	34	2.71%	0	0
P	70650	2859	94337	03/29/2004	0	2832	12:59:32	03/28/2004	0	27	0.95%	0	0
P	70651	5	93902	03/29/2004	0	5	10:26:12	03/28/2004	0	0	0.00%	0	0
P	70652	307	94219	03/29/2004	0	304	13:01:12	03/28/2004	0	3	0.99%	0	0
P	70653	10	94036	03/29/2004	0	11	12:59:32	03/28/2004	0	-1	-9.09%	0	0
P	70654	687	93822	03/29/2004	0	679	10:21:16	03/28/2004	0	8	1.18%	0	0
P	70655	416	112115	03/29/2004	0	414	20:34:36	03/28/2004	0	2	0.48%	0	0
P	70656	854	112157	03/29/2004	0	853	20:39:36	03/28/2004	0	1	0.12%	0	0
P	70657	1805	112337	03/29/2004	0	1791	20:48:00	03/28/2004	0	14	0.78%	0	0
P	70658	1477	112446	03/29/2004	0	1471	20:54:36	03/28/2004	0	6	0.41%	0	0
P	70659	2778	141411	03/29/2004	0	2759	21:39:40	03/28/2004	0	19	0.69%	0	0
P	70660	0	141558	03/29/2004	0	0	21:54:40	03/28/2004	0	0	0.00%	0	0
P	70661	3	142342	03/29/2004	0	3	22:01:20	03/28/2004	0	0	0.00%	0	0
P	70662	2323	141437	03/29/2004	0	2300	21:46:24	03/28/2004	0	23	1.00%	0	0
P	70663	196	110538	03/29/2004	0	194	21:33:04	03/28/2004	0	2	1.03%	0	0
P	70664	0	110558	03/29/2004	0	0	21:34:44	03/28/2004	0	0	0.00%	0	0
P	70665	103	110757	03/29/2004	0	102	21:53:04	03/28/2004	0	1	0.98%	0	0
P	70666	2433	110857	03/29/2004	0	2428	21:46:28	03/28/2004	0	5	0.21%	0	0
P	70667	190	102755	03/29/2004	0	189	16:14:48	03/28/2004	0	1	0.53%	0	0
P	70668	154	102939	03/29/2004	0	154	16:26:28	03/28/2004	0	0	0.00%	0	0
P	70669	1476	104026	03/29/2004	0	1466	16:34:48	03/28/2004	0	10	0.68%	0	0
P	70670	2	102613	03/29/2004	0	2	16:06:28	03/28/2004	0	0	0.00%	0	0
P	70671	2358	140456	03/29/2004	0	2332	22:33:12	03/28/2004	0	26	1.11%	0	0
P	70672	2861	140236	03/29/2004	0	2840	22:21:32	03/28/2004	0	21	0.74%	0	0
P	70673		INVENTORY				INVENTORY						
P	70674	2584	140419	03/29/2004	0	2567	22:26:36	03/28/2004	0	17	0.66%	0	0
P	70675	1126	135345	03/29/2004	0	1118	21:34:56	03/28/2004	0	8	0.72%	0	0

P	70676	797	134954	03/29/2004	0	797	21:21:36	03/28/2004	0	0	0.00%	0	0
P	70677	1182	135122	03/29/2004	0	1169	21:28:16	03/28/2004	0	13	1.11%	0	0
P	70678	409	135315	03/29/2004	0	406	21:33:16	03/28/2004	0	3	0.74%	0	0
P	70679	2314	100912	03/29/2004	0	2295	14:06:40	03/28/2004	0	19	0.83%	0	0
P	70680	1865	101154	03/29/2004	0	1849	14:20:00	03/28/2004	0	16	0.87%	0	0
P	70681	0	101047	03/29/2004	0	0	14:15:00	03/28/2004	0	0	0.00%	0	0
P	70682	1851	101020	03/29/2004	0	1833	14:08:20	03/28/2004	0	18	0.98%	0	0
P	70683	1077	103229	03/29/2004	0	1070	15:00:04	03/28/2004	0	7	0.65%	0	0
P	70684	5	104715	03/29/2004	0	5	17:46:44	03/28/2004	0	0	0.00%	0	0
P	70685	7	103356	03/29/2004	0	8	17:13:24	03/28/2004	0	-1	-12.50%	0	0
P	70686	1434	103108	03/29/2004	0	1419	15:08:24	03/28/2004	0	15	1.06%	0	0
P	70687	1236	104005	03/29/2004	0	1221	15:46:48	03/28/2004	0	15	1.23%	0	0
P	70688	2800	103545	03/29/2004	0	2774	17:06:48	03/28/2004	0	26	0.94%	0	0
P	70689	1791	103800	03/29/2004	0	1779	16:40:08	03/28/2004	0	12	0.67%	0	0
P	70690	0	103925	03/29/2004	0	0	16:48:28	03/28/2004	0	0	0.00%	0	0
P	70691	5	102523	03/29/2004	0	5	15:53:28	03/28/2004	0	0	0.00%	0	0
P	70692	2274	102150	03/29/2004	0	2257	15:06:52	03/28/2004	0	17	0.75%	0	0
P	70693	348	102221	03/29/2004	0	343	15:08:32	03/28/2004	0	5	1.46%	0	0
P	70694	3232	102315	03/29/2004	0	3207	15:21:52	03/28/2004	0	25	0.78%	0	0
P	70695	2028	140833	03/29/2004	0	2013	0:06:52	03/29/2004	0	15	0.75%	0	0
P	70696	2268	143108	03/29/2004	0	2246	0:21:56	03/29/2004	0	22	0.98%	0	0
P	70697		INVENTORY				INVENTORY						
P	70698		INVENTORY				INVENTORY						
P	70699	1137	113857	03/29/2004	0	1128	18:06:56	03/28/2004	0	9	0.80%	0	0
P	70700	2335	114051	03/29/2004	0	2307	18:00:20	03/28/2004	0	28	1.21%	0	0
P	70701	517	115733	03/29/2004	0	513	18:13:40	03/28/2004	0	4	0.78%	0	0
P	70702	2324	113817	03/29/2004	0	2307	18:13:40	03/28/2004	0	17	0.74%	0	0
P	70703	1658	113635	03/29/2004	0	1646	18:22:00	03/28/2004	0	12	0.73%	0	0
P	70704	3410	113714	03/29/2004	0	3383	18:27:00	03/28/2004	0	27	0.80%	0	0
P	70705	2462	112831	03/29/2004	0	2444	18:40:24	03/28/2004	0	18	0.74%	0	0
P	70706		INVENTORY				INVENTORY						
P	70707	1210	140748	03/29/2004	0	1196	22:42:04	03/28/2004	0	14	1.17%	0	0
P	70708	2244	140034	03/29/2004	0	2225	22:48:44	03/28/2004	0	19	0.85%	0	0
P	70709	1642	135923	03/29/2004	0	1633	23:00:28	03/28/2004	0	9	0.55%	0	0
P	70710	2963	140118	03/29/2004	0	2945	22:47:08	03/28/2004	0	18	0.61%	0	0
P	70711	2103	110506	03/29/2004	0	2090	21:28:48	03/28/2004	0	13	0.62%	0	0
P	70712	2297	110410	03/29/2004	0	2287	21:22:08	03/28/2004	0	10	0.44%	0	0

P	70713	2520	110244	03/29/2004	0	2501	19:22:08	03/28/2004	0	19	0.76%	0	0
P	70714	6	133924	03/29/2004	0	6	21:05:00	03/28/2004	0	0	0.00%	0	0
P	70715	774	101447	03/29/2004	0	764	14:33:52	03/28/2004	0	10	1.31%	0	0
P	70716	4	101319	03/29/2004	0	3	14:28:52	03/28/2004	0	1	33.33%	0	0
P	70717	3017	101411	03/29/2004	0	3014	14:22:12	03/28/2004	0	3	0.10%	0	0
P	70718	2612	101651	03/29/2004	0	2589	14:42:16	03/28/2004	0	23	0.89%	0	0
P	70719	0	100430	03/29/2004	0	0	12:42:16	03/28/2004	0	0	0.00%	0	0
P	70720	1008	100651	03/29/2004	0	995	12:53:56	03/28/2004	0	13	1.31%	0	0
P	70721	1899	100835	03/29/2004	0	1878	14:00:36	03/28/2004	0	21	1.12%	0	0
P	70722	2405	100753	03/29/2004	0	2377	12:53:56	03/28/2004	0	28	1.18%	0	0
P	70723	95	141922	03/29/2004	0	95	22:49:00	03/28/2004	0	0	0.00%	0	0
P	70724	1394	142530	03/29/2004	0	1384	22:29:00	03/28/2004	0	10	0.72%	0	0
P	70725	1839	142457	03/29/2004	0	1819	22:34:12	03/28/2004	0	20	1.10%	0	0
P	70726	2125	141745	03/29/2004	0	2112	22:40:56	03/28/2004	0	13	0.62%	0	0
P	70727		INVENTORY				INVENTORY						
P	70728		INVENTORY				INVENTORY						
P	70729		INVENTORY				INVENTORY						
P	70730		INVENTORY				INVENTORY						
P	70731	2544	113313	03/29/2004	0	2530	18:55:44	03/28/2004	0	14	0.55%	0	0
P	70732	2114	111518	03/29/2004	0	2107	20:02:24	03/28/2004	0	7	0.33%	0	0
P	70733	3242	120106	03/29/2004	0	3226	18:55:56	03/28/2004	0	16	0.50%	0	0
P	70734	2026	112909	03/29/2004	0	2010	18:40:44	03/28/2004	0	16	0.80%	0	0
P	70735	2764	95624	03/29/2004	0	2727	14:40:48	03/28/2004	0	37	1.36%	0	0
P	70736	1225	95710	03/29/2004	0	1215	13:00:44	03/28/2004	0	10	0.82%	0	0
P	70737	2661	95501	03/29/2004	0	2634	13:34:08	03/28/2004	0	27	1.03%	0	0
P	70738	2	100058	03/29/2004	0	2	12:14:08	03/28/2004	0	0	0.00%	0	0
P	70739	2	114140	03/29/2004	0	2	17:40:48	03/28/2004	0	0	0.00%	0	0
P	70740	425	114208	03/29/2004	0	423	17:35:48	03/28/2004	0	2	0.47%	0	0
P	70741	4444	115439	03/29/2004	0	4428	3:07:32	03/29/2004	0	16	0.36%	0	0
P	70742	1848	114021	03/29/2004	0	1834	17:54:08	03/28/2004	0	14	0.76%	0	0
P	70743	2368	143040	03/29/2004	0	2353	22:59:08	03/28/2004	0	15	0.64%	0	0
P	70744	1884	143138	03/29/2004	0	1868	23:07:32	03/28/2004	0	16	0.86%	0	0
P	70745	0	143257	03/29/2004	0	0	23:14:08	03/28/2004	0	0	0.00%	0	0
P	70746	2	143200	03/29/2004	0	2	23:07:32	03/28/2004	0	0	0.00%	0	0
P	70747	2920	101903	03/29/2004	0	2901	14:46:04	03/28/2004	0	19	0.65%	0	0
P	70748	2	102019	03/29/2004	0	2	14:51:00	03/28/2004	0	0	0.00%	0	0
P	70749	1811	102055	03/29/2004	0	1799	14:59:24	03/28/2004	0	12	0.67%	0	0

P	70750	2355	102126 03/29/2004	0	2330	15:04:28	03/28/2004	0	25	1.07%	0	0
P	70751	2838	143400 03/29/2004	0	2835	0:39:32	03/29/2004	0	3	0.11%	0	0
P	70752	1642	143421 03/29/2004	0	1642	23:26:12	03/28/2004	0	0	0.00%	0	0
P	70753	2	144139 03/29/2004	0	2	23:37:56	03/28/2004	0	0	0.00%	0	0
P	70754	2	144221 03/29/2004	0	2	23:38:00	03/28/2004	0	0	0.00%	0	0
P	70755	1128	140910 03/29/2004	0	1122	23:19:40	03/28/2004	0	6	0.53%	0	0
P	70756	3069	135829 03/29/2004	0	3050	23:04:40	03/28/2004	0	19	0.62%	0	0
P	70757	2697	141118 03/29/2004	0	2673	23:06:24	03/28/2004	0	24	0.90%	0	0
P	70758	1187	141012 03/29/2004	0	1180	23:24:44	03/28/2004	0	7	0.59%	0	0
P	70759	970	111619 03/29/2004	0	963	20:13:08	03/28/2004	0	7	0.73%	0	0
P	70760	2	112004 03/29/2004	0	2	11:31:32	03/28/2004	0	0	0.00%	0	0
P	70761	31	112034 03/29/2004	0	31	20:26:32	03/28/2004	0	0	0.00%	0	0
P	70762	56	111545 03/29/2004	0	55	20:06:36	03/28/2004	0	1	1.82%	0	0
P	70763		INVENTORY			INVENTORY						
P	70764		INVENTORY			INVENTORY						
P	70765		INVENTORY			INVENTORY						
P	70766		INVENTORY			INVENTORY						
P	70767	214	110707 03/29/2004	0	203	22:16:16	03/28/2004	0	11	5.42%	0	0
P	70768		INVENTORY			INVENTORY						
P	70769	381	92912 03/29/2004	0	0			0	381	100.00%	0	0
P	70770		INVENTORY			INVENTORY						
P	70771	1534	93557 03/29/2004	0	1521	9:58:28	03/28/2004	0	13	0.85%	0	0
P	70772	1802	93647 03/29/2004	0	1732	21:26:52	03/26/2004	0	70	4.04%	0	0
P	70773	853	93455 03/29/2004	0	851	3:51:46	03/29/2004	0	2	0.24%	0	0
P	70774	1405	93713 03/29/2004	0	1372	10:13:32	03/28/2004	0	33	2.41%	0	0
P	70775	49	104910 03/29/2004	0	49	15:13:32	03/28/2004	0	0	0.00%	0	0
P	70776	6278	134159 03/29/2004	0	6203	15:40:16	03/28/2004	0	75	1.21%	0	0
P	70777	867	105722 03/29/2004	0	858	15:25:16	03/28/2004	0	9	1.05%	0	0
P	70778	366	105559 03/29/2004	0	352	15:31:56	03/28/2004	0	14	3.98%	0	0
P	70779	1181	105349 03/29/2004	0	1169	15:52:00	03/28/2004	0	12	1.03%	0	0
P	70780	3876	105450 03/29/2004	0	3804	15:47:00	03/28/2004	0	72	1.89%	0	0
P	70781	2425	114339 03/29/2004	0	2409	17:27:00	03/28/2004	0	16	0.66%	0	0
P	70782	2583	105246 03/29/2004	0	2559	15:53:44	03/28/2004	0	24	0.94%	0	0
P	70783	1764	142607 03/29/2004	0	1744	22:27:04	03/28/2004	0	20	1.15%	0	0
P	70784	1691	142956 03/29/2004	0	1682	22:20:24	03/28/2004	0	9	0.54%	0	0
P	70785	1	142243 03/29/2004	0	2	21:58:44	03/28/2004	0	-1	-50.00%	0	0
P	70786	3335	142306 03/29/2004	0	3311	22:07:24	03/28/2004	0	24	0.72%	0	0

P	70787		INVENTORY			INVENTORY					
P	70788		INVENTORY			INVENTORY					
P	70789		INVENTORY			INVENTORY					
P	70790		INVENTORY			INVENTORY					
P	70791		INVENTORY			INVENTORY					
P	70792		INVENTORY			INVENTORY					
P	70793		INVENTORY			INVENTORY					
P	70794		INVENTORY			INVENTORY					
P	70795	2250	135539 03/29/2004	0	2240 21:05:36 03/28/2004	0	10	0.45%	0	0
P	70796	2187	135452 03/29/2004	0	2167 21:05:36 03/28/2004	0	20	0.92%	0	0
P	70797	2356	134919 03/29/2004	0	2324 21:13:56 03/28/2004	0	32	1.38%	0	0
P	70798	1	134704 03/29/2004	0	2 21:12:20 03/28/2004	0	-1	-50.00%	0	0
P	70799	2280	100117 03/29/2004	0	2200 23:39:00 03/26/2004	0	80	3.64%	0	0
P	70800	3	100149 03/29/2004	0	3 12:27:20 03/28/2004	0	0	0.00%	0	0
P	70801	2356	100524 03/29/2004	0	2329 12:40:40 03/28/2004	0	27	1.16%	0	0
P	70802	2755	100230 03/29/2004	0	2728 12:32:24 03/28/2004	0	27	0.99%	0	0
P	70803		INVENTORY			INVENTORY				
P	70804		INVENTORY			INVENTORY				
P	70805		INVENTORY			INVENTORY				
P	70806		INVENTORY			INVENTORY				
						AVG:	**22.16912**	**0.89%**		

Note:

1 26 meters in inventory.
2 Average variance attributed to time differences between AMR read and Radix read (See note 4).
3 Meter P66625 not logging. Automatic read unavailable.
4 A power outage occurred on 2004-03-29 for system 111, line 1. Reason for the outage is unknown.
Outage occurred at 2217 hrs until 2225 hrs. Refer to WO # 395530.
As a result, the AMR packett was interrupted on that day, and the system pulled the readings
for the previous day.
5 Meter P70769 in Inventory in Turtle but attached to customer in JDE.
2004-04-05 - Meter was taken out of inventory in Turtle as set to read.
6 Meter P70799 - System detected Incorrect Data on 27th & 28th. Good read detected on the 26th.
7 Meter P70772 - System detected Unreliable Data on 27th & 28th. Good read detected on the 26th.

Appendix F

Actual Bill from AMR Development

NEWFOUNDLAND AND LABRADOR HYDRO

Head Office: 500 Columbus Drive, St. John's, Newfoundland & Labrador, P.O. Box 12400, A1B 4K7, Telephone toll-free 1-888-737-1296

ACCOUNT NUMBER [redacted]

HST # R121394928

NAME [redacted]

SERVICE ADDRESS

BILLING MONTH APR 2004

DISCOUNT DATE MAY 15 2004

METER NUMBER	PREVIOUS DATE	PRESENT DATE	DAYS USE	PREVIOUS READING	PRESENT READING	MULTIPLIER	KWH-USED
[redacted]	MAR 28	APR 30	33	2634	3813	1	1179

D1.20 DOMESTIC DIESEL

PREVIOUS BALANCE	- PAYMENTS TO	± ADJUSTMENTS	+ FORFEITED DISCOUNTS	± INTEREST	= BALANCE FORWARD
$383.16	APR 30 2004		3.08	3.03	$389.27

	DETAIL	SUMMARY
BASIC CUSTOMER CHARGE	15.77	
******700 KWH @ 7.185 CENTS	50.29	
******300 KWH @ 9.849 CENTS	29.54	
******179 KWH @ 13.352 CENTS	23.90	
DISCOUNT 1.5%	1.79CR	
HARMONIZED SALES TAX (15%) THIS MONTH	17.66	
ELECTRIC SERVICE CHARGES THIS MONTH		135.37
PLEASE, PAY THIS AMOUNT ---------->		$524.64

PLEASE DO NOT STAPLE

HYDRO THE POWER OF COMMITMENT

PLEASE DETACH AND RETURN THIS PORTION WITH PAYMENT

ALL BILLS ARE DUE AND PAYABLE WHEN RENDERED

[redacted]

(Y)

ACCOUNT NUMBER [redacted]

BALANCE DUE $524.64

BILLING MONTH APRIL 2004

CURRENT CHARGES $135.37

PAST DUE $389.27

DISCOUNT AMOUNT $1.79CR

DISCOUNT DATE MAY 15 2004

ENTER AMOUNT PAID HERE IF DIFFERENT THAN BALANCE DUE

TO AVOID INTEREST, PAY BY MAY 27 2004

00024311040515000052464000052643 8

For fast efficient access to your account information, call our toll-free number: 1-888-737-1296 or logon to our website at www.nlh.nf.ca

Billing Information

For billing information 24 hours per day 7 days per week logon to Hydro's website at www.nlh.nf.ca or call our toll free number for automated or agent assisted service.

Payment Options. For your convenience Newfoundland & Labrador Hydro offers the following payment options:

Pre-authorized Payment Plan – have your payment automatically withdrawn from your chequing or savings account each month;
Internet - pay through your personal bank's internet bill payment option;
Financial Institution – pay in person at most financial instituitions; and
By Mail – pay by mail using the return envelope enclosed with your bill.

(Never send cash payments through the mail!)

Equal Payment Plan. Our Equal Payment Plan allows you to spread your electric service charges over a 12-month period so you pay the same amount each month. For more information please call our Customer Service toll-free number.

Interest Charges. Account balances over $50.00, which are outstanding by the next month's billing date, are subject to interest charges. The rate of interest is the prime rate charged by chartered banks on the last working day of the previous month plus five per cent.

Moving? Please call us as soon as you know when you want your final meter reading taken. We require 48 hours notice for a final reading and 10 days written notice if service is to be disconnected.

Residential meter reading. For your own information or if you wish to check your meter reading, draw the exact position of your meter hands on the dials to the right. Record the reading in the space directly under the dials. When the pointer is between two numbers, it is recorded as the smaller number. To determine your kilowatt hour (Kwh) usage subtract the "present reading" on your last bill from the new reading.

HYDROWISE
You Have the Power. Use it Wisely.

Every time you turn on a switch or start an appliance in your home you are using electric energy.

Each type of electrical device uses a different amount of electricity. By using electricity wisely in your home you can reduce energy consumption and lower your electric bill.

Electricity is used in the home for many different purposes... lighting, heating water, washing clothes, and running the refrigerator. In most homes there are many electrical devices... from televisions to stoves to lamps. Here's how a typical family of four in a home without electric heat uses electricity during a winter month:

ITEM	Typical Kilowatt Hours
Lighting and minor appliances	140
Water Heating	500
Electric Range	100
Refrigerator (frost free)	105
Deep Freeze	50
Clothes Washer	5
Clothes Dryer(20 hours/month)	96
Television (colour)	35
Furnace	125
Monthly Total	**1156**

Using electricity wisely will save you money and help protect our environment.

Actual meter reading.
(Draw exact position and write number below.)

Is your meter accessible?

Please do not staple

For billing and account, inquiries and general information, please call our toll-free number

1-888-737-1296

NEWFOUNDLAND AND LABRADOR HYDRO
P.O. BOX 12600
ST. JOHN'S, NL
A1B 4K8

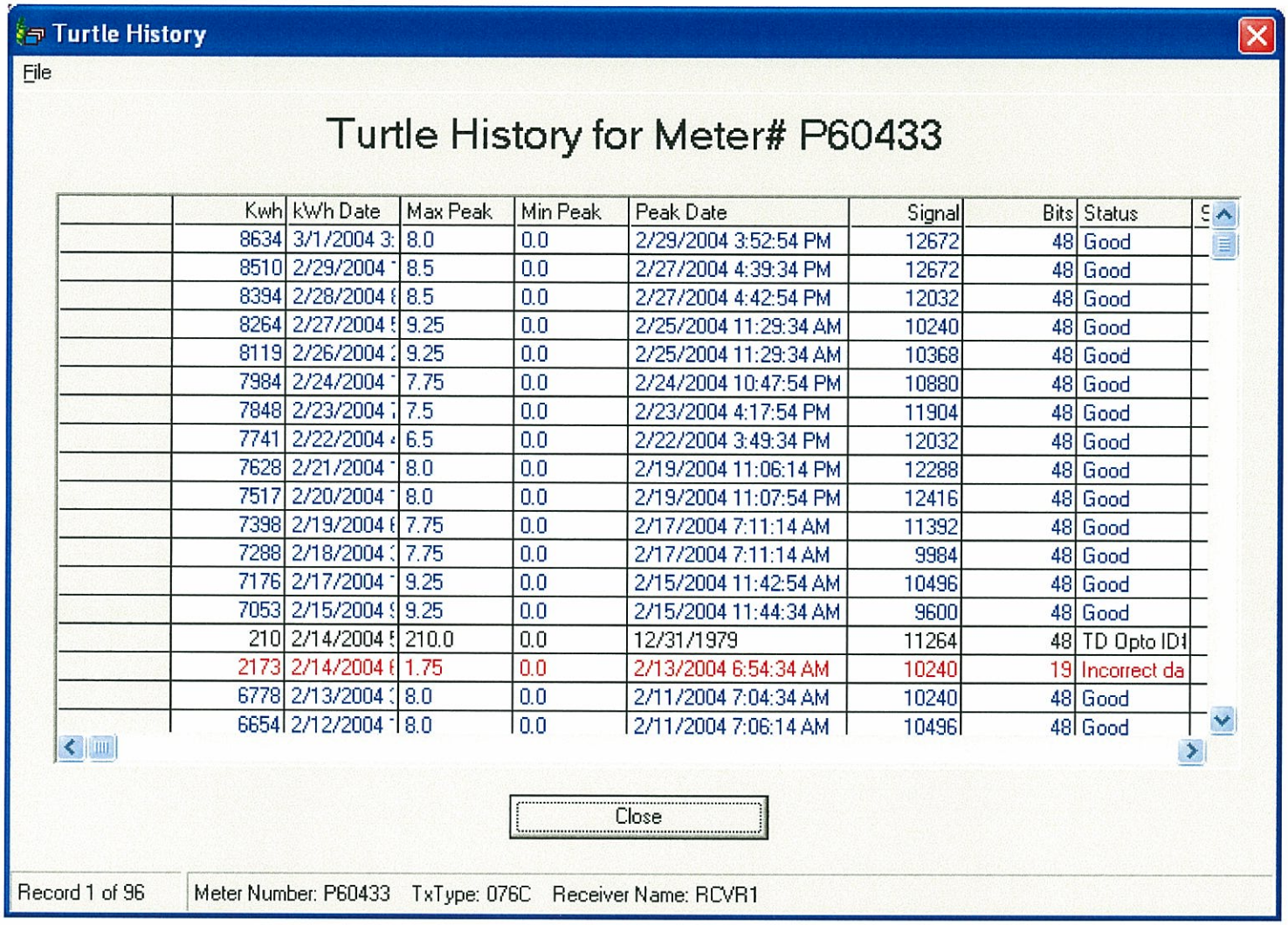
Please insert with address showing in envelope window.

Appendix G

Sample Screens & Reports from
Turtle AMR Management System

Turtle History Report

This screen is available from the Turtle Management System and shows the complete history for a meter

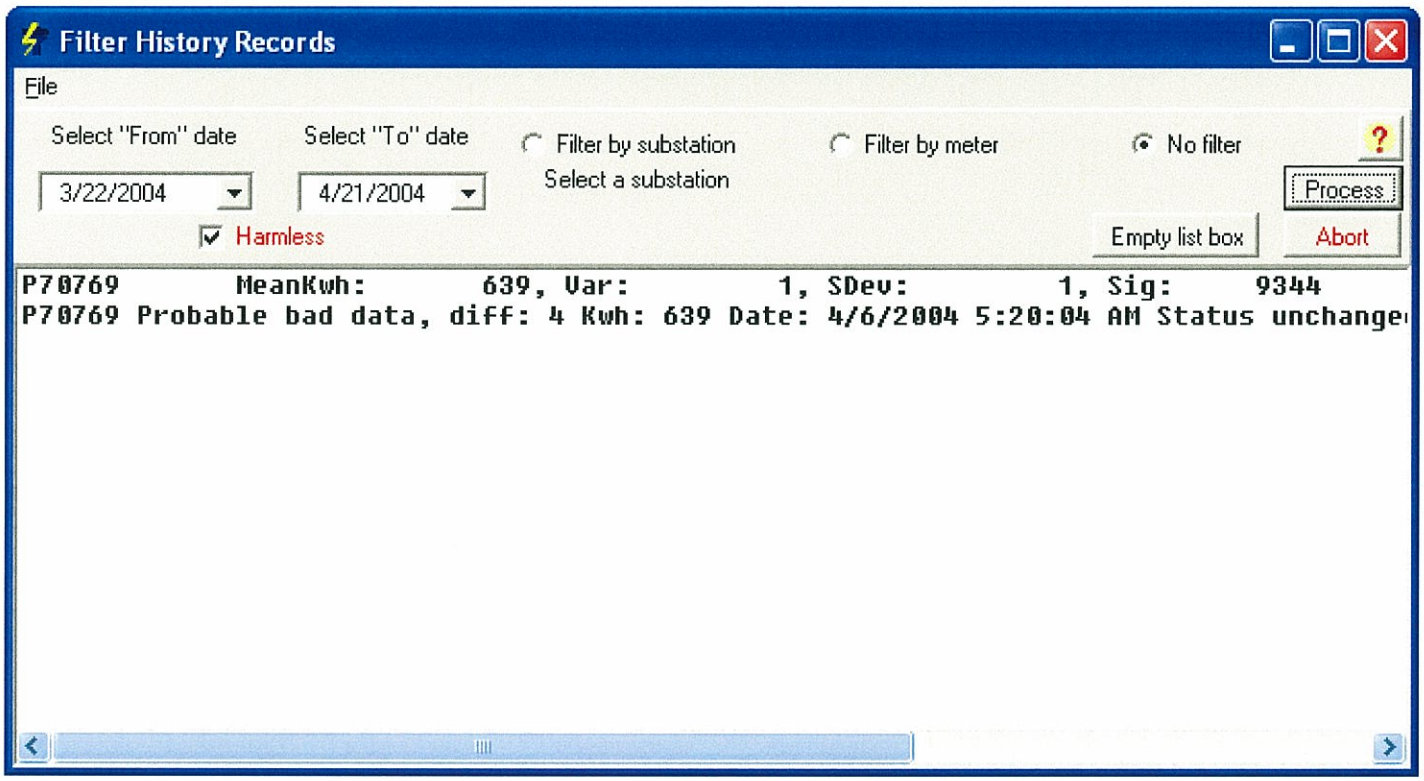


	Kwh	kWh Date	Max Peak	Min Peak	Peak Date	Signal	Bits	Status
	8634	3/1/2004 3:	8.0	0.0	2/29/2004 3:52:54 PM	12672	48	Good
	8510	2/29/2004	8.5	0.0	2/27/2004 4:39:34 PM	12672	48	Good
	8394	2/28/2004	8.5	0.0	2/27/2004 4:42:54 PM	12032	48	Good
	8264	2/27/2004	9.25	0.0	2/25/2004 11:29:34 AM	10240	48	Good
	8119	2/26/2004	9.25	0.0	2/25/2004 11:29:34 AM	10368	48	Good
	7984	2/24/2004	7.75	0.0	2/24/2004 10:47:54 PM	10880	48	Good
	7848	2/23/2004	7.5	0.0	2/23/2004 4:17:54 PM	11904	48	Good
	7741	2/22/2004	6.5	0.0	2/22/2004 3:49:34 PM	12032	48	Good
	7628	2/21/2004	8.0	0.0	2/19/2004 11:06:14 PM	12288	48	Good
	7517	2/20/2004	8.0	0.0	2/19/2004 11:07:54 PM	12416	48	Good
	7398	2/19/2004	7.75	0.0	2/17/2004 7:11:14 AM	11392	48	Good
	7288	2/18/2004	7.75	0.0	2/17/2004 7:11:14 AM	9984	48	Good
	7176	2/17/2004	9.25	0.0	2/15/2004 11:42:54 AM	10496	48	Good
	7053	2/15/2004	9.25	0.0	2/15/2004 11:44:34 AM	9600	48	Good
	210	2/14/2004	210.0	0.0	12/31/1979	11264	48	TD Opto ID
	2173	2/14/2004	1.75	0.0	2/13/2004 6:54:34 AM	10240	19	Incorrect da
	6778	2/13/2004	8.0	0.0	2/11/2004 7:04:34 AM	10240	48	Good
	6654	2/12/2004	8.0	0.0	2/11/2004 7:06:14 AM	10496	48	Good

Blue - Good Reading
Red - Interruption
Black - End of Interruption

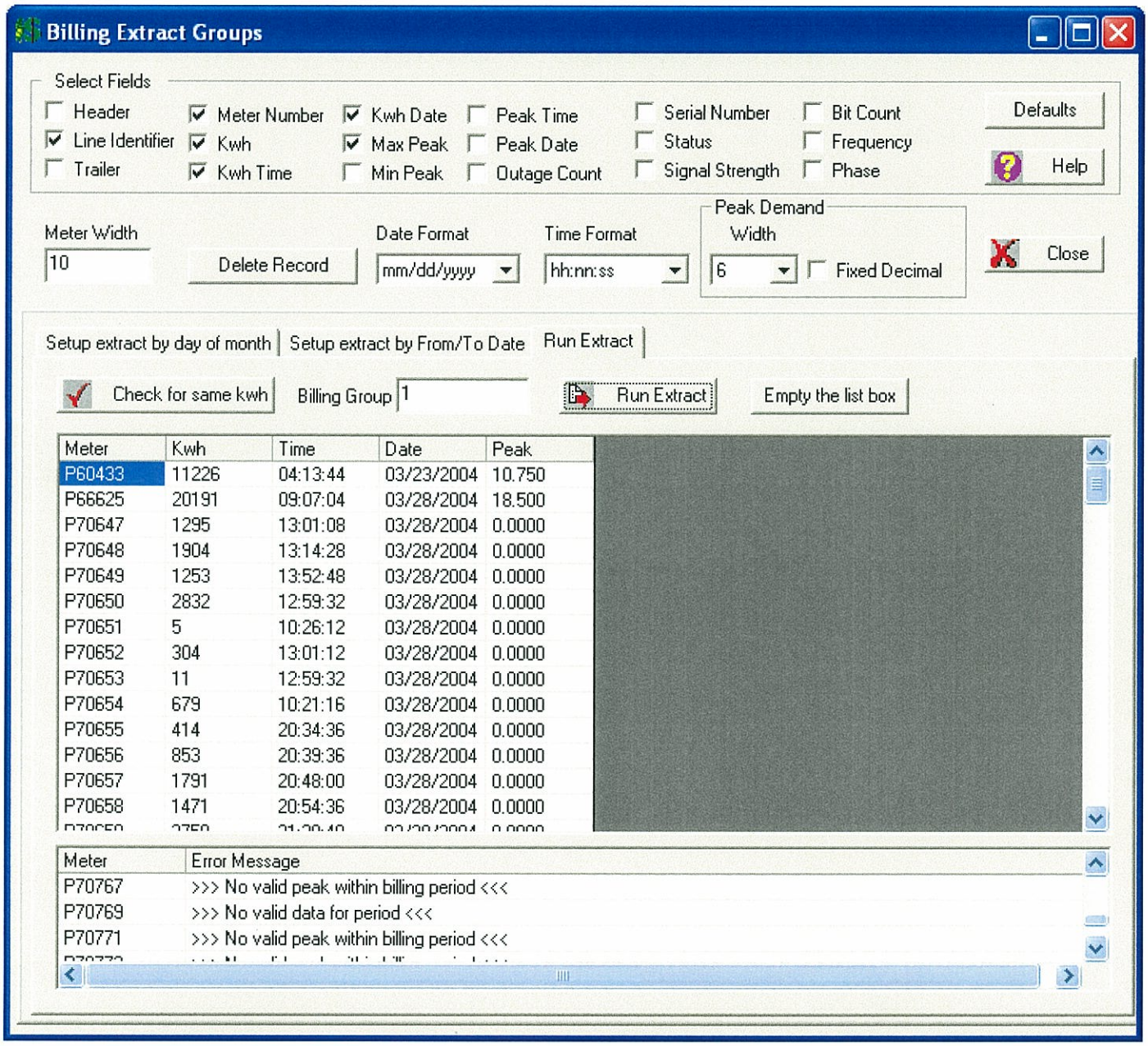
Filter History Report

This screen is available from the Turtle Management System and lists probable bad data. This report should be run following a download and prior to a billing.



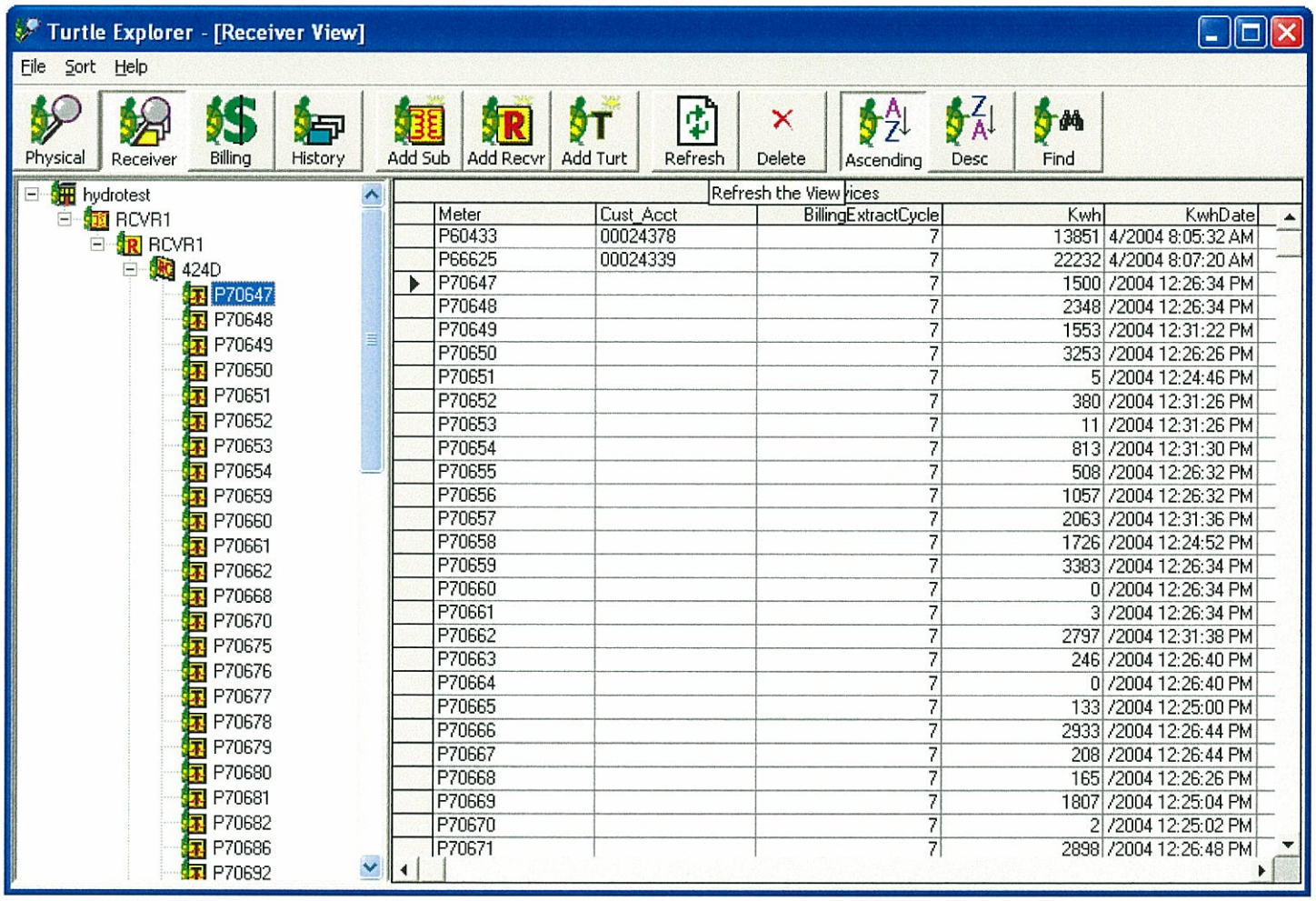
Billing Extract Results

This screen is available from the Turtle Management System. It shows the data extracted for billing and any errors that occurred during the extract.



Turtle Explorer

This screen is available from the Turtle Management System. It shows each receiver installed and details on the meters reporting to that receiver.



Excerpts of Reports shown on the next pages can be produced from the Turtleware Management System

Summary Report:

The Summary Report analyzes the Turtle Database and provides the following:

Summary of the database
Receiver download status
Turtle transmitters not logging
Turtle transmitters with disrupted packets

It displays both the previous and current report information, with any difference displayed. The Summary report will also show if the receiver downloaded. This report is auto-scheduled to run on a nightly basis.

Usage Report:

The Usage Report is used to analyze the Turtle transmitter logs and calculate the usage for a particular meter (or customer account). This report may be used to assist customers who call and would like to know when and how much power they used at a particular time.

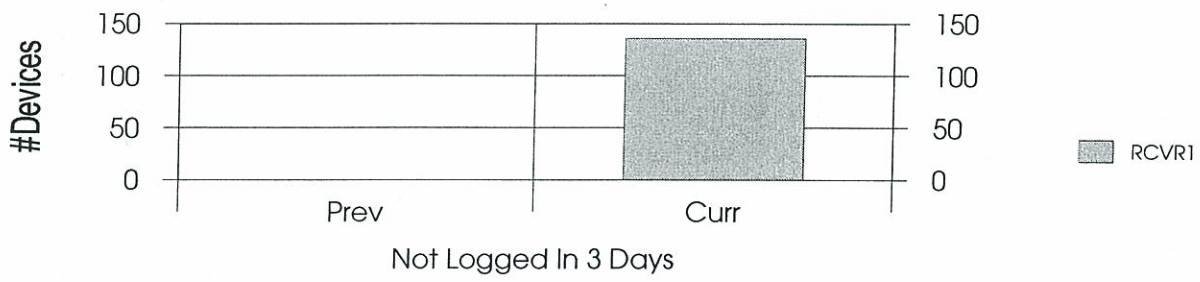
Power Outage Report:

The Power Outage Report is used to display the number of power outages that have been recorded by the Turtle transmitters. The report also displays the approximate time and duration of the power outage.

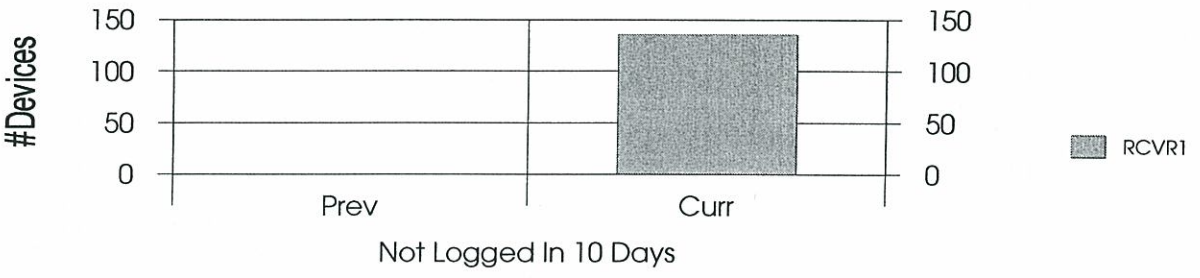
Turtle® Energy Management System/AMR

Summary Report

Report Date: 04/28/2004



Not Logged In 3 Days



Not Logged In 10 Days

ReceiverID	Down - load Good?	Down - load Dur. (Min)	ST3	ST4	ST5	ST6	ST7	Total	>3 Days	>10 Days	Disrupted
RCVR1	NO	0	0	0	0	136	26	162	136, +136	136, +136	0

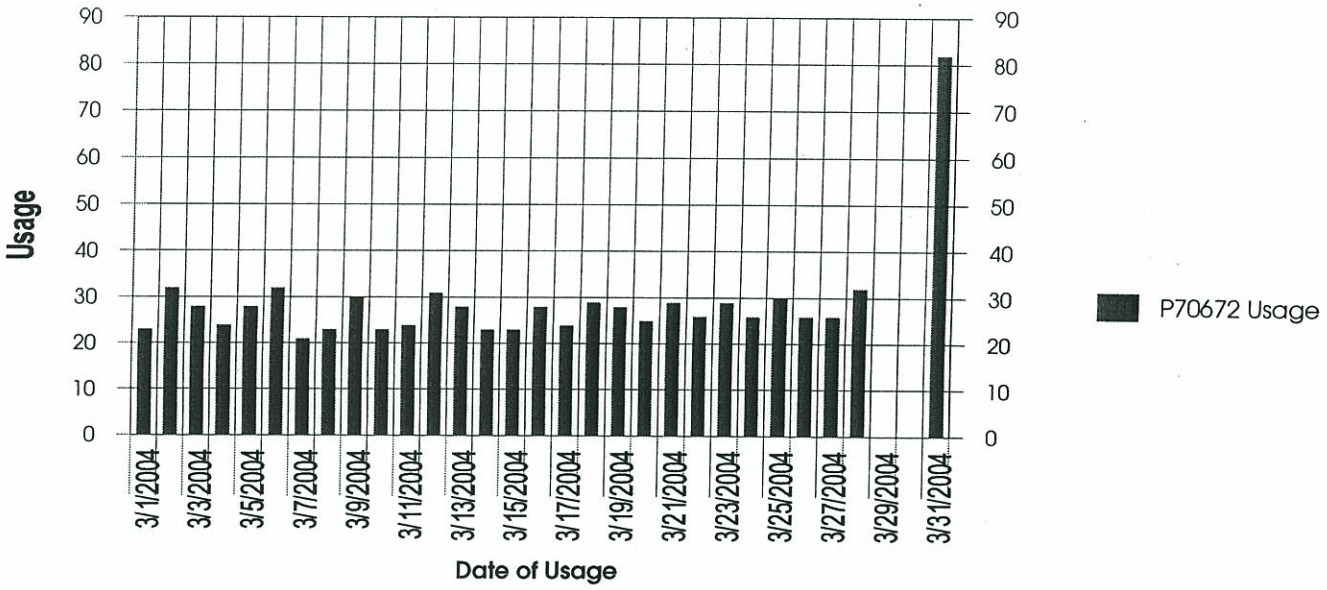
Summary Report

Report Date	Devices Not Logging in 3 Days - Supporting Data				
4/28/2004 3:13:45 PM	Supporting Data Follows.				
Receiver	Phase	Cust Acct	Meter	kWh Date	Log Date
RCVR1	A		P70647	4/15/2004 12:26:34 PM	4/15/2004 12:26:34 PM
RCVR1	A		P70648	4/15/2004 12:26:34 PM	4/15/2004 12:26:34 PM
RCVR1	A		P70649	4/15/2004 12:31:22 PM	4/15/2004 12:31:22 PM
RCVR1	A		P70650	4/15/2004 12:26:26 PM	4/15/2004 12:26:26 PM
RCVR1	A		P70651	4/15/2004 12:24:46 PM	4/15/2004 12:24:46 PM
RCVR1	A		P70652	4/15/2004 12:31:26 PM	4/15/2004 12:31:26 PM
RCVR1	A		P70653	4/15/2004 12:31:26 PM	4/15/2004 12:31:26 PM
RCVR1	A		P70654	4/15/2004 12:31:30 PM	4/15/2004 12:31:30 PM
RCVR1	A		P70659	4/15/2004 12:26:34 PM	4/15/2004 12:26:34 PM
RCVR1	A		P70660	4/15/2004 12:26:34 PM	4/15/2004 12:26:34 PM
RCVR1	A		P70661	4/15/2004 12:26:34 PM	4/15/2004 12:26:34 PM
RCVR1	A		P70662	4/15/2004 12:31:38 PM	4/15/2004 12:31:38 PM
RCVR1	A		P70668	4/15/2004 12:26:26 PM	4/15/2004 12:26:26 PM
RCVR1	A		P70670	4/15/2004 12:25:02 PM	4/15/2004 12:25:02 PM
RCVR1	A		P70675	4/15/2004 12:26:50 PM	4/15/2004 12:26:50 PM
RCVR1	A		P70676	4/15/2004 12:25:10 PM	4/15/2004 12:25:10 PM
RCVR1	A		P70677	4/15/2004 12:31:50 PM	4/15/2004 12:31:50 PM
RCVR1	A		P70678	4/15/2004 12:31:50 PM	4/15/2004 12:31:50 PM
RCVR1	A		P70679	4/15/2004 12:31:26 PM	4/15/2004 12:31:26 PM
RCVR1	A		P70680	4/15/2004 12:26:54 PM	4/15/2004 12:26:54 PM
RCVR1	A		P70681	4/15/2004 12:26:54 PM	4/15/2004 12:26:54 PM
RCVR1	A		P70682	4/15/2004 12:26:54 PM	4/15/2004 12:26:54 PM
RCVR1	A		P70686	4/15/2004 12:25:18 PM	4/15/2004 12:25:18 PM
RCVR1	A		P70692	4/15/2004 12:27:06 PM	4/15/2004 12:27:06 PM
RCVR1	A		P70693	4/15/2004 12:27:06 PM	4/15/2004 12:27:06 PM
RCVR1	A		P70694	4/15/2004 12:27:10 PM	4/15/2004 12:27:10 PM
RCVR1	A		P70697	4/14/2004 8:06:58 AM	4/14/2004 8:06:58 AM
RCVR1	A		P70715	4/15/2004 12:27:30 PM	4/15/2004 12:27:30 PM
RCVR1	A		P70716	4/15/2004 12:27:30 PM	4/15/2004 12:27:30 PM
RCVR1	A		P70718	4/15/2004 12:27:34 PM	4/15/2004 12:27:34 PM
RCVR1	A		P70719	4/15/2004 12:27:34 PM	4/15/2004 12:27:34 PM
RCVR1	A		P70720	4/15/2004 12:25:54 PM	4/15/2004 12:25:54 PM
RCVR1	A		P70721	4/15/2004 12:25:54 PM	4/15/2004 12:25:54 PM
RCVR1	A		P70722	4/15/2004 12:32:34 PM	4/15/2004 12:32:34 PM
RCVR1	A		P70727	4/14/2004 8:08:30 AM	4/14/2004 8:08:30 AM
RCVR1	A		P70728	4/14/2004 8:08:38 AM	4/14/2004 8:08:38 AM
RCVR1	A		P70729	4/14/2004 8:08:34 AM	4/14/2004 8:08:34 AM
RCVR1	A		P70736	4/15/2004 12:31:30 PM	4/15/2004 12:31:30 PM
RCVR1	A		P70737	4/15/2004 12:27:46 PM	4/15/2004 12:27:46 PM
RCVR1	A		P70738	4/15/2004 12:26:06 PM	4/15/2004 12:26:06 PM
RCVR1	A		P70743	4/15/2004 12:26:10 PM	4/15/2004 12:26:10 PM
RCVR1	A		P70745	4/15/2004 12:26:10 PM	4/15/2004 12:26:10 PM
RCVR1	A		P70747	4/15/2004 12:29:38 PM	4/15/2004 12:29:38 PM
RCVR1	A		P70748	4/15/2004 12:29:34 PM	4/15/2004 12:29:34 PM
RCVR1	A		P70749	4/15/2004 12:29:38 PM	4/15/2004 12:29:38 PM
RCVR1	A		P70751	4/15/2004 12:29:46 PM	4/15/2004 12:29:46 PM
RCVR1	A		P70752	4/15/2004 12:29:46 PM	4/15/2004 12:29:46 PM
RCVR1	A		P70756	4/15/2004 12:31:34 PM	4/15/2004 12:31:34 PM
RCVR1	A		P70757	4/15/2004 12:29:58 PM	4/15/2004 12:29:58 PM
RCVR1	A		P70758	4/15/2004 12:29:58 PM	4/15/2004 12:29:58 PM
RCVR1	A		P70775	4/15/2004 12:30:30 PM	4/15/2004 12:30:30 PM
RCVR1	A		P70783	4/15/2004 12:30:42 PM	4/15/2004 12:30:42 PM

Turtle®
Energy Management System/AMR

Usage Report for Meter # P70672

From 03/01/2004 To 03/31/2004

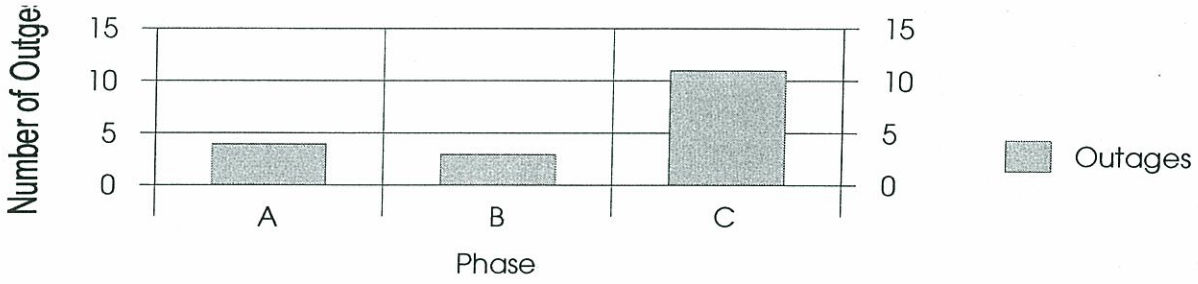


Cust Acct	Device Type	Meter	Date Of Usage	Usage	Reading
	Turtle	P70672	4/1/2004	27	2980
	Turtle	P70672	3/31/2004	82	2922
	Turtle	P70672	3/28/2004	32	2812
	Turtle	P70672	3/27/2004	26	2780
	Turtle	P70672	3/26/2004	26	2754
	Turtle	P70672	3/25/2004	30	2699
	Turtle	P70672	3/24/2004	26	2669
	Turtle	P70672	3/23/2004	29	2643
	Turtle	P70672	3/22/2004	26	2586
	Turtle	P70672	3/21/2004	29	2560
	Turtle	P70672	3/20/2004	25	2531
	Turtle	P70672	3/19/2004	28	2506
	Turtle	P70672	3/18/2004	29	2446
	Turtle	P70672	3/17/2004	24	2417
	Turtle	P70672	3/16/2004	28	2393
	Turtle	P70672	3/15/2004	23	2335
	Turtle	P70672	3/14/2004	23	2312
	Turtle	P70672	3/13/2004	28	2289
	Turtle	P70672	3/12/2004	31	2228
	Turtle	P70672	3/11/2004	24	2197
	Turtle	P70672	3/10/2004	23	2173
	Turtle	P70672	3/9/2004	30	2119
	Turtle	P70672	3/8/2004	23	2089
	Turtle	P70672	3/7/2004	21	2066
	Turtle	P70672	3/6/2004	32	2019
	Turtle	P70672	3/5/2004	28	1987
	Turtle	P70672	3/4/2004	24	1959
	Turtle	P70672	3/3/2004	28	1935

Turtle® Energy Management System/AMR

Outage Report by Meter for RCVR1

1/6/2004 to 4/28/2004



Meter	Cust Acct	Phase	Outages
P70687		C	8
Est. Start	Est. End	Other Meters Affected	Pattern
4/9/2004 6:05:00 AM	4/9/2004 6:06:44 PM	35	Good, Bad, ID
3/29/2004 9:33:28 AM	3/30/2004 5:06:42 PM	0	Good, Bad, ID
3/26/2004 11:15:08 PM	3/27/2004 11:26:48 AM	0	Good, Bad, ID
3/24/2004 5:40:08 AM	3/25/2004 1:06:48 AM	0	Good, Bad, ID
3/18/2004 10:41:48 PM	3/20/2004 6:53:28 PM	0	Good, Bad, ID
3/15/2004 12:55:08 PM	3/16/2004 6:15:08 AM	0	Good, Bad, ID
3/5/2004 4:41:48 AM	3/5/2004 11:28:28 PM	0	Good, Bad, ID
2/15/2004 3:48:28 PM	2/16/2004 5:33:28 AM	0	Good, Bad, ID

Meter	Cust Acct	Phase	Outages
P70648		A	3
Est. Start	Est. End	Other Meters Affected	Pattern
4/9/2004 6:02:58 AM	4/9/2004 6:06:34 PM	53	Good, Bad, ID
3/29/2004 4:07:56 AM	3/29/2004 9:54:30 PM	58	Good, Bad, ID
2/29/2004 4:12:48 AM	2/29/2004 2:41:08 PM	0	Good, Bad, ID

Meter	Cust Acct	Phase	Outages
P70713		B	3
Est. Start	Est. End	Other Meters Affected	Pattern
4/9/2004 6:03:08 AM	4/9/2004 6:11:32 PM	32	Good, Bad, ID
3/27/2004 3:13:32 PM	3/29/2004 9:54:30 PM	32	Good, Bad, ID
2/24/2004 5:53:48 AM	2/24/2004 1:02:08 PM	0	Good, Bad, ID

Meter	Cust Acct	Phase	Outages
P70647		A	2
Est. Start	Est. End	Other Meters Affected	Pattern
4/9/2004 6:02:58 AM	4/9/2004 6:06:34 PM	53	Good, Bad, ID
3/29/2004 4:07:56 AM	3/29/2004 9:54:30 PM	58	Good, Bad, ID

Meter	Cust Acct	Phase	Outages
P70649		A	2
Est. Start	Est. End	Other Meters Affected	Pattern
4/9/2004 6:02:58 AM	4/9/2004 6:06:34 PM	53	Good, Bad, ID
3/29/2004 4:07:56 AM	3/29/2004 9:54:30 PM	58	Good, Bad, ID

Meter	Cust Acct	Phase	Outages
P70650		A	2